Surna.name: __________________________________________
Name: __________________________________________
I.D. Number: __________________________________________
Study-Unit Code / Title: CIS1002 Electronic Commerce 2

UNIVERSITY OF MALTA
Faculty of Information and Communication Technology
Department of Computer Information Systems

CIS1002 Electronic Commerce 2

Date: 1st June 2015
Time: 10.00-11.35 hrs

FOR OFFICE USE ONLY
Examination Number

FOR EXAMINERS' USE
Total Number of Marks obtained by Candidate
CIS1002 - Electronic Commerce II

Instructions.

1. Answer all questions.
2. Read all questions carefully.
3. Put answers in spaces provided. Plenty of space has been provided for answering each question. Note that the amount of space provided does not imply that you must use it all. Answer each question to the best of your ability.
4. No calculators or other electronic devices.

<table>
<thead>
<tr>
<th>Section</th>
<th>Points</th>
<th>Your Score</th>
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<tr>
<td>Multiple Choice</td>
<td>40</td>
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<td>Short Answer</td>
<td>60</td>
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<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Section 1: Multiple Choice  [40 marks]

**CIRCLE** the letter of the **BEST** answer.

[2]  (a) A __________ is a collection of rules for formatting, ordering, and error checking data sent across a network.
   A. Public Network
   B. Protocol
   C. Backbone Router
   D. Packet

[2]  (b) IPv6 uses a __________ number for addresses.
   A. 32 bit
   B. 64 bit
   C. 128 bit
   D. 256 bit

[2]  (c) Early versions of __________ let web page designers create text-based electronic documents with headings, title bar titles, bullets, lines, and ordered lists.
   A. HTTP
   B. XML
   C. SGML
   D. HTML

[2]  (d) The roots of Web technology for Business-to-Business transactions lie in a hierarchically structured approach to inter-firm information transfer called __________.
   A. Client/Server
   B. TCP/IP
   C. Object Technology
   D. Electronic Data Interchange

[2]  (e) To use the services of a VAN, a company must install __________ software that is compatible with the VAN.
   A. Network Compiler
   B. EDI Translator
   C. LAN Interpreter
   D. VAN Router

[2]  (f) The major issue that most companies must deal with in forming supply chain alliances is developing __________.
   A. Trust
   B. Standard Procedures
   C. Open Communication Channels
   D. Network Relationships

[2]  (g) A(n) __________ is a marketplace formed by several large buyers in a particular industry.
   A. Private Company Marketplace
   B. Private Store
   C. Industry Consortia-Sponsored Marketplace
   D. Customer Portals Marketplace
(h) A ________ filter examines 'from' addresses and compares them to a list of known good sender addresses.
   A. Black List
   B. Full-Privilege
   C. Tracert
   D. White List

(i) Efforts to reduce the environmental impact of large computing installations are called ________ computing.
   A. Efficient
   B. Green
   C. eConserve
   D. eWise

(j) ________ is the number of HTTP requests that a particular hardware and software combination can process in a unit of time.
   A. Output
   B. Throughput
   C. Capability
   D. Bandwidth Limit

(k) ________ often offer web server management and rent application software to businesses.
   A. Static Catalog Providers
   B. Client Service Providers
   C. Knowledge Management Providers
   D. Commerce Service Providers

(l) In the early days of electronic commerce, shoppers selected items they wanted to purchase by ________.
   A. Filling out online forms
   B. Selecting one item at a time
   C. Emailing credit card information
   D. Placing items into a shopping cart

(m) ________ software packages are business systems that integrate all facets of a business, including accounting, logistics, manufacturing, marketing, planning, project management, and treasury functions.
   A. ERP
   B. ERT
   C. HTL
   D. EML
(n) __________ software is designed to help businesses manage the information in documents, rather than the documents themselves.
   A. Indexing Management
   B. Programming Management
   C. Information Management
   D. Knowledge Management

(o) The ability of a network to connect devices that use different operating systems is called
   ________
   A. Net Neutrality
   B. Spoofing
   C. Platform Neutrality
   D. Network Independence

(p) Any act or object that poses a danger to computer assets is known as a ____________.
   A. Problem
   B. Risk
   C. Issue
   D. Threat

(q) A(n) _____ is a small application program.
   A. Buffer
   B. Runner
   C. Web Bug
   D. Applet

(r) Internet payments for items costing from a few cents to approximately a euro are called
   ____________.
   A. Micropayments
   B. Nanopayments
   C. Small-Value Payments
   D. Mini-Value Payments

(s) When eMails used in a phishing expedition are carefully designed to target a particular person or organisation, the exploit is called ___________.
   A. Phishing
   B. Identity Theft
   C. Spear Phishing
   D. Organised Crime

(t) When a cardholder successfully contests a charge, the acquiring bank must retrieve the money it placed in the merchant account in a process called a ________.
   A. Refund
   B. Chargeback
   C. Reverse Charge
   D. Digital Justice
Section 2: Short Answer  [60 marks]

(a) You have just been hired at a firm that is looking to move into the eCommerce world. The company wants to use a standard catalogue online representation of their offerings. Their product set is large and varied enough such that a static website would not be sufficient for their needs and a more dynamic approach is required. The company does have a transaction server (for order fulfilment and payment processing) in addition to a content database server populated with the catalogue that could be utilised already. Additional hardware may be required.

1. (10 marks) Draw a possible n-tier architecture for this eCommerce website. This should include the ability to utilise the database and the transaction server. Label all of the components.

2. (10 marks) For each component of the diagram give a brief explanation of its role.
(b) You have been hired as a consultant to a medium sized company that leverages most of its sales from its eCommerce platform. They have recently invested in a new ERP system and are considering purchasing extensions to utilise Electronic Data Interchange technologies (EDI). You receive an email from the manager overseeing the transition asking you few questions, specifically: what is the difference between indirect connection EDI and direct connection EDI? He would also like to know what are the advantages of using EDI over traditional paper based methods (like they do now with their purchasing process). How would you respond to his query?
[8]  (c) What are the benefits of using a mall-style commerce service provider (5 marks)? What costs are associated with them (2 marks)? Give one example of a mall-style commerce provider (2 marks).

[6]  (d) What is the difference between a credit card and a charge card?
(e) Hash functions by themselves are not an ideal integrity enforcement solution. One solution to this is the employment of digital signatures. Assume we have a scenario where we want to send an email to a vendor agreeing to a previously discussed contract. Describe the following:

1. How is a digital signature created for this email? (3 marks)

2. What additional step would be required to guarantee message secrecy? (2 marks)

3. What are the benefits of a digital signature in this scenario? (5 marks)
(f) Email is a very powerful tool in the hands of an eCommerce operation if used wisely. Describe some of the potential drawbacks of Email.

__________________________________________________________________________________

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__________________________________________________________________________________

__________________________________________________________________________________

(g) As an individual packet travels from one network to another, the computers through which the packet travels determine the best route for getting the packet to its destination. Describe this process.
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) Total marks add to 102%, this will be scaled to 100%.

4) General instructions:
   Answer 3 out of 5 questions (34 marks per question)

Q1 INFORMATION SYSTEMS

a) What are the five main types of resources that usually form part of an information system? [10 marks]

b) Describe briefly the function of three of the following types of Information systems:
   i. Manufacturing systems
   ii. Financial reporting systems
   iii. Data warehouse
   iv. Expert Systems
   v. Geographic Information Systems [9 marks]

c) Most of these systems utilise the services of a database management system. What is the benefit of this? [5 marks]
d) Consider a hospital which is about to computerise a number of its information processing functions. Give two functions in this context for which one could develop information systems. [6 marks]

e) Mention two benefits that the hospital would derive from implementing such computer information systems as mentioned in d) above. [4 marks]

Q2 SPREADSHEETS

a) Explain in your own words each of the following terms in the context of spreadsheets: cell, address, worksheet, formula and function [5 terms x 2 marks each]

b) What is a pivot table used for? Give an example [3 + 2 marks]

c) Mention three elements of a pivot table. [6 marks]

d) Give two examples of facilities in a spreadsheet to help you manipulate data which is in the form of a list of records with several columns representing different types of values or attributes. [6 marks]

e) Which feature could be used to illustrate visually the results of your analysis? [3 marks]

f) What are the basic steps to generate visual output as specified in e) above? [4 marks]

Q3 DATA MINING

a) Briefly explain what you understand by Data Mining? [6 marks]

b) What do you think distinguishes Data Mining from other data related sciences? [5 marks]

c) What do you understand by a classification technique? What is its objective? [5 marks]

d) How can one measure the performance of such a data mining technique? [6 marks]

e) Give an example of an application of a classification technique. [6 marks]

f) In the case of a tree-based classifier, what do you understand by node and a leaf? [6 marks]
Q4 DATABASE

A pharmaceutical company plans to computerise its ordering system. An IT company has been tasked with designing the database for the new system.

The following elements of information will be needed in this database:

Client Name, Client Address, Client contact number, Date of order, Type of product, Qty of product, Price of order, Payment Receipt No, Payment Data, Payment amount.

a) What table or tables would you recommend to set up to store the data? [6 marks]
b) Would there be the need to have more than one table and why? [4 marks]
c) What would the fields for each table be? [6 marks]
d) What primary keys would you add to each table? [6 marks]
e) Can you identify any relationships between the tables? If so, list them and specify the tables and fields involved in each relationship? [6 marks]
f) What database tools would you use to i) input data, ii) select data using criteria and iii) present data in a readable, printable format? [6 marks]

Q5 GROUPWARE AND SECURITY

a) You are part of a team of researchers based in different research centers spread all over the world and tasked with studying the effects of prolonged use of a range of medicinal products across a large region. Give three ways in which groupware could be of help in such a context. [3 marks x 3 examples of help, 1 mark overall]

b) Discuss the areas of risks to information systems in the following types of activities. Explain the reason of concern and discuss ways how one can reduce the risks in each case:

i) Storing sensitive data e.g. credit card details on a laptop [6 marks]
ii) Receiving advertising mail without having asked for it [6 marks]
iii) Copying data or applications from disks from unknown or unreliable sources [6 marks]
c) Describe briefly the roles of two from the following IT related jobs:

- Database administrator
- Chief Information Officer
- Programmer
- Systems Analyst
- Web Master

[2 x 3 marks]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS1005 Computer Programming for Engineers

22\textsuperscript{nd} June 2015

8.30 – 10.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:
   \textbf{Answer \textit{ALL} questions on the given script.}

1. (a) Explain the use of the "$=$" operator as an assignment operator and as a relational comparison operator in logical expressions.
   (6 marks)
   (b) Describe and compare machine code, assembly language and high level language.
   (6 marks)
   \hspace{1cm} (12 marks)

2. (a) MS Excel can record macros using either absolute or relative cell references. What are the main differences between the two?
   (5 marks)
   (b) With respect to MS Excel what are the limitations of keyboard macros and how can they be overcome?
   (5 marks)
   \hspace{1cm} (10 marks)

3. (a) Why is modular programming preferred over other computer programming techniques?
   (4 marks)
   (b) How is an argument list used to pass information to a procedure? Illustrate with an example.
   (4 marks)
   (c) Briefly explain how parameters can be passed by value to a \textbf{Sub} or \textbf{Function}.
   (4 marks)
   \hspace{1cm} (12 marks)
4. (a) What is a Static variable?
(2 marks)

(b) Distinguish between procedural programming statements and object-oriented programming statements giving examples of the two.
(4 marks)

(c) Describe the following terms and the relationship between them: Objects, Properties, Methods and Collections.
(4 marks)

(10 marks)

5. (a) Explain how active and passive debugging could be used to find and correct logic errors in VBA (Visual Basic for Applications).
(4 marks)

(b) Briefly explain two other types of errors commonly encountered during programme development.
(4 marks)

(8 marks)

6. (a) Which VBA variable types are used to store floating-point numbers?
(2 marks)

(b) How are 4-byte, floating-point variable types represented in memory?
(2 marks)

(c) What is the difference between the statements Dim and Const?
(2 marks)

(d) Define the terms variable scope and variable lifetime.
(4 marks)

(10 marks)

7. (a) Explain how the WorksheetFunctions object is used to access Excel functions from within VBA.
(2 marks)

(b) With the aid of examples, explain how the following string functions are used to manipulate strings:
- Mid(string, start, length),
- Right(string, length),
- Trim(string), and
- InStr(string1, string2)
(8 marks)

(10 marks)
8. (a) What is structured programming?
   (4 marks)

   (b) Describe the operation of two control structures (decision structures) commonly used in VBA with the aid of an example and flowcharts.
   (4 marks)

   (8 marks)

9. (a) Write a code snippet that outputs the following sequence of numbers in a message box using the for ... next loop:
   
   20, 17, 14, 11, 8, 5
   
   (4 marks)

   (b) How can the same sequence of numbers be generated using a Do ... Loop?
   (4 marks)

   (8 marks)

10. (a) How is a dynamic array of integers declared, initialised and re-dimensioned within a VBA programme?
    (4 marks)

    (b) Explain the concept of the bubble sort algorithm using a single dimension array.
    (4 marks)

    (c) How can programme data be written to disk from within VBA? Illustrate your answer with an example.
    (4 marks)

    (12 marks)
Instructions:

1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.
3) General instructions:

   *This paper contains SIX questions; you are to attempt Question 1 and any other THREE questions.*

   Important: Put Sections A and Section B on a DIFFERENT BOOKLET.

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Section A

**Question 1 (Compulsory)**

a) Big O Notation

i) Is *Bubble Sort* $O(n^2)$, $O(n^3)$, or both? Explain your answer.

ii) Is *Bubble Sort* $\Theta(n^3)$? Explain your answer.

iii) Define *Running Time Function*.

iv) What do you understand by the *time* and *space* complexity of an algorithm?

v) What are the time and space complexity of *Bubble Sort*?

vi) What does it mean for an algorithm to be *intractable*?

\[2 + 1 + 2 + 1 + 1 + 1 = 8 \text{ marks}\]

b) Give a formal definition for the *(theta)* \( \Theta \) relation.

\[5 \text{ marks}\]

c) Draw an *expression tree* for \((3 \times 6) + (7 - 4)\). Define *post-order traversal* and give the post-order traversal of your expression tree.

\[6 \text{ marks}\]

d) i) Describe the *Quick Sort* sorting algorithm.

ii) Why is the *Quick Sort* preferred over the *Merge Sort* for everyday programming? Explain your answer.

iii) What are the *best-case* and *worst-case* time complexities for *Quick Sort*? Explain your answer.

\[6 \text{ marks}\]

Total marks for question one: 25 marks
**Question 2 (Selectable)**

a) Define **AVL-tree**. Does an AVL-tree offer any advantages compared to a **binary search tree**? Explain your answer.  

7 marks

b) Define **2-3 Tree** and draw a 2-3 Tree with 3 levels (height 2). Insert numeric values in the leaves and then update the non-leaf nodes as appropriate.  

10 marks

c) Insert a number in the AVL-Tree below in such a way that the AVL-Tree becomes unbalanced. Describe how the AVL-Tree is rebalanced using one of the **AVL rotations**. Describe also the procedure for checking if an AVL-Tree requires rebalancing after insertion of a new value.  

8 marks

Total marks for question two: 25 marks
Question 3 (Selectable)

a) Express the time complexity of the following code segments as a function of \( n \), (where \( n \) can be taken to be the size of the input). Also give the time complexity of each code segment in Big O notation.

i) \[ i := n \]
   \[ \text{repeat} \]
   \[ \text{print "Hello";} \]
   \[ i := i \div 2; \]
   \[ \text{until } i <= 1; \]

ii) \[ \text{for } i := 1 \text{ to } (2 * n) \text{ do} \]
   \[ \text{begin} \]
   \[ \text{for } j := 1 \text{ to } (3 * n) \text{ do} \]
   \[ \text{begin} \]
   \[ \text{write "Students should play less and study more";} \]
   \[ \text{end;} \]
   \[ \text{end;} \]

iii) \[ x := n \]
    \[ \text{repeat} \]
    \[ \text{for } i := 1 \text{ to } (2 * x) \text{ do} \]
    \[ \text{begin} \]
    \[ \text{print "Hello";} \]
    \[ \text{end;} \]
    \[ n := n \div 2; \]
    \[ \text{until } n <= 1; \] \[ [4 + 4 + 4 = 12 \text{ marks}] \]

Question 3 continues overleaf
b) Binary Search Trees

i) Define Binary Search Tree (BST).
ii) Define height of a BST?
iii) What are the best and worst case heights of a BST? Construct a best-case height BST and a worst-case height BST (2 BSTs in all) containing the numbers 3, 5, 8, 11, 19, 23, and 31.
iv) Insert the number 6 in the BST below and then give an in-order traversal of the BST after insertion.
v) What is the time complexity of searching a BST? Explain your answer.

\[
\begin{array}{c}
8 \\
4 & 12 \\
2 & 5 & 9 & 14 \\
3 & 7 & 10 \\
\end{array}
\]

\[2 + 2 + 3 + 3 + 3 = 13 \text{ marks}\]

Total marks for question three: 25 marks

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**Question 4 (Selectable)**

a) State what you understand by *programming paradigm*. Name the four main programming paradigms. For each paradigm name one programming language that implements that paradigm.

[7 marks]

b) Define *static* and *dynamic* typing. Discuss the advantages and disadvantages of both.

[6 marks]

c) A friend of yours claims that all the main programming languages, irrespective of the programming paradigm that they implement, are *Turing powerful*. Is she right or wrong? Explain your answer. If she is right then why is it useful to have different programming paradigms?

[7 marks]

d) Explain what *Unification* is in Prolog. Give an example of how it works.

[5 marks]

Total marks for question four: 25 marks
Section B

Question 5 (Selectable)

Hash tables:
   a) What is the rationale behind the hash table abstract data type?  
      [5 marks]

   b) Describe how the following two implementations of hash tables work. In your answer make sure to 
      describe how the hashing function(s) work, how inserting works, how collisions are dealt with, and 
      how values are retrieved from the hash table. 
      i) Chaining. 
      ii) Double hashing. 
      [5 + 5 = 10 marks]

String distance:

   c) Using pseudo code, describe how the Levenshtein string distance algorithm works. 
   d) Use the algorithm to determine the distance between the string “abstract” and “absolute”. 
      [5 + 5 = 10 marks]

Total marks for question five: 25 marks

Question 6 (Selectable)

Distance functions:

   a) Define a distance function. 
      [5 marks]

Graphs:

   b) Write down short notes on the following: 
      i. Undirected vs. directed graphs. 
      ii. All trees are directed acyclic graphs. 
      iii. Determining whether an undirected graph is connected. 
      [4 + 4 + 4 = 12 marks]

   c) Compare and contrast the implementation of a graph as either an adjacency matrix, or an 
      adjacency list. 
      [4 + 4 = 8 marks]

Total marks for question six: 25 marks
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

Answer Question A11 and any other TWO questions from Section B.

Total marks possible 100.

State any assumptions you make.

SQL syntax from a wide variety of DBMS are accepted: eg Oracle, Postgresql, Microsoft SQL Server and Microsoft Access. It is best if a student declares which syntax he is opting for.

For procedural extensions to SQL one can, as in SQL Syntax, choose one's own. Again it is best if a student declares which syntax he is opting for.

Where a subsection asks a number of questions, marks are spread equally unless otherwise indicated.
Section A

A11  The database contains data pertaining to an experimental forestry program lasting over many years and involving many different trees of different species, in different forests; in addition many measurements are carried out on these trees. The following are the tables that make up the database schema:

<table>
<thead>
<tr>
<th>Table</th>
<th>Attribute</th>
<th>Type</th>
<th>Notes</th>
<th>Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Sp_name</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Species name</td>
</tr>
<tr>
<td></td>
<td>Sp_woodtype</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Wood yielded by tree species</td>
</tr>
<tr>
<td></td>
<td>Sp_maxht</td>
<td>I</td>
<td>F.K.</td>
<td>Max. height</td>
</tr>
<tr>
<td>Forest</td>
<td>Fo_name</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Forest name</td>
</tr>
<tr>
<td></td>
<td>Fo_size</td>
<td>I</td>
<td>F.K.</td>
<td>Forest area</td>
</tr>
<tr>
<td></td>
<td>Fo_loc</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Geographical name</td>
</tr>
<tr>
<td></td>
<td>Fo_comp</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Forest owner</td>
</tr>
<tr>
<td>Tree</td>
<td>Tr_species</td>
<td>C(10)</td>
<td>F.K. Species.sp_name</td>
<td>Species number</td>
</tr>
<tr>
<td></td>
<td>Tr_forest</td>
<td>C(10)</td>
<td>F.K. Forest.fo_name</td>
<td>Sequence number</td>
</tr>
<tr>
<td></td>
<td>Tr_num</td>
<td>I</td>
<td>F.K.</td>
<td>Tr_planted: Date</td>
</tr>
<tr>
<td></td>
<td>Tr_loc</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Tr_parent: I</td>
</tr>
<tr>
<td></td>
<td>Tr_parent</td>
<td>I</td>
<td>F.K. Tree.tr_num</td>
<td>Tr_parent: I</td>
</tr>
<tr>
<td>Measure</td>
<td>Me_trnum</td>
<td>I</td>
<td>F.K. Tree.tr_num</td>
<td>Sequence number</td>
</tr>
<tr>
<td></td>
<td>Me_num</td>
<td>I</td>
<td>F.K.</td>
<td>Me_result: I</td>
</tr>
<tr>
<td></td>
<td>Me_result</td>
<td>I</td>
<td>F.K.</td>
<td>Me_result: I</td>
</tr>
<tr>
<td></td>
<td>Me_type</td>
<td>C(10)</td>
<td>F.K.</td>
<td>Me_type: C(10)</td>
</tr>
</tbody>
</table>

Notes:
C(N) and I stand for Character(N) and Integer type respectively.
P.K. and F.K. are abbreviations for primary and foreign keys respectively.

(a)  i  Write a SQL construct for the following query:
Print measure number, tree number and type of measure from the measure table.
Order output by measure date.

ii Write a SQL construct for the following query:
Print a unique list of measure types.

iii Write a SQL construct for the following query:
Print the minimum and maximum values of measure whose type is ‘ACID’.

[ 6 marks ]

(b) Write a SQL construct for the following query:
List the forest name, company name and location for any forest whose name must start with ‘GREAT’, and has a size greater than 1000000 or its location is ‘SOUTH’. In the output ensure that company name and location are concatenated as ‘ABC Co Ltd – SOUTH’.

[ 4 marks ]
(c) i Write a SQL construct for the following query:
List species name, species wood type, forest name and forest location for all trees. Ensure that output does not contain repetitions.

ii Write a SQL construct for the following query:
In the measure table one can find rows for 'HEIGHT' readings for many trees. List those trees that have a measured height (i.e. me_type="HEIGHT") that is actually greater than the expected height of the tree’s species max height (i.e. sp_maxht).

iii Write a SQL construct for the following query:
List trees that are co-located (i.e. tr_loc values are identical) and where one tree is the “granddaughter” of the other. The output should include the number of each tree, their common location, and forest name.

[ 12 marks ]

(d) Write a SQL construct for the following query:
For each species with the same wood type (i.e. sp_woodtype) compare their maximum height (i.e. sp_maxht). The output should include the species wood type, species name of the larger height, species of the smaller height.

[ 6 marks ]

(e) Write a SQL construct for the following query:
For each species wood type, forest location, and measure type output the average of measure result and count of aggregates. Exclude measure on species whose wood type is ‘SOFT’ and whose aggregate count is less than 10.

[ 6 marks ]

(f) Write a SQL construct for the following query:
Which trees have all measure types?

[ 6 marks ]
Section B

B11  (a)  i  Refer to figure 1.a. Describe the ERM parts depicted.

   ii  Refer to figure 1.a. Convert the ERM into SQL DDL constructs. Also introduce two tuples into each table implemented.

[ 4 + 6 marks ]

(b)  i  Refer to figure 1.b. Describe the ERM parts depicted.

   ii  Refer to figure 1.b. Convert the ERM into SQL DDL constructs.

[ 4 + 6 marks ]

(c)  i  Refer to figure 1.c. Describe the ERM parts depicted. Note: 'M', 'N' and 'P' stand for "many cardinality".

   ii  Refer to figure 1.c. Convert the ERM into SQL DDL constructs.

[ 4 + 6 marks ]

Figure 1. ERM diagrams
B12  (a)  i  What is a “functional dependency”? Give an example (in the context of data normalisation).

ii  What is a “candidate key”? Give an example. How many candidate keys may a table have?

iii  State the second normal form (in the context of data normalisation).

[ 6 marks ]

(b)  i  When is a 1NF table automatically in 2NF?

ii  When is a 2NF table automatically in 3NF?

[ 10 marks ]

(c)  i  Get the data in table 1 into 2NF. State primary key attribute set and any other FD(s).

ii  Get the data in table 2 into 2NF. State primary key attribute set and any other FD(s).

[ 14 marks ]

Table 1: Data normalisation – table name is tableA and first row are attributes names.

<table>
<thead>
<tr>
<th>Aattr1</th>
<th>Aattr2</th>
<th>Aattr3</th>
<th>Aattr4</th>
<th>Aattr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>JACK</td>
<td>DOG</td>
<td>9923</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>JASON</td>
<td>COUSIN</td>
<td>1125</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>JENNIFER</td>
<td>COUSIN</td>
<td>4879</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>JASON</td>
<td>COUSIN</td>
<td>2203</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>JEANETTE</td>
<td>SISTER</td>
<td>1358</td>
</tr>
</tbody>
</table>

Table 2: Data normalisation – table name is tableB and first row are attributes names.

<table>
<thead>
<tr>
<th>Aattr1</th>
<th>Aattr2</th>
<th>Aattr3</th>
<th>Aattr4</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>7889 xxx</td>
<td>115</td>
<td>HONDA</td>
</tr>
<tr>
<td>20</td>
<td>8655 ccc</td>
<td>155</td>
<td>MERC</td>
</tr>
<tr>
<td>30</td>
<td>3345 vrvr</td>
<td>115</td>
<td>HONDA</td>
</tr>
<tr>
<td>40</td>
<td>7878 cffc</td>
<td>175</td>
<td>BMW</td>
</tr>
</tbody>
</table>
B13 a) In relational algebra we have the completeness property for a subset of operators.
   i) What exactly is a complete set?
   ii) List a set of operators that form a complete set (i.e. name of each operator).
   iii) Show how one operator, not in your complete set (i.e. not in ii)), is defined.

   [ 10 marks]  

b) Refer to the database schema given in question A11. Give a relational algebra query for the following types of queries. (Hint: candidate can use WinRDBI syntax).
   i) A projection and a selection on one relation.
   ii) A natural join between two relations.
   iii) A Cartesian product between two tables.
   iv) A union based query between two tables.

   [ 20 marks]  

B14 a) What are database cursors?

   [ 5 marks ]  

b) Give a brief, but annotated example in PGPLSQL, of declaring, opening and retrieving database entity instances through a cursor definition.

   [10 marks ]  

c) Write a PGPLSQL procedure to compute a five year moving average of trees in forest ‘BUSKET’ and for measure ‘HEIGHT’.

   Notes: use function year(me_date) to extract the year from a date attribute; Given a sorted sequence of values, a moving average is a new sequence defined by taking the arithmetic mean of subsequences of the original (e.g. in this case 5 years).

   [ 15 marks ]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS1042 Introduction to Databases and Information Management       11th June 2015

13.00pm – 16.05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart
devices are permitted.

3) General instructions:

Answer Question A11 and Question A12 and any other TWO questions from Section B.
Total marks possible 130.

State any assumptions you make.

SQL syntax from a wide variety of DBMS are accepted: eg Oracle, Postgresql,
Microsoft SQL Server and Microsoft Access. It is best if a student declares which syntax
she is opting for.

For procedural extensions to SQL one can, as in SQL Syntax, choose one’s own. Again
it is best if a student declares which syntax he is opting for.

Where a subsection asks a number of questions, marks are spread equally unless
otherwise indicated.
Section A

A11 The database contains data pertaining to an experimental forestry program lasting over many years and involving many different trees of different species, in different forests; in addition many measurements are carried out on these trees. The following are the tables that make up the database schema:

<table>
<thead>
<tr>
<th>Table</th>
<th>Attribute</th>
<th>Type</th>
<th>Notes</th>
<th>Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Sp_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Species name</td>
</tr>
<tr>
<td></td>
<td>Sp_woodtype</td>
<td>C(10)</td>
<td></td>
<td>Wood yielded by tree species</td>
</tr>
<tr>
<td></td>
<td>Sp_maxh</td>
<td>I</td>
<td></td>
<td>Max. height</td>
</tr>
<tr>
<td>Forest</td>
<td>Fo_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Forest name</td>
</tr>
<tr>
<td></td>
<td>Fo_size</td>
<td>I</td>
<td></td>
<td>Forest area</td>
</tr>
<tr>
<td></td>
<td>Fo_loc</td>
<td>C(10)</td>
<td></td>
<td>Geographical name</td>
</tr>
<tr>
<td></td>
<td>Fo_comp</td>
<td>C(10)</td>
<td></td>
<td>Forest owner</td>
</tr>
<tr>
<td>Tree</td>
<td>Tr_species</td>
<td>C(10)</td>
<td>F.K. Species.sp_name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tr_forest</td>
<td>C(10)</td>
<td>F.K. Forest.fo_name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tr_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Sequence number</td>
</tr>
<tr>
<td></td>
<td>Tr_planted</td>
<td>Date</td>
<td></td>
<td>Date of planting</td>
</tr>
<tr>
<td></td>
<td>Tr_loc</td>
<td>C(10)</td>
<td></td>
<td>Forest quadrant</td>
</tr>
<tr>
<td></td>
<td>Tr_parent</td>
<td>I</td>
<td>F.K. Tree.tr_numb</td>
<td>Precreating tree reference</td>
</tr>
<tr>
<td>Measure</td>
<td>Me_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Sequence number</td>
</tr>
<tr>
<td></td>
<td>Me_result</td>
<td>I</td>
<td></td>
<td>Test’s measure</td>
</tr>
<tr>
<td></td>
<td>Me_date</td>
<td>Date</td>
<td></td>
<td>Measure taken on</td>
</tr>
<tr>
<td></td>
<td>Me_type</td>
<td>C(10)</td>
<td></td>
<td>Type of measure</td>
</tr>
</tbody>
</table>

Notes:

C(N) and I stand for Character(N) and Integer type respectively.
P.K. and F.K. are abbreviations for primary and foreign keys respectively.

(a) i Write a SQL construct for the following query:
   Print measure number, tree number and type of measure from the measure table.
   Order output by measure date.

   ii Write a SQL construct for the following query:
   Print a unique list of measure types.

   iii Write a SQL construct for the following query:
   Print the minimum and maximum values of measure whose type is ‘ACID’.

   [ 6 marks ]

(b) Write a SQL construct for the following query:
List the forest name, company name and location for any forest whose name must start with ‘GREAT’, and has a size greater than 1000000 or its location is ‘SOUTH’.
In the output ensure that company name and location are concatenated as ‘ABC Co Ltd – SOUTH’.

   [ 4 marks ]
(c) i Write a SQL construct for the following query:
List species name, species wood type, forest name and forest location for all trees. Ensure that output does not contain repetitions.

ii Write a SQL construct for the following query:
In the measure table one can find rows for 'HEIGHT' readings for many trees. List those trees that have a measured height (i.e. me_type='HEIGHT') that is actually greater than the expected height of the tree's species max height (i.e. sp_maxht).

iii Write a SQL construct for the following query:
List trees that are co-located (i.e. tr_loc values are identical) and where one tree is the "granddaughter" of the other. The output should include the number of each tree, their common location, and forest name.

(d) Write a SQL construct for the following query:
For each species with the same wood type (i.e. sp_woodtype) compare their maximum height (i.e. sp_maxht). The output should include the species wood type, species name of the larger height, species of the smaller height.

(e) Write a SQL construct for the following query:
For each species wood type, forest location, and measure type output the average of measure result and count of aggregates. Exclude measure on species whose wood type is 'SOFT' and whose aggregate count is less than 10.

(f) Write a SQL construct for the following query:
Which trees have all measure types?
A12  (a)  i  What is a transaction?
   ii  What is a transaction processing system?  [ 4 marks ]

   (b)  Clearly describe a transaction’s state transition diagram.  [ 6 marks ]

   (c)  i  What is the significance of serial and interleaved processing of a transaction?
   ii  Give an example of lost update during uncontrolled transaction processing.  [ 6 marks ]

   (d)  Describe the two phase locking use in a centralised DBMS. Indicate the properties of this protocol.  [ 10 marks ]

   (e)  Is the following schedule fragment following two phase locking? Explain.
   T1: rlk(Y), r(Y), ulk(Y), wlk(X), r(X),..., w(X), ulk(X).  [ 4 marks ]

Section B

B11  (a)  i  Refer to figure 1.a. Describe the ERM parts depicted.
   ii  Refer to figure 1.a. Convert the ERM into SQL DDL constructs. Also introduce two tuples into each table implemented.  [ 4 + 6 marks ]

   (b)  i  Refer to figure 1.b. Describe the ERM parts depicted.
   ii  Refer to figure 1.b. Convert the ERM into SQL DDL constructs.  [ 4 + 6 marks ]

   (c)  i  Refer to figure 1.c. Describe the ERM parts depicted. Note: ‘M’, ‘N’ and ‘P’ stand for “many cardinality”.
   ii  Refer to figure 1.c. Convert the ERM into SQL DDL constructs.  [ 4 + 6 marks ]
Figure 1. ERM diagrams
B12  (a) i What is a “functional dependency”? Give an example (in the context of data normalisation).

ii What is a “candidate key”? Give an example. How many candidate keys may a table have?

iii State the second normal form (in the context of data normalisation).

[ 6 marks ]

(b) i When is a 1NF table automatically in 2NF?

ii When is a 2NF table automatically in 3NF?

[ 10 marks ]

(c) i Get the data in table 1 into 2NF. State primary key attribute set and any other FD(s).

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[ 14 marks ]

Table 1: Data normalisation – table name is tableA and first row are attributes names.

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<th>Aattr4</th>
<th>Aattr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>JACK</td>
<td>DOG</td>
<td>9923</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>JASON</td>
<td>COUSIN</td>
<td>1125</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>JENNIFER</td>
<td>COUSIN</td>
<td>4879</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>JASON</td>
<td>COUSIN</td>
<td>2208</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>JEANETTE</td>
<td>SISTER</td>
<td>1358</td>
</tr>
</tbody>
</table>

Table 2: Data normalisation – table name is tableB and first row are attributes names.

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<tr>
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<th>Aattr2</th>
<th>Aattr3</th>
<th>Aattr4</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>7889 xxx</td>
<td>115</td>
<td>HONDA</td>
</tr>
<tr>
<td>20</td>
<td>8655 ccc</td>
<td>155</td>
<td>MERC</td>
</tr>
<tr>
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<td>3345 vvr</td>
<td>115</td>
<td>HONDA</td>
</tr>
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B13  a) In relational algebra we have the completeness property for a subset of operators.
   
i) What exactly is a complete set?
   
ii) List a set of operators that form a complete set (i.e. name of each operator).
   
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   [ 10 marks]

b) Refer to the database schema given in question A11. Give a relational algebra query for the following types of queries. (Hint: candidate can use WinRDBI syntax).
   
i) A projection and a selection on one relation.
   
ii) A natural join between two relations.
   
iii) A Cartesian product between two tables.
   
iv) A union based query between two tables.

   [ 20 marks]

B14  a) What are database cursors?

   [ 5 marks ]

b) Give a brief, but annotated example in PGPLSQL, of declaring, opening and retrieving database entity instances through a cursor definition.

   [10 marks ]

c) Write a PGPLSQL procedure to compute a five year moving average of trees in forest ‘BUSKET’ and for measure ‘HEIGHT’.

   Notes: use function year(me_date) to extract the year from a date attribute; Given a sorted sequence of values, a moving average is a new sequence defined by taking the arithmetic mean of subsequences of the original (e.g. in this case 5, years).

   [ 15 marks ]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2015 Examination / Assessment Session

CIS1104 Networking

23rd June 2015
8.30 – 11.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted except for translators.
3) General instructions:

This exam paper contains THREE sections.
- From Section A you are to answer ONE question.
- From Section B you are to answer ONE question.
- You are to answer ANY other TWO questions.

Important: Put Sections A and C on the SAME BOOKLET, and Section B on a DIFFERENT BOOKLET.

Section A

1 a) Explain briefly the socket primitives Socket(), Bind() and Listen(). How does the three-way TCP/IP handshake occur?
[12 marks (6-Explanation of Primitives; 6-Explanation of Three-Way Handshake)]

b) What is a named Pipe? Which are the differences compared with classical anonymous Pipes, under a Unix-Like OS?
Give an example of applying named Pipes in a network situation between two Windows machines.
[13 marks (1-What is..; 4-Differences; 8-Example)]

2 a) Discuss the functionality and operation of Message Queues. Give 3 Examples of implementations.
[13 marks (7-Discuss; 6-Examples)]

b) Structured cabling systems should be considered when designing and implementing data communication systems within buildings. Concisely discuss the advantages and benefits from such systems.
[12 marks (4-For Introduction; 8-Advantages and Benefits)]
Section B (Use a separate Booklet for this section)

3

a) Concisely, discuss the importance of designing networks upon a layered architecture and elaborate how the International Standards’ Organisation has adopted this approach in its Open Systems of Interconnectivity Reference Model.

[13 marks (2-for Introduction; 4-for Highlighting concepts; 7-for depicting the model and explanation of each layer)]

b) Describe the addressing schemes that can be adopted in an IPv4 based TCP/IP network.

[12 marks (3-Introduction; 9-Schemes)]

4

What are the enabling drivers conducive to the introduction of Storage Area Network technologies within computing environments, and what are the major benefits of deploying such networks?

[25 marks (13-Enabling Drivers; 12-Benefits)]

Section C

5

a) Compare VC (Virtual Circuit) and Datagram networks for a number of issues.

[14 marks]

b) What is the difference between routing and forwarding?
List desirable properties of a routing algorithm. Briefly describe what happens with a stable routing algorithm with regards to equilibrium.

[11 marks (2-What is..; 1-Per Property; 3-Briefly..)]

(continued on next page)
6 a) Consider the following undirected, weighted graph:

Step through Dijkstra's algorithm to calculate the shortest paths from A to all the other vertices. Define labels, explaining the difference between temporary and permanent labels.

Show the steps you take in the table below. Cross out the old values (labels) and write in the newer ones, from left to right, as the algorithm proceeds. List the vertices in the order which you marked them. Finally indicate the shortest path from node A to node F.

<table>
<thead>
<tr>
<th>Vertex</th>
<th>Distance</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lowest Cost (Shortest Distance) Path from A to F: ________________________________

(answer on script)

[13 marks (1-Definition;10-Table;2-Path)]

b) Define the "Flooding" technique. Mention a protocol using it. How can "infinite flooding" be stopped?

[12 marks (4-Definition;1-Example;7-How can..)]
Important instructions and information to candidates  
(Please read and heed)

**Point 1 (structure)**
You are allocated a **total of three hours** for this paper. Read any question carefully before attempting it. This paper contains **six questions in all**. The questions are divided into **two sections** (A & B). You are to attempt **all** the questions in Section A and **any two** questions from Section B. This paper will be marked out of 100, but carries an 80% weighting of the mark obtainable for this study-unit as a whole. Your course-work carries the remaining 20%.

**Point 2 (clarity)**
It is important that you use legible handwriting and understandable English grammar. **Please be warned** that work presented in unintelligible handwriting and/or unclear English will not be considered for marking.

**Point 3 (maturity)**
You should present your thoughts on paper in a mature and reasoned fashion, using interplay of concepts expounded in class. **This is a key consideration** and will be highly valued.

**Point 4 (presentation)**
You should keep all parts of any given question together. Scattered answers will be penalised or may even not be considered at all when marking.

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**Mark allocation by question.**

- Question 1 – Compulsory : 30 marks
- Question 2 – Compulsory : 30 marks
- Question 3 – Selectable : 20 marks
- Question 4 – Selectable : 20 marks
- Question 5 – Selectable : 20 marks
- Question 6 – Selectable : 20 marks

**Obtainable total:** 100 marks (**30 + 30 + 20 + 20**)

**The use of calculators is allowed**
Section A – Two compulsory questions.

Question 1 [Generic] (a compulsory question for 30 marks)
All the parts of this question refer to the same “company”.
(a) In today’s highly competitive software development landscape, any start-up company needs to seriously assess how to provide quality software before even starting to plan the actual development. As part of a software development team, you are asked to help draft a brief report stating how quality of the company’s software products could be gauged in order to better place the company’s offerings amongst its competitors. Produce the report (point-form is enough) and justify your suggestions.
   [8 marks (3-report; 5-justification)]

(b) Following strategic decisions, the company decides to enter the software development market with a series of mobile apps targeted at students – integrating their academic and social lives (e.g. specific organisers, event managers, ticket portals, university service integrators, etc.). From your initial report, you are asked to highlight the most relevant quality aspects and provide more detail in-line with the nature of these apps.
   [8 marks (3-highlight; 5-detail)]

(c) The same start-up company now needs to start thinking about the actual development process. There are a number of modelling techniques out there, so there is also some confusion or uncertainty. As a software engineer you are asked by the company to suggest and explain which modelling techniques would best suit the various stages of development of the company’s products (as outlined in ‘b’ above). Every suggestion must be duly justified.
   [9 marks (4-models; 5-justification)]

(d) A common problem noticed by team-leaders in the company is that many new software developers reason about data flow in the same way they would reason about flowcharts. How would you explain the difference to improve the efficient applicability of one and the other to solution modelling?
   [5 marks]

Question 2 [Generic] (a compulsory question for 30 marks)
(a) “Communication is the key to quality” – Explain this overriding principle in terms of modern software development. All your statements and points raised need to be duly reasoned and justified. Provide one concrete example of quality failure and one concrete example of quality guarantee due to communication.
   [18 marks (4-points raised; 8-reasoning and justification; 6-examples)]

(b) Data modelling is something that many software developers think can happen following the establishment of system functionality. Comment and construct arguments on this and use one concrete example in your reasoning.
   [10 marks (3-comments; 4-reasoning and justification; 3-example)]

(c) What is a “state” in terms of system behaviour?
   [2 marks]

End of Section A
[This space is left blank intentionally]
Section B – Four selectable questions from which to select any two.

Question 3 [Control Flow & Data] (a selectable question for 20 marks)
Figure 1 describes part of a regatta management system. Modify the model in figure 1 by introducing control elements that will show that the data “Message” will be set to “confirmed” only when the three data elements “Race type”, “Boat type”, and “Crew ID” are available, and set to “pending” when any of these three data elements is/are missing. Any control process(es) used must be specified using a Finite State Machine (FSM) and any data used in the FSM(s) must be shown using Data Structure Diagrams (DSDs).

Any assumptions you choose to make regarding features and functionality must be stated as part of your assumptions at the start of your answer. All models must be drawn in ink and legible, and must be fully and clearly labeled using meaningful identifiers.

![Diagram](image)

Figure 1.

Question 4 [Data Flow] (a selectable question for 20 marks)
You have been commissioned by the administration of a secondary school to implement a web based system that would help the school’s teachers in keeping their students’ parents informed about the pupil’s academic progress. The system should therefore allow the teachers to store academic information in a database so that it would be possible to send this information to the parents automatically via email and SMS. As an example, if the Physics teacher gives an end of month test to the students and the test results are stored in the database, the system should allow the teacher to send a report with the test marks via both email and SMS. While emails can be sent instantly at any time of the day, the system should make sure that the SMS messages are sent only during a certain time window (say between 7.00am and 8.00pm). In other words if a teacher decides to send the academic reports late during the night or early in the morning, the system should hold the messages and then send them the following day after 7.00am.

Model the above behaviour using De Marco DFD notation decomposed up to and including level 1.

Any assumptions you choose to make regarding features and functionality must be stated as part of your assumptions at the start of your answer. All models must be drawn in ink and legible, and must be fully and clearly labeled using meaningful identifiers.
Question 5 [SDLCs] (a selectable question for 20 marks)
(a) The V-shaped SDLC was a first step towards a more agile form of software development. Explain why and how.

[7 marks (3-SDLC choice; 4-justification)]

(b) Company X is currently in the business of developing solutions for the processing of navigation data to be used off-line by aviators (i.e. mostly documentation updating solutions). The company now feels it has accumulated enough experience and manpower to diversify into the domain of solutions for radar data stream processing (i.e. the gathering, processing, integrating and presenting of radar information from various sources). The SDLC used to date was a combination of Waterfall and V-shaped approaches. Would you suggest a new type of SDLC? What would it be? Fully justify your reasoning.

[9 marks (3-SDLC suggestion; 6-justification)]

(c) Explain the difference between a model and an SDLC. State one concrete example.

[4 marks (2-difference; 2-example)]

Question 6 [Development] (a selectable question for 20 marks)
(a) Provide a context-level (i.e. level 0) DFD and a Use-Case Diagram (UCD) modeling the behavior of a basic walk-in fast food order-taking system. Both models must be fully and clearly labeled using meaningful identifies. The real-world system in question is very common and straightforward, however any assumptions you choose to make regarding features/functionality must be stated at the start.

[11 marks (6-DFD; 5-UCD)]

(b) A key tool employed in modern professional software development is abstraction. Explain this and outline the practices of specification and design in terms of actions undertaken in each and in terms of abstraction.

[9 marks (3-explanation; 3-specification; 3-design)]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems

May/June 2015 Assessment Session

CIS1111 C Programming for Engineers 11th June 2015

10.00am – 12.05pm

Examination Instructions

This is an open book examination. You may use any hardcopy written reference material, including hard copy course notes, textbooks and dictionaries with any annotations. Digital equipment is not permitted.

This paper contains 2 Sections.
Answer all questions from Section A and any two questions from Section B.
SECTION A – ANSWER ALL QUESTIONS

QUESTION 1. This is a compulsory question related to C programming constructs. You are only required to write code snippets as shown in the example below:

Sample Question: Write code that outputs on the screen fifteen asterisks on the same line.
Sample Answer: 
$$
\text{for}(i = 0; i < 15; i++)
\{
    \text{printf("\*";});
\}
$$

Answer the following questions:

a) Using only one printf statement, write the required code to produce the following output:

"All I can say is, 'Damn the exam!'"
- William Shawcross, The Queen Mother: The Official Biography

b) A variable of type double named \( g \) holds the value \( 9.80665 \). Write a statement to output on the screen the contents of \( g \) in two decimal places.

c) Write the required code to output on separate lines the square of the numbers between 1 and \( n \), where \( n \) is a variable of type int.

d) Write the required code in order to ask the user to enter the characters Y or N as an answer for a Yes/No question. The input should not be case sensitive (i.e. y or n are also valid) however any other character should not be allowed. If the user enters an invalid character then the user should be asked to re-enter the character. This should be repeated until a valid character is entered.

e) A variable \( ch \) of type char contains a digit. Write the required code to convert the contents of this variable to an actual integer. The integer should be stored in a variable num of type int.

[3 marks each]
[Total of 15 Marks]

QUESTION 2. This is a compulsory question. You are required to provide a descriptive answer for each question.

Answer the following questions:

a) The aim of the program below is to display the contents of array days.

```c
int main(void)
{
    int i;
    for(i = 1; i <= 7; i++)
    {
        puts(days[i]);
    }
}
```
When the above program is executed, something goes wrong. Answer the following questions:
   i. What is wrong with the above code?
   ii. What is actually outputted on the screen?
   iii. Write a code snippet to show how the above code can be altered in order to give the correct output. [2 marks each]
       [6 Marks]

b) When the following program is executed:

```c
#include <stdio.h>

int main(void)
{
    char quote[39] = "'What's normal anyways?' - Forrest Gump";
    puts(quote);
}
```

The following output is given:

![Output of the program](image)

Answer the following questions:
   i. What is wrong with the above program?
   ii. Write a code snippet to show how the above code can be corrected. [3 marks + 2 marks]
       [5 Marks]

c) When executed, what will this program output?

```c
int main(void)
{
    float avg = (4 + 3 + 3) / 3;
    printf("%f\n", avg);
}
```

[4 Marks]
[Total of 15 Marks]

---

**QUESTION 3. This is a compulsory question. You are required to write a code snippet to answer this question.**

The following incomplete code illustrates a program that consists of an array holding 16 sorted names. The last part of the program displays these names on the screen. You are required to write code in the part which is being marked with an empty rectangle so that the names will be shuffled. When the names are outputted they should not be outputted in ascending order but in a random order.

You are only required to write in your examination script the missing code and not the entire program.
```c
#include <stdio.h>
#include <time.h>

int main (void)
{
    int i, j, k;
    char temp[20];

    for(i = 0; i < 16; i++)
    {
        puts(names[i]);
    }

    return 0;
}
```

[5 marks for the algorithm used for the solution]
[5 marks for correct implementation]
[5 marks for overall program correctness]

[Total of 15 Marks]

**QUESTION 4.** This is a compulsory question related to pointers. You are required to provide a descriptive answer for parts a and b and a code snippet for part c.

**Answer the following questions:**

a) Explain the meaning of the following three lines of code:

```
int *pNum;
int num = 28;
pNum = &num;
```

[1 Mark for each line of code]

[3 Marks]

b) The memory sketch below illustrates what happens when the program written below is executed. (It is assumed that variable pNum is stored at memory location 102).

```c
int main(void)
{
    int *pNum;
    pNum = (int*)malloc(sizeof(int));
    *pNum = 27;
    printf("Variable pNum is pointing to location %d \n", pNum);
    printf("that is holding value %d.\n", *pNum);
}
```
When executed, what will be the program output (with respect to the memory sketch)?

[2 marks for each variable output] [4 Marks]

c) An array nombres of type int has a length of 5. Using pointer techniques (do not use array indexing with [...] and a for loop, write the required code in order to display the contents of this array on the same line, separated by a comma (,). You are not required to write the whole program but only the missing part (shown as an empty rectangle) in the code snippet below:

```
#include <stdio.h>

int main(void)
{
    int i;
    int numbers[5] = {76, 34, 56, 14, 28};
    int *ptrNumbers;

    /* Insert missing code here */

    printf("\n");

    return 0;
}
```

[8 Marks]
[Total of 15 Marks]
SECTION B – ANSWER ANY 2 QUESTIONS FROM THIS SECTION

QUESTION 5. This is an optional question. You are required to write a complete C program by answering the given questions.

The program that you are required to implement is related to single linked lists, recursive functions and the Fibonacci sequence. You are required to create a linked list and fill it with the Fibonacci sequence up to a number indicated by the user. The program should then display a menu that allows the user to either output the Fibonacci value for a particular position or display the whole list.

By answering the following questions, you will be able to implement this program:

a) Define the struct that is required to represent the nodes for the required linked list and also declare all the global variables that might be required for this program. [2 Marks]

b) Implement a recursive function that accepts a (positive) integer parameter and returns the Fibonacci value for that number.
(Hint: The Fibonacci sequence is computed as follows: \( F_0 = 0, F_1 = 1, F_n = F_{n-1} + F_{n-2} \) ) [5 Marks]

c) Write a function to add a Fibonacci number to the list. [2 Marks]

d) Write a function to display all the Fibonacci numbers that are stored in the list. [3 Marks]

e) Write a function to display on the screen the Fibonacci value of a particular number by reading it from the list. [3 Marks]

f) Write the main function for this program. When the program starts it should first ask the user to enter up to which number s/he wishes to generate the Fibonacci sequence. Then the program should generate the Fibonacci sequences and display the following menu:
   1. Show the Fibonacci List
   2. Display the Fibonacci value of a particular number
   3. Exit [5 Marks]

[Total of 20 Marks]

QUESTION 6. This is an optional question related to looping structures. To answer this question you are required to write three separate code snippets.

In C and in other imperative and object oriented languages there are three basic types of loops. Although there are three types of loops, in theory it is possible to do anything with only one type of loop. This is obviously not recommended. In this question you are required to show that this is possible by providing three different answers each time using a different type of loop.
QUESTION:
Write a program which will find the average of a set of positive numbers entered by
the user. There is no limit to how many numbers the user can input, in fact an end-of-
data marker such as "-1" should be used to stop the program from asking the user to
enter more numbers.

[3 marks for correct identification of loops]
[4 marks for each correct loop implementation]
[5 marks for overall correctness of the solution]
[Total of 20 Marks]

QUESTION 7. This is an optional question. You are required to write a complete C
program.

Write a program (possibly using a greedy algorithm) in which the user would enter an integer
amount of money in Euros. The program should then display on the screen the minimum
number of €500, €200, €100, €50, €20, €10, €5, €2 and €1 notes and coins that would make
up the entered amount.

[Note: To get full marks in this question, you are not only required to provide a correct
working solution, but you are required to provide a neat solution preferably using only few
lines of code and statements.]

[8 marks for the technique used to solve the problem]
[5 marks for the correct use of programming constructs]
[7 marks for overall correctness]
[Total of 20 Marks]

END OF PAPER
Instructions:

1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted except for translators.
3) General instructions:

This exam paper contains THREE sections.
- From Section A you are to answer ONE question. (30 marks)
- From Section B you are to answer ONE question. (30 marks)
- From Section C you are to answer ONE compulsory question. (40 marks)
- Obtainable total marks: 100

Important: Put Sections A and C on the SAME BOOKLET, and Section B on a DIFFERENT BOOKLET.

Section A

1 a) Explain briefly the overall usage/purpose of the socket primitives Socket(), Bind() and Listen().
   How does the three-way TCP/IP handshake occur?
   [7 marks (4-Explanation of Primitives;3-Explanation of Three-Way Handshake)]

b) What is a named Pipe? Which are the differences compared with classical anonymous Pipes, under a Unix-Like OS?
   Give an example of applying named Pipes in a network situation between two Windows machines.
   [8 marks (1-What is...;2-Differences;5-Example)]

c) Discuss the functionality of Message Queues. Give 3 Examples of implementations.
   [7 marks (4-Discuss;3-Examples)]

d) List 4 Signals you are aware of, explaining their usage.
   [8 marks (1-Per usage;1-Per Signal Listed)]
2 a) List 6 features reserved to YouTube accounts in “good standing”.
   Discuss briefly ways how the YouTube API can be used or applied.
   [7 marks (½-Per Feature; 4-Ways...)]

   b) How does Dropbox integration work in respect of Facebook Groups? Give an example of what you think it might be used for.
   [8 marks (6-How does Dropbox; 2--Example)]

   c) i) List 3 events which can occur, and subsequently a process will be informed about them, by the OS via a software interrupt.
      ii) How can a process cause a software interrupt in another process?
      iii) How can a process associate its own handler with an interrupt?
      [3 marks] [2 marks] [2 marks]

   d) i) What is the difference between interrupt handlers and trap handlers?
      ii) What defines specific hardware interrupt and trap numbers?
      iii) Similarly, what defines software interrupt numbers and exceptions?
      iv) Which specific instruction is used to invoke software interrupts on a PC?
      [2 marks] [2 marks] [2 marks] [2 marks]

Section B (Use a separate Booklet for this section)

3 a) What are the three super classes of computer networks and explain upon which criteria are such classes determined.
   [15 marks (5-Introduction; 10-Explanation)]

   b) What do you understand by the terms loosely coupled and tightly coupled networks? Discuss the major differences between the two.
   [15 marks (5-Explanation of terms; 10-Differences)]

4 a) With reference to the ISO OSI Reference Model:
   Place the following acronyms in the corresponding layer within the OSI RM: TCP, MAC, and IP. Explain each one of these acronyms.
   [15 marks (5-Placing; 10-Explanation)]

   b) What are the main functions of the Data Link Layer and the Network Layer as defined within the ISO OSI RM?
   [15 marks (3-Introduction; 6-Per layer)]
Section C

6 a) Discuss the importance of the Internet today in everyday life as “the Network of Networks” and its impact on the world. [5 marks]

b) Define Server and Client, in the context of interprocess communication. [8 marks]

i) Discuss how through message passing, operating system functionality can be implemented in utility processes instead of the kernel. [10 marks]

ii) Is message passing reliable (integrity of data, order of data received)? Suggest ways in which this can be achieved. [6 marks (4-Is message...; 2-Suggest ways)]

iii) What is a bound port? What is a free port, and what can be implemented with a free port? [11 marks (2-Bound port; 2-Free port; 7-what can be implemented..)]

[Total 40 marks]
Important instructions and information to candidates
(Please read and heed)

Point 1 (structure)
You are allocated a total of two hours for this paper. Read any question carefully before attempting it. This paper contains four questions in all. The questions are divided into two sections (A & B). You are to attempt the question in Section A and any two questions from Section B. This paper will be marked out of 100, but carries an 80% weighting of the mark obtainable for this study-unit as a whole. Your course-work carries the remaining 20%.

Point 2 (clarity)
It is important that you use legible handwriting and understandable English grammar. Please be warned that work presented in unintelligible handwriting and/or unclear English will not be considered for marking.

Point 3 (maturity)
You should present your thoughts on paper in a mature and reasoned fashion, using interplay of concepts expounded in class. This is a key consideration and will be highly valued.

Point 4 (presentation)
You should keep all parts of any given question together. Scattered answers will be penalised or may even not be considered at all when marking.

Mark allocation by question.

Question 1 – Compulsory : 40 marks
Question 2 – Selectable : 30 marks
Question 3 – Selectable : 30 marks
Question 4 – Selectable : 30 marks

Obtainable total: 100 marks \((40 + 30 + 30)\)

The use of calculators is allowed.
Section A – One compulsory question.

Question 1 [Generic] (a compulsory question for 40 marks)

(a) “Communication is the key to quality” – Explain this overriding principle in terms of modern software development. All your statements and points raised need to be duly reasoned and justified. Provide one concrete example of quality failure and one concrete example of quality guarantee due to communication.

[18 marks (4-points raised; 8-reasoning and justification; 6-examples)]

(b) Data modelling is something that many software developers think can happen following the establishment of system functionality. Comment and construct arguments on this and use one concrete example in your reasoning.

[10 marks (3-comments; 4-reasoning and justification; 3-example)]

(c) What is a “state” in terms of system behaviour?

[2 marks]

(d) The use of models in the software development process is essential. The choice of the right models for the right representation is pivotal in the effectiveness of the developer. Conversely, the selection of an inappropriate model could be detrimental to the software solution’s quality. Explain what is meant by this. Provide one concrete example (choose between a positive and negative one) to accompany your reasoning.

[10 marks (4-explain; 6-examples)]
Section B – Three selectable questions from which to select any two.

Question 2 [Modelling] (a selectable question for 30 marks)

You have been commissioned by the administration of a secondary school to implement a web based system that would help the school’s teachers in keeping their students’ parents informed about the pupil’s academic progress. The system should therefore allow the teachers to store academic information in a database so that it would be possible to send this information to the parents automatically via email and SMS. As an example, if the Physics teacher gives an end of month test to the students and the test results are stored in the database, the system should allow the teacher to send a report with the test marks via both email and SMS. While emails can be sent instantly at any time of the day, the system should make sure that the SMS messages are sent only during a certain time window (say between 7.00am and 8.00pm). In other words, if a teacher decides to send the academic reports late during the night or early in the morning, the system should hold the messages and then send them the following day after 7.00am.

Model the above behaviour using De Marco DFD notation decomposed up to and including level 1. Produce a DSD of the data that would be held in the academic information database.

Any assumptions you choose to make regarding features and functionality must be stated as part of your assumptions at the start of your answer. All models must be drawn in ink and legible, and must be fully and clearly labeled using meaningful identifiers.

[30 marks (8-DFD level 0[3-model elements; 5-correctness]; 14-DFD level 1[6-model elements; 8-correctness]; 8-DSD)]

Question 3 [Control] (a selectable question for 30 marks)

Figure 1 describes part of a regatta management system. Modify the model in figure 1 by introducing control elements that will show that the data “Message” will be set to “confirmed” only when the three data elements “Race type”, “Boat type”, and “Crew ID” are available, and set to “pending” when any of these three data elements is/are missing. Create a second model that would furthermore always set the data “Message” to “not_confirmed” if the database “Regatta DB” is empty. Any control process(es) used must be specified using a Finite State Machine (FSM) and any data used in the FSM(s) must be shown using Data Structure Diagrams (DSDs).

Any assumptions you choose to make regarding features and functionality must be stated as part of your assumptions at the start of your answer. All models must be drawn in ink and legible, and must be fully and clearly labeled using meaningful identifiers.
Question 4 [SDLCs] (a selectable question for 30 marks)
(a) Explain the difference between a model and an SDLC. State one concrete example.
[5 marks (2-difference; 3-example)]

(b) The V-shaped SDLC was a first step towards a more agile form of software development. Explain why and how.
[8 marks (3-SDLC choice; 5-justification)]

(c) Company X is currently in the business of developing solutions for the processing of navigation data to be used off-line by aviators (i.e. mostly documentation updating solutions). The company now feels it has accumulated enough experience and manpower to diversify into the domain of solutions for radar data stream processing (i.e. the gathering, processing, integrating and presenting of radar information from various sources). The SDLC used to date was a combination of Waterfall and V-shaped approaches. Would you suggest a new type of SDLC? What would it be? Fully justify your reasoning.
[9 marks (3-SDLC suggestion; 6-justification)]

(d) Clearly explain the role of abstraction in SDLCs. It is important that as a result of your reasoning it is shown how SDLCs can only be effective together with the three main principles of Software Engineering.
[8 marks (4-reasoning; 4-principles)]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2015 Examination / Assessment Session
CIS1217 Data Structures and Algorithms 18th June 2015
10.00 – 12.05

Instructions:
1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.
3) General instructions:
   The total mark for this paper is 75. The mark obtained will then be scaled to out of 100.
   This paper contains FIVE questions; you are to attempt Question 1 and any other TWO questions.
   Important: Put Sections A and Section B on a DIFFERENT BOOKLET.

Section A

Question 1 (Compulsory)

a) Big O Notation
   i) Is Bubble Sort O(n^2), O(n^3), or both? Explain your answer.
   ii) Is Bubble Sort Θ(n^2)? Explain your answer.
   iii) Define Running Time Function.
   iv) What do you understand by the time and space complexity of an algorithm?
   v) What does it mean for an algorithm to be intractable?

[ 2 + 1 + 2 + 2 + 1 = 8 marks]

b) Give a formal definition for the (theta) Θ relation.
[5 marks]

c) Draw an expression tree for (3 * 6) + (7 – 4). Define post-order traversal and give the post-order traversal of your expression tree.
[6 marks]

d) i) Describe the Quick Sort sorting algorithm.
   ii) What are the best-case and worst-case time complexities for Quick Sort? Explain your answer.
[6 marks]

Total marks for question one: 25 marks
Question 2 (Sortable)

a) Define *AVL-tree*. [7 marks]

b) Define 2-3 Tree and draw a 2-3 tree with 3 levels (height 2). Insert numeric values in the leaves and then update the non-leaf nodes as appropriate. [10 marks]

c) Insert a number in the AVL-Tree below in such a way that the AVL-Tree becomes unbalanced. Describe how the AVL-Tree is rebalanced using one of the *AVL rotations*. Describe also the procedure for checking if an AVL-Tree requires rebalancing after insertion of a new value. [8 marks]

![AVL Tree Diagram]

Total marks for question two: 25 marks
Question 3 (Selectable)

a) Express the time complexity of the following code segments as a function of $n$, (where $n$ can be taken to be the size of the input). Also give the time complexity of each code segment in Big O notation.

(i) $i := n$
    repeat
    print “Hello”;
    $i := i \text{ div } 2$;
    until $i <= 1$;

(ii) for $i := 1$ to $(2 \times n)$ do
    begin
    for $j := 1$ to $(3 \times n)$ do
        begin
        write “Students should play less and study more”;
        end;
    end;

(iii) $x := n$
    repeat
    for $i := 1$ to $(2 \times x)$ do
        begin
        print “Hello”;
        end;
    $n := n \text{ div } 2$;
    until $n <= 1$;  \[4 + 4 + 4 = 12 \text{ marks}\]

Question 3 continued overleaf
b) Binary Search Trees

i) Define Binary Search Tree (BST).
ii) Define height of a BST?
iii) What are the best and worst case heights of a BST? Construct a best-case height BST and a worst-case height BST (2 BSTs in all) containing the numbers 3, 5, 8, 11, 19, 23, and 31.
iv) Insert the number 6 in the BST below and then give an in-order traversal of the BST after insertion.

[3 + 3 + 3 + 4 = 13 marks]

Total marks for question three: 25 marks
Section B

Question 4 (Selectable)

Hash tables:

a) What is the rationale behind the hash table abstract data type? [5 marks]

b) Describe how the following two implementations of hash tables work. In your answer make sure to describe how the hashing function(s) work, how inserting works, how collisions are dealt with, and how values are retrieved from the hash table.
   i. Chaining.
   ii. Double hashing.

   [5 + 5 = 10 marks]

String distance:

c) Using pseudo code, describe how the Levenshtein string distance algorithm works.

d) Use the algorithm to determine the distance between the string “cat” and “cart”.

   [5 + 5 = 10 marks]

Total marks for question four: 25 marks

Question 5 (Selectable)

Distance functions:

a) What is a distance function? [5 marks]

Graphs:

b) Write down short notes on the following:
   i. Undirected vs. directed graphs.
   ii. All trees are directed acyclic graphs.
   iii. Determining whether an undirected graph is connected.

   [4 + 4 + 4 = 12 marks]

c) Compare and contrast the implementation of a graph as either an adjacency matrix, or an adjacency list.

   [4 + 4 = 8 marks]

Total marks for question five: 25 marks
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

Six questions to choose any four. Each question carries 25 marks. If a question has a section with sub-sections, then, if not otherwise indicated, each sub-section carries equal marks.

1 (a) Consider the relational schema of the tree measures database in Appendix A. For each table classify it into one, and only one, of the following: reference file, master file, and transaction file.

[ 5 marks ]

(b) What is a covering index? State one table that will benefit from a covering index.

[ 4 marks ]

(c) Given a query over a data file and our intention is to decrease disk activity (e.g. reads and write). How can one evaluate whether it's opportune to go for a full serial table scan against using an index look-up?

[ 8 marks ]

(d) What are the computational costs involved to introduce and maintain a dense index on a secondary key?

[ 8 marks ]
2 (a) Consider the B tree of order 4 in figure 1. Compute the number of keys an order four B tree can hold in three levels at a 65% loading of the max.

[ 7 marks ]

(b) Consider the B tree of order 4 in figure 1. Insert the following sequence of keys into it: 22, 99, 12, 2, 0, and 21. Clearly explain and show the steps involved.

[ 12 marks ]

(c) Consider the tree measures schema in Appendix A and in particular the tree table. What B tree based indices should be introduced to facilitate the following queries (i.e. stating the composition of index key is important). Clearly explain your reasoning.

i Range query on planting date (assume that range query does not cover more than 2% of tree tuples).

ii We have many queries that match on species and some a conjunction of species and forest (assume that range query does not cover more than 2% of tree tuples).

[ 6 marks ]

Figure 1: An example B tree
3  (a) State and explain two drawbacks of external and static (fixed sized hash index) hashing? Response must be specific to a database context. [ 4 marks ]

(b) What are two issues that external and extendible hashing address? Give an example in each case. Response must be specific to a database context. [ 6 marks ]

(d) Give detailed rendition of how external and extendible hashing can facilitate the processing of the following SQL queries (based on Appendix A tree measures database). Response should start by stating which extendible index is used or built on ad hoc basis.

i  SELECT *
    FROM tree
    WHERE tr_loc = 'R2D2';

ii SELECT DISTINCT tr_forest
    FROM tree;

iii SELECT tr_forest, tr_species, count(*)
    FROM tree
    GROUP BY tr_forest, tr_species; [ 15 marks ]

4  (a) List and explain five characteristics of hard disks vis-à-vis a DBMS? [ 5 marks ]

(b) How is the time required to move a disk block to and from main memory broken down? If all the required data is on the same disk cylinder how does this time work out? Furthermore consider the effect of sustained sequential reads. [ 10 marks ]

(c) In terms of databases and DBMSs what are and how are these used?
   i  Storage Area Network (SAN).
   ii Redundant Array of Independent Disks I (RAID1). [ 10 marks ]
5  (a) Explain the state transition diagram associated with a database transaction over an OLTP.  

[6 marks]

(b) Explain the trade-off between sharing and consistency level for a centralized database for an OLTP.  

[6 marks]

(c) Give a serialisable schedule, following a two phase locking protocol, of the following two concurrent transactions. Assume we have only read/write locks and c is a request to commit. A serial schedule is not an acceptable solution here.  
T1: r1(x), r1(y), r1(z), w1(z), w1(y), c1.  
T2: r2(a), w2(a), w2(z), r2(x), r2(b), w2(b), c2.  

[13 marks]

6 Refer to schema in appendix one. Specifically note that the tree table has a self-referential relationship through the attribute tr_parent being related to tr_numb. Write SQL query construct to implement the following queries – use the recursive option of the common table expression syntax.  

(a) Given any tree instance, identified by tr_numb, work out its highest ancestor. Print out the tree number, location and owning company (i.e. fo_comp).  

[6 marks]

(b) Given any tree instance, identified by tr_numb, work out all its descendants. Print out the tree number, location and owning company (i.e. fo_comp).  

[6 marks]

(c) Given any tree instance, identified by tr_numb but must have at least one measure in ‘acidity’ (i.e. me_type='ACID'), print it descendents and for each descendant indicate it generation relative to the given tree.  

[6 marks]

(d) How best to optimise these type of queries and what's the expected type of query results that would benefit from such measures?  

[7 marks]
Appendix A: Forest relational schema

The database contains data pertaining to an experimental forestry program lasting over many years and involving many different trees of different species, in different forests; in addition many measurements are carried out on these trees. The following are the tables that make up the database schema:

<table>
<thead>
<tr>
<th>Table</th>
<th>Attribute</th>
<th>Type</th>
<th>Notes</th>
<th>Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Sp_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Species name</td>
</tr>
<tr>
<td></td>
<td>Sp_woodtype</td>
<td>C(10)</td>
<td></td>
<td>Wood yielded by tree species</td>
</tr>
<tr>
<td></td>
<td>Sp_maxht</td>
<td>I</td>
<td>N.N.</td>
<td>Max. height</td>
</tr>
<tr>
<td>Forest</td>
<td>Fo_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Forest name</td>
</tr>
<tr>
<td></td>
<td>Fo_size</td>
<td>I</td>
<td>N.N.</td>
<td>Forest area</td>
</tr>
<tr>
<td></td>
<td>Fo_loc</td>
<td>C(10)</td>
<td>U.</td>
<td>Geographical name</td>
</tr>
<tr>
<td></td>
<td>Fo_comp</td>
<td>C(10)</td>
<td></td>
<td>Forest owner</td>
</tr>
<tr>
<td>Tree</td>
<td>Tr_species</td>
<td>C(10)</td>
<td>F.K. Specie.sp_name</td>
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<td></td>
<td>Tr_forest</td>
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<td></td>
<td>Tr_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Sequence number</td>
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<td>Tr_planted</td>
<td>Date</td>
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<td>Date of planting</td>
</tr>
<tr>
<td></td>
<td>Tr_loc</td>
<td>C(10)</td>
<td></td>
<td>Forest quadrant</td>
</tr>
<tr>
<td></td>
<td>Tr_parent</td>
<td>I</td>
<td>F.K. Tree.tr_numb</td>
<td>Procreating tree reference</td>
</tr>
<tr>
<td>Measure</td>
<td>Me_trnumb</td>
<td>I</td>
<td>F.K. Tree.tr_numb</td>
<td></td>
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<td></td>
<td>Me_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Sequence number</td>
</tr>
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<td></td>
<td>Me_result</td>
<td>I</td>
<td></td>
<td>Test’s measure</td>
</tr>
<tr>
<td></td>
<td>Me_date</td>
<td>Date</td>
<td></td>
<td>Measure taken on</td>
</tr>
<tr>
<td></td>
<td>Me_type</td>
<td>C(10)</td>
<td></td>
<td>Type of measure</td>
</tr>
</tbody>
</table>

**Notes:**

C(N) and I stand for Character(N) and Integer type respectively.

P.K., F.K., U. & N.N. are abbreviations for primary key, foreign key, Unique and Not Null respectively.
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS2086 e-Business 20th June 2015

8.30am – 10.35am

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

There are total thirteen questions. Attempt any ten questions. Start each question on a new page.

Question 1: (total 10 marks)

i. What is Crowdfunding? [1 mark]

ii. Write any two advantages/applications of crowdfunding to businesses? [1x2=2 marks]

iii. Write one limitation/problem of crowdfunding? [1 mark]

iv. What is Crowdsourcing? [1 mark]

v. Write any two advantages/applications of crowdsourcing to businesses? [1x2=2 marks]

vi. Write one limitation/problem of crowdsourcing? [1 mark]

vii. In your opinion, is tripadvisor.com an example of crowdsourcing? Justify your answer. [2 marks]

Question 2: (total 10 marks)

i. How B2C is different than C2B? Give an example of each to support your answer. [2x2=4 marks]

ii. Write any six barriers/inhibitors to B2C e-business. [1x6=6 marks]
Question 3: (total 10 marks)

i. Name any four business activities which can be controlled by ERP. [1x 4=2 marks]

ii. What is Knowledge Management? Write any three advantages/applications of Knowledge Management. [1+3=4 marks]

iii. Write any four advantages of e-business to society. [1x4=4 marks]

Question 4: (total 10 marks)

i. What is an e-market? [1 mark]

ii. Write any four advantages/applications of e-markets to businesses. [1x4=4 marks]

iii. What is m-commerce? [1 mark]

iv. Write any four advantages/applications of m-commerce over web-based e-commerce. [1x4=4 marks]

Question 5: (total 10 marks)

i. Write any five advantages of e-business to businesses/organizations. [1x5=5 marks]

ii. For each of the following suggest if these are B2B, B2C, C2B or C2C and justify your answer:
   a. Crowdfunding [1x5=5 marks]
   b. Crowdsourcing
   c. PayPal
   d. ebay
   e. A donation website

Question 6: (total 10 marks)

i. Write any five advantages of e-Governance. [1x5=5 marks]

ii. Suggest any five e-governance concerns/challenges. [1x5=5 marks]

Question 7: (total 10 marks)

i. Contrast and describe the RACE and SOSTAC™ marketing strategy frameworks. [4+6=10 marks]

For each of the following questions (Question 8 – Question 13) assume that you are planning to start a new business of online selling a product of your choice.

Question 8: (total 10 marks)

i. Suggest the product(s) you are planning to sell online. Justify that the product is suitable for selling online rather than the traditional medium. [2 marks]

ii. What is the market segment (targeted customer base) and geographic location you are targeting? Justify your choice. [1+1=2 marks]
iii. Suggest what the barriers of entry for your proposed business are. How would you deal with these (specify any two barriers of entry)? [2x2=4 marks]

iv. Suggest if you would like to go for differentiation or cost leadership or both. Why and how? [1+1=2 marks]

**Question 9: (total 10 marks)**

i. Provide the SWOT analysis for your proposed business. You are required to write only two strengths, two weaknesses, two opportunities and two threats. Each of these should be the most critically important. [2x4=8 marks]

ii. Contrast viral marketing and social media marketing. [2 marks]

**Question 10: (total 10 marks)**

i. Suggest the ‘attractiveness’ of your proposed business based on Porter’s five forces. How would you develop a competitive strategy that best defends against the competitive forces or influences them in the favour of your business? [5x2=10 marks]

**Question 11: (total 10 marks)**

i. Porter suggested six fundamental principles for strategic positioning. How would you follow each of these principals to develop strategy for your proposed business? [1x6=6 marks]

ii. What are Ward’s four types of strategic systems? [1x4=4 marks]

**Question 12: (total 10 marks)**

i. Differentiate between Markets and contract and vertical integration governance structure. [3x1=3 marks]

ii. Differentiate between forward integration and backward integration business strategies. [1 mark]

iii. Assume that you are required to buy a refrigerator. Specify any three transaction costs involved. What might these be in the absence of Information Technology? [1x3+1x3=6 marks]

**Question 13: (total 10 marks)**

i. Suggest a product which is not suitable for selling online. Justify your answer. [2 marks]

ii. Explain any two types of assess specificities. How does each of these contribute to the transaction cost? Provide a suitable example for each. [2x2=4 marks]

iii. What is the analysis of the ‘External Environment’? Which three types of environments would you analyse? [1+3=4 marks]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS2090 Practical Design and Implementation with DBMS  4th June 2015

10:00am –12:05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:
   Attempt question 1 and any other two questions. Marks tally to 100%. Where a subsection asks a number of questions, marks are spread equally unless otherwise indicated

1 (a) Explain disk striping. Is disk striping on its own considered a RAID set-up? [ 6 marks ]

(b) What are the advantages of a RAM cache when aiding disk access methods? [ 4 marks ]

(c) List four devices and software artefacts that are used to aid the processing and optimisation of DBMS activities. [ 4 marks ]

(d) A hard disk unit is organised into four spaces. State and place in capacity order. [ 4 marks ]

(e) What processing advantage can a sequential file have over a serial file? [ 4 marks ]

(f) When are covering indexes (or index organised tables) indicated? [ 4 marks ]

(g) Explain the sort-merge algorithm for a data file. [ 6 marks ]

(h) Explain the use of a bit index in two queries. [ 6 marks ]
2. (a) Use a B tree type of index to compute a relational join between two tables.
     [8 marks]
(b) Why is a 50% occupancy assured in a B tree type of index?
     [8 marks]
(c) B+ indexes are a variant of B tree indexes, and are very popular with
     implementations. B+ indexes are characterised with having all index entries
     present in its leaf pages level. Describe a simple method to place a huge
     number of index entries into an empty B+ index – this is called bulk loading.
     Indicate its relative merits when compared to building a B+ tree and inserting
     each index entry one by one. Provide clear and concise pseudo code.
     [14 marks]

3. (a) How is external extendible hashing used in the following query processing and
     optimisation:
     SELECT DISTINCT attr
     FROM table
     WHERE ...;
     [6 marks]
(b) How is external extendible hashing used in the following query processing and
     optimisation:
     SELECT attr1, sum(attr2)
     FROM table
     WHERE ...
     GROUP BY attr1;
     [6 marks]
(c) How is external extendible hashing used in an inner join between two tables?
     [6 marks]
(d) i In external extendible hashing the hashing function plays a crucial role in
     accommodating the scaling requirement of hash storage. How does the
     use of a hashing function realise this?
     ii Encryption maps a record to a string of bit patterns. If the encryption
     process is made to provide two outputs; the first is the whole record and
     the second is its primary key (512 bits). What type of access methods
     can extendible hashing provide when the encrypted key is used?
     [12 marks]
4 (a) Write down a declarative query on the forest database in SQL SELECT construct (see appendix A) for the following: Print the tree number, forest size, species wood-type, measure result for measure whose type are 'ACID'. [6 marks]

(b) Translate (a) above into a relational algebra expression. The permissible algebraic operators are: SELECT, PRODUCT, PROJECT, UNION and DIFF. [8 marks]

(c) Draw the Relational Algebra Tree (RAT) for your reply in (b) above. [6 marks]

(d) Reorder the products into a pipeline sequence from (c) above. Make sure you state which algebraic transformation you are using. [10 marks]

Figure 1: DBMS schematic

5 (a) What are the true costs of the introduction and up-keep of indexes in a DBMS? [6 marks]

(b) Make a case for the adoption of a sparse (or non-dense) index. [3 marks]

(c) Consider figure 1 which represents a schematic view of a DBMS storage structure and the flow of data between them.
   i Describe each data structure in terms of persistence, access speed, access mode, data placement and access method (serial, sequential, direct and index sequential).
   ii Also indicate how data moves from one structure to another where applicable.
   iii Which RAID set-up will you consider for the database files, and the log files, respectively? [21 marks]
Appendix A: Forest relational schema

The database contains data pertaining to an experimental forestry program lasting over many years and involving many different trees of different species, in different forests; in addition many measurements are carried out on these trees. The following are the tables that make up the database schema:

<table>
<thead>
<tr>
<th>Table</th>
<th>Attribute</th>
<th>Type</th>
<th>Notes</th>
<th>Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Sp_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Species name</td>
</tr>
<tr>
<td></td>
<td>Sp_wdctype</td>
<td>C(10)</td>
<td></td>
<td>Wood yielded by tree species</td>
</tr>
<tr>
<td></td>
<td>Sp_maxht</td>
<td>I</td>
<td>N.N.</td>
<td>Max. height</td>
</tr>
<tr>
<td>Forest</td>
<td>Fo_name</td>
<td>C(10)</td>
<td>P.K.</td>
<td>Forest name</td>
</tr>
<tr>
<td></td>
<td>Fo_size</td>
<td>I</td>
<td>N.N.</td>
<td>Forest area</td>
</tr>
<tr>
<td></td>
<td>Fo_loc</td>
<td>C(10)</td>
<td>U.</td>
<td>Geographical name</td>
</tr>
<tr>
<td></td>
<td>Fo_comp</td>
<td>C(10)</td>
<td></td>
<td>Forest owner</td>
</tr>
<tr>
<td>Tree</td>
<td>Tr_species</td>
<td>C(10)</td>
<td>F.K. Species.sp_name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tr_forest</td>
<td>C(10)</td>
<td>F.K. Forest.fo_name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tr_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Sequence number</td>
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<tr>
<td></td>
<td>Tr_planted</td>
<td>Date</td>
<td></td>
<td>Date of planting</td>
</tr>
<tr>
<td></td>
<td>Tr_loc</td>
<td>C(10)</td>
<td></td>
<td>Forest quadrant</td>
</tr>
<tr>
<td></td>
<td>Tr_parent</td>
<td>I</td>
<td>F.K. Tree.tr_numb</td>
<td>Procreating tree reference</td>
</tr>
<tr>
<td>Measure</td>
<td>Me_trnmb</td>
<td>I</td>
<td>F.K. Tree.tr_numb</td>
<td>Sequence number</td>
</tr>
<tr>
<td></td>
<td>Me_numb</td>
<td>I</td>
<td>P.K.</td>
<td>Test’s measure</td>
</tr>
<tr>
<td></td>
<td>Me_result</td>
<td>Date</td>
<td></td>
<td>Measure taken on</td>
</tr>
<tr>
<td></td>
<td>Me_type</td>
<td>C(10)</td>
<td></td>
<td>Type of measure</td>
</tr>
</tbody>
</table>

Notes:
C(N) and I stand for Character(N) and Integer type respectively.
P.K., F.K., U. & N.N. are abbreviations for primary key, foreign key, Unique and Not Null respectively.
You have been assigned to design an app that allows any user to book a table in a restaurant called EasyBookSystem. The app can be used by any restaurant that subscribes to it. Restaurants register for a yearly fee using PayPal. Currently there is no app that provides this service locally but such apps have been implemented in various countries. From preliminary studies done on similar apps in EU countries, it was noted that over 40% of similar apps that allow users to reserve tables, are made via mobile. EasyBookSystem app aims to allow guests book tables easily and free of charge. Nearly one third of online reservations are made between 10.00pm. and 10.00am. The app is expected to give guests the freedom to book whenever they please, even when the restaurant is closed.

a) Design an EasyBookSystem mobile application, listing the “activities” you would use. Describe in detail the main screen that would be required to inform the user of the information needed at the various stages. Refer to the Human Interaction Guidelines (HIG) of the respective platform you are designing for. Consider the following key aspects in your proposal:
i) Choice of platform/s you intend to design your application for and justify your approach.
ii) Key HIG being adopted in your solution.
iii) Flow chart of application showing only an informed title and enough info to show the scope of screen.
iv) List the activities you are using for your application.
v) Detailed diagram of Main Screen.

List any assumptions you will consider in your solution. For your proposed design only consider features clients that are booking tables would need.

[10 marks, (2 marks each)]

b) Create a process map template that best fits the proposed solution.

[12 marks]

c) Identify at least 6 main points (obstacles) and propose solutions to address the challenges listed.

[6 marks and 12 marks for solutions]

Note for Question 1: You do not need to implement the application or algorithm.

[Total 40 Marks]

2) Location-Based Services, VGI and data quality

a. Technology developments have led to new spatial concepts and services. Define Location Based Services (LBS), and explain the role of spatial data to support such services. Include the potential of Volunteered Geographic Information (VGI) in complementing and supporting the diffusion of such services

[10 marks]

b. Discuss two case studies where mobile GIS are used

[10 marks]

c. The availability of services such as Google Earth and the rising trends in VGI have made GIS application a collaborative concern. Discuss this statement making reference to data quality issues in such new services and how these can be improved.

[10 marks]

[Total 30 marks]
3) Refer to the case study described in question 1. This question is related to the Android Lifecycle

a) Draw the Android Lifecycle for the main screen clearly showing each method and which of them you will override to achieve the functionality required. [14 marks]

b) The Android platform supports three broad categories of sensors. List them giving at least two examples for each. [6 marks]

c) Why are personas used when designing mobile applications? [2 marks]

d) Referring to the case study described in question 1 explain what is a cognitive walk through. By creating a persona that represents a particular user group, list the key stages of cognitive walkthrough. [2 marks, 6 marks] [Total 30 marks]

4) a) This question is related to designing mobile applications using the Android SDK.

i) List the three essential considerations required when creating notifications. [3 marks]

ii) Android Runtime (ART) is an application runtime environment used by the Android mobile operating system. ART replaces Dalvik, which is the process virtual machine originally used by Android.

- List the main features of an ART virtual machine. Distinguish between an ART VM and Dalvik VM.

- Distinguish between: 1) Activity, 2) Services, 3) Broadcast receivers and 4) Content providers. [2, 2 marks]
iii) What is the difference between Intents and Pending Intents? Write the code that is used to adopt Pending Intents when using notifications.

[2 marks, 6 marks]

b) Spatial Analysis in Geographic Information System (GIS)

i. Define spatial analysis and explain the role of GIS in decision-support. [5 marks]
ii. List four examples of spatial analysis tools in GIS [4 marks]

iii. You are a business person that owns a supermarket in an urban area. You want your staff to analyse the current and potential customers’ catchment areas in order to make better marketing decisions. Briefly answer the following:

a. What type of spatial analysis can be conducted? [2 marks]
b. What type of data will be needed for such an analysis and how will this help you in your marketing decisions? [4 marks]

[Total 30 marks]

5) a) This question refers to Usability.

"The usefulness of mobile devices has increased greatly in recent years allowing users to perform more tasks in a mobile context. This increase in usefulness has come at the expense of the usability of these devices in some contexts. Advances in mobile technology have enabled a wide range of applications to be developed that can be used by people on the move. Developers sometimes overlook the fact that users will want to interact with such devices while on the move. Small screen sizes, limited connectivity, high power consumption rates and limited input modalities are just some of the issues that arise when designing for small, portable devices."

Harrison et al, (2013)

i. List and briefly describe the five usability attributes defined by Jacob Neilson. [5 marks, 5 marks]
ii. When developing mobile applications a number of challenges have presented new usability issues that are difficult to model. Highlight six usability issues that have been introduced by the advent of mobile devices. Briefly describe four of them.

[6 marks, 4 marks]

b) This question is about Mobile Commerce.

The term m-commerce (mobile commerce) refers to a business model which allows a consumer to complete a commercial transaction using a mobile device, either at the point of sale (e.g. payments made through NFC technology), or remotely (e.g. through SMS payments or payments charged via mobile operators’ billing systems or through app or mobile websites). (OECD, 2012). Mobile systems make use of native systems or Web APIs interact with these service server providers.

i. With the use of tablets and smart mobile devices more users are purchasing through their preferred devices. List the five main stages that a mobile developer needs to consider when designing an app that offers payment facilities.

[5 marks]

ii. Refer to any case study of your choice and highlight the main characteristics relevant to the design of m-commerce apps. In your discussion briefly describe the business model adopted.

[5 marks]

[Total 30 marks]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS3021 I.S. Strategy Management and Practice  5th June 2015

10:00am –12:05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

   This paper contains SIX questions; you are to attempt any FOUR questions.

Q1

a) Discuss the strengths and weaknesses of structured strategy as opposed to unstructured strategy when used in ICT.
   [10 marks: (5 marks for differences, 5 marks for strengths vs weaknesses)]

b) Describe IT strategy from a management perspective.
   [5 marks: (1 mark for each valid point)]

c) Is it possible to have a single strategy that fits all IT problems? Discuss.
   [5 marks: (1 mark for each valid point)]

d) How does strategy affect Knowledge Intensive Enterprises? Discuss.
   [5 marks: (1 mark for each valid point)]

Q2

a) What is the strategic formulation process and its relevance?
   [5 marks: (1 mark for each valid point)]
b) What are the results of a strategic formulation process? Discuss their relevance to IT systems.  
[5 marks: (1 mark for each valid point)]

c) How can a strategic alliance benefit the ICT sector?  
[5 marks: (1 mark for each valid point)]

d) What types of conflict can arise from the internal culture of an organization? How will this affect strategy?  
[10 marks: (5 mark for conflict, 1 mark per valid pt., 5 marks for how affect, 1 mark per valid pt.)]

Q3

a) Explain the differences between i) strategic vision and ii) strategic intent  
[5 marks: (2.5 marks for strategic v, 2.5 marks for strategic intent)]

b) What is meant by the term strategic context? Briefly explain.  
[5 marks: (2.5 marks for definition, 2.5 marks for explain)]

c) Explain the differences between i) technical feasibility and ii) operational feasibility for IT systems  
[5 marks: (2.5 marks for technical feasibility, 2.5 marks for operational feasibility)]

d) How can stakeholders influence strategic context? Is this influence positive or negative?  
[5 marks: (2.5 marks for how, 2.5 marks for explaining if positive or negative)]

e) Outline the differences between any two types of strategic policies.  
[5 marks: (2.5 marks each)]

Q4

a) What is a multi-vision E-Business Strategy?  
[5 marks: (2.5 for definition, 2.5 marks for explanation)]

b) In terms of IT strategy explain the concerns of i) uniqueness and ii) relevance  
[5 marks: (2.5 marks for uniqueness, 2.5 marks for relevance)]

c) How does IT strategy differ from Information Systems (IS) Strategies?  
[5 marks: (2.5 marks for IT strategy, 2.5 marks for IS strategy)]

d) What is the difference between i) planned and ii) unplanned IT strategy  
[5 marks: (2.5 marks for planned, 2.5 marks for unplanned)]

e) Is it important to consider recovery planning procedures in IT strategy? If so why?  
[5 marks: (2.5 marks for recovery planning, 2.5 marks why)]
Q5

a) What are the main elements of an information security strategy?
[10 marks (5 marks for main elements of is sec. strategy, 5 marks for explain)]

b) Show how such a strategy would include mechanisms to always keep abreast of the evolving threat landscape as well as any major spikes in risk, both from a technical and human perspective.
[15 marks (5 marks for how such a strategy would include mechanisms, 5 marks for technical perspective, 5 marks for human perspective)]

Q6

a) Compare and contrast the following terms
   i. Critical Success Factor and Key Performance Indicator
   ii. Tolerance and Risk
   iii. Service Level Agreement and Operational Level Agreement
   iv. Incident and Problem

[20 marks (5 marks each, 2.5 marks for compare, 2.5 marks for contrast)]

b) Show how Prince 2 embraces the project management principles of segregation of duties and issue escalation.
[5 marks (2.5 marks seg of duties, 2.5 marks for escalation)]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS3022 I.S. Strategy Management and Practice

5th June 2015

10:00am – 13:05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

This paper contains SEVEN questions; you are to attempt any FIVE questions.

Q1

a) Various definitions and schools of thought exist and propose different definitions and ideas about what strategy really is. Discuss and explain. [5 marks (2 marks for discuss and 3 marks for explain with some definition examples)]

b) How is vision linked to context for a particular domain IT strategy? [5 marks (1 mark for each valid point)]

c) Discuss the importance of the strategy formulation process for a complex project. [5 marks (1 mark for each valid point)]

d) What is meant by ‘strategic intent’? What is strategic intent composed of? [5 marks (3 marks for strategic intent, 2 marks for what it is composed of)]

Q2

a) Explain to what extent it is possible to support IT strategy using quantitative tools. [5 marks (1 mark for each valid)]

b) Discuss if good strategic assessment is indicative of the overall success a strategy. [2 marks (1 mark for each valid point)]
c) Explain the concept of ‘Context’ in defining strategy.  
[3 marks (1 mark for context, 2 marks for explain)]

d) Create a simple plan for implementing a small E-business strategy for increasing sales and customers. Describe any possible issues that can arise and briefly explain any possible solutions.  
[10 marks (5 marks for E-Business strategy, 5 marks for issues and solutions)]

Q3

a) Discuss why risk management assessment has to be carried out for IT projects  
[5 marks (1 mark for each valid explanation point)]

b) Discuss the positive and negative effects of risk management.  
[5 marks (2.5 marks for positive, 2.5 marks for negative)]

c) What types of objective planning must be included in strategic vision.  
[5 marks (1 mark for each valid point)]

d) Explain the difference between an Information Systems Plan and a statement of work  
[5 marks (2.5 marks for IS plan, 2.5 marks for SOW)]

Q4

a) Discuss the use of the CMM (Capability Maturity Model) in assessing IT Strategies.  
[10 marks (1 mark for each valid point)]

b) How is good project management directly related to successful implementation of modern IT strategies?  
[5 marks (5 marks for each valid point)]

c) What is meant by negative strategy? Briefly discuss and give an example.  
[5 marks (2 marks for neg. strategy, 3 marks for example)]

Q5

Compare and contrast the following terms

i. Project and Programme;

ii. Sandboxing and Abstraction;

iii. Issue and Risk;

iv. Work Products and Stage Boundaries (within the context of Prince 2);  
[5 marks (each 2.5 marks for compare, 2.5 marks for contrast)]
Q6

Outline the main rationale behind outsourcing. Describe two different types of outsourcing models showing the pros and cons of each approach. Your answer should be amplified through concrete examples.

[20 marks (5 marks for outsourcing, 10 marks for two different outsourcing models 5 marks each, 2.5 marks for pro and 2.5 marks for cons, 5 marks for concrete examples)]

Q7

a) An organisation is setting of with the task of consolidating a number of fragmented websites its different operational arms maintain into a unified site management solution. Outline, using PRINCE2 as a basis, the main activities such a project would follow.

[10 marks (5 marks for PRINCE 2, 5 marks for main activities)]

b) Show how a change in requirements towards the end of the project would be tackled using PRINCE2 methodology.

[10 marks (5 marks for requirement change, 5 marks for how this is tackled with PRINCE2)]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May 2015 Examination / Assessment Session

CIS3031 Scientific and Quantitative Aspects of I.S. 30th May 2015

08:30am – 10:35am

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) Total marks add to 102%, this will be scaled to 100%.

4) This exam paper contains 3 sections:
   
   Choose one question from Section A, one question from Section B and one more question from any section A, B or C.
   
   Each section is to be answered on separate booklets. Sections are to be clearly indicated on their respective booklets.

SECTION A

Question 1

a. Give an example of each of the four main classical ways of finding the solution to a given problem namely the application of an explicit formula, the use of recursion, the use of an algorithm that converges to a solution, the enumeration of cases. [8 marks]

b. Why do algorithms normally have an initialization stage, an iterative body and a termination step? [6 marks]

c. Specify in algorithmic pseudo code or in a programming language that you are familiar with an algorithm for finding the shortest distance between a starting node and any other node on a given network. [8 marks]
d. Use an algorithm to find the shortest distance between node A and any other node on the following diagram:

![Diagram of a network with nodes A, B, C, D, E, F and edges with weights 2, 3, 4, 5, 6, 7, 8, 9.]

[Choice of algorithm: 2 marks, algorithm steps: 5 marks, calculation and result: 5 marks=Total: 12 marks]

Question 2

a. New Travel plc is an agency which markets new travel destinations. It can promote and sell these new destinations using three forms of investment and marketing strategies. The net return for each type of outcome is shown in the following payoff matrix:

<table>
<thead>
<tr>
<th>Type of Investment</th>
<th>Good Sales 000's</th>
<th>Average Sales 000's</th>
<th>Poor Sales 000's</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td>B</td>
<td>600</td>
<td>300</td>
<td>-100</td>
</tr>
<tr>
<td>C</td>
<td>900</td>
<td>250</td>
<td>-400</td>
</tr>
<tr>
<td>Probability</td>
<td>0.30</td>
<td>0.40</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Find the expected profit under risk (EVUR) and under certainty (EVUC). Find also the expected value of Perfect information (EVPI)

[8 marks]
b. New Travel plc can utilize the services of a market researcher at a cost of £10,000 to study the market potential of these new destinations. The data in the table below indicates the historic outcome of the market researcher’s forecasting success.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Market Researcher finding</th>
<th>Good Sales Potential</th>
<th>Average Sales Potential</th>
<th>Poor Sales Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td></td>
<td>0.7</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.2</td>
<td>0.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td>0.1</td>
<td>0.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

(i) What is the optimal policy if the market research indicates good sales potential? Average sales potential? Poor sales potential?

[good sales potential: 5 marks, average sales potential: 5 marks, poor sales potential: 5 marks, Total: 15 marks]

(ii) What is the expected payoff given the above market research information? [6 marks]

(iii) Should the market researcher be hired on a cost-benefit assessment? Explain your choice. [5 marks]

SECTION B

Question 3

A regional Weather Monitoring agency has been tasked with developing a model for the regional weather in order to better understand the dynamics of the current weather patterns over the region and put the regional administration in a better position to plan for better utilisation of land for agriculture, design better water catchment and drainage systems and prepare for adverse weather conditions such as floods.

A Geographic Information System (GIS) was proposed which could permit the capture the necessary data and permit appropriate spatial and network analysis.

a) What kind of spatial data format would you recommend to use which could encapsulate these requirements in such a context? Select one from the following data formats: raster, digital elevation model, vector, network topology, triangulated irregular networks. Explain your reason for your choice? [6 marks]

b) What would be the main elements of this data format? [8 marks]

c) How could data over different time points be stored for the same geographic points? [4 marks]

d) Part of the requirements was the possibility of calculating the average rainfall over a year for each geographic point and then displaying it in visual form? Explain briefly how this can be done using such a GIS. [5 marks]
e) How would it be possible to visualise the different levels of intensity e.g. rainfall over the whole region without presenting data in numeric form? [5 marks]

f) How can the variation of rainfall for the same region but over different time periods be visualised using a GIS? [6 marks]

Question 4

A regional water distribution utility company has paper based maps of its water distribution network as well as detailed accounts of all its consumers, on an address-by-address basis in a text/numeric database.

The company has been advised to implement a Geographic Information System (GIS) to exploit the data available from these two sources and be able to model its distribution network and identify problem areas and propose solutions.

a) i) How can it transform the information contained in its paper maps into a form that can be handled by the GIS without having to manually input all the data? [4 marks]
   ii) What kind of device can be used in this respect? [4 marks]
   iii) Mention two hardware devices that could be used in such an approach [2 marks]
   iv) Mention two functions of the software [2 marks]
   v) What could be two potential sources of error in this process? [4 marks]

b) i) What do you understand by geo-referencing? [3 marks]
   ii) Why is it important to any GIS? [3 marks]

c) i) What is meant by address geo-coding? [4 marks]
   ii) What is its benefit in the context of the example application described above? [2 marks]
   iii) Explain briefly how this can be implemented? [6 marks]

SECTION C

Question 5

a. What do we understand by a heuristic in the context of problem solving? [5 marks]

b. State the five steps followed in heuristic searching and for each step state at least two heuristic methods which are applied to arrive at a solution. [12 marks]

c. Spatial analysis in Geographic Information Systems (GIS) can serve as a decision supporting tool in different fields. Discuss this statement using examples of GIS based solutions used in three different applications.

   Explanation of how spatial analysis supports decision making [7 marks]

   Application examples: [3 applications x 3 marks each]

   Continuity between concept and applications [1 mark]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems

B.Sc. IT - Year III
May 2015 Examination / Assessment Session

CIS3041: SECURITY, QUALITY AND RISK ISSUES IN I.S.  22nd June 2015

17.00-20.05

Instructions:
1) The first 5 (five) minutes of the exam is reading time.
2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted except for translators.
3) This exam paper contains SIX questions, you are to attempt 4 out of 6 questions.

1 a) With reference to the attached SERIM integrated Software risk model and in the context of studying the risk profile of a Student Management System (SIMS), comment on the following topics giving in each case two examples of risk considerations/ issues.

   (i) Risk Factors  [3 marks for risk factors + 3 marks examples]
   (ii) Risk metrics  [3 marks for metrics structure + 3 marks for comments]
   (iii) Risk management activities  [3 marks for activities + 3 marks for activity diagram]

b) Using the SERIM model describe how you would apply in practice this SERIM method to measure the various risks in the development of the above Student Management System.

   [7 marks]

   [Total 25 marks]

2 a) Draw an appropriate diagram and comment on the structure, clauses, and main features of the ISO 9001 quality reference model.

   [16 marks]

b) With reference to this ISO9001 model give two examples of non-compliance issues which may be raised in each the following areas:

   (i) Management Responsibility;  [3 marks for non-compliance examples]
   (ii) Resource Management;  [3 marks for non-compliance examples]
   (iii) Measurement, analysis and improvement.  [3 marks for non-compliance examples]

   [Total 25 marks]
3 a) Discuss why it is essential to recognize Quality, Security and Risk as three major non-functional aspects in the development of a software system. How are these three aspects inter-related?
   [8 marks for discussion + 4 marks inter-relations]

b) Give reasons why it is important to create a balanced scorecard and use appropriate software metrics to measure quantitatively these three important non-functional aspects of a software system.
   [7 marks]

c) Discuss why a policy of continuous improvement is necessary in the management of these three non-functional aspects of software development.
   [6 marks]
   [Total 25 marks]

4 a) Why was Code Access Security (CAS) required in .NET? What does it do? (6 items)
   [16 marks (4-Why was..; 2-Per CAS activity)]

b) Have there been problems with CAS usage?
   [3 marks (1-Per problem class)]

c) Discuss briefly the changes to .NET after the deprecation of CAS, including changes in security policy.
   [6 marks (1-Per change)]
   [Total 25 marks]

5 a) What is a Strong Name signature in .NET? What is it used for?
   [8 marks (6-What is.; 2-What is..)]

b) Discuss the main shortcomings of .NET’s conventional short name signatures.
   [14 marks (7-Per shortcoming)]

c) List three lessons which apply to managed code under .NET.
   [3 marks (1-Per lesson)]
   [Total 25 marks]

6 a) Define the terms: SDL, (Windows) Access Token, Privileges, SID, Man-In-The-Middle attack, threat target
   [3 marks (½-Per Term)]

b) How can relative attack surfaces be counted for an application?
   [10 marks (1-Per attack surface)]

c) What is defense in depth? Give an example.
   [12 marks (3-Definition; 9-Example)]
   [Total 25 marks]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2015 Examination / Assessment Session

CIS3041 Security, Quality and Risk Issues in IS. 22nd June 2015

[Evening course] 17:00pm – 20:05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted except for translators.

3) This exam paper contains SIX questions, you are to attempt 4 out of 6 questions.

1a. Business Continuity Planning (BCP) and Disaster Recovery Planning (DRP) are major operational considerations in the management of operational risks. In the context of a Hospital Management System explain how a BCP/DRP process can be established and implemented for providing and securing ICT operations. [12 marks]

1b. Why are staff training and regular testing of such a plan essential for its effective application when faced with an emerging or actual risk event? [8 marks]

1c. Discuss how cloud computing can support and ensure Business continuity [5 marks]

[25 marks]

2a. Discuss access control in its various physical, technical and logical forms and in the context of protecting and securing an ICT information system from security breaches. [2 marks each for physical, technical and logical measures total 6 marks]

2b. Discuss the issues of identification, authentication, accountability and auditing in the management of access control. [2 marks for each type of issue total 8 marks]

2c. Describe the Kerberos authentication protocol and give two examples where it is used. [8 marks for protocol and 3 marks for examples total 11 marks]

[25 marks]
3a. Draw a diagram showing the main structures and clauses of the ISO9000 quality model. [10 marks]

3b. The ISO quality model is based on eight basic quality management principles. State these eight principles. [8 marks]

3c. In the context of modern software methodologies give an example of how each of these principles is incorporated to ensure in built quality assurance. [7 marks]

4a. Discuss the role of a software quality manager in building a software quality culture within an organization {hint: Consider technical, business, and stakeholder assurance issues} [8 marks]

4b. Discuss the importance of documentation in maintaining and improving quality within an ICT company. [8 marks]

4c. XYZ, a software development company has noticed there has been an increase in complaints and requests for support since a new update to their flagship software package was distributed. Describe some of the quality measures the software quality manager will need to take to reassure their client base. [9 marks]

5a. With reference to the attached SERIM integrated Software risk model and in the context of studying the risk profile of a Manufacturing Management System (MMS), comment on the following topics giving in each case two examples of risk considerations/ issues.

(i) Risk Factors [4 marks for risk factors + 2 marks examples]
(ii) Risk metrics [4 marks for metrics structure + 2 marks for comments]
(iii) Risk management activities [4 marks for activities + 2 marks for activity diagram]

5b. Why is the concept of just in time important in software risk management? Discuss. [7 marks]

[25 marks]
6a. The ISACA society states that ICT risk issues can be strategic, operational, financial or compliance related. Discuss these types of risk and give two examples of each type. [8 marks for discussion + 8 marks for examples]

6b. Why is it important that software risks are prioritized and that only high risks above a certain degree of severity are monitored? [5 marks]

6c. Explain why the software risk profile of a company changes over time and discuss the implication of this for a risk manager? [4 marks]

[25 marks]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2015 Examination / Assessment Session

CIS3088 e-Learning Applications Development 12th June 2015

10:00am – 13:05pm

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:
   • Answer any 10 questions from the following 13 questions.
   • All parts of a question should be written together.

1. The ‘Learning pyramid’ suggests the approximate percentage of knowledge retention associated with different learner engagement methods (including demonstration, audio-visual presentation, lecturing, teaching others, discussion, reading and practicing doing).
   a. Draw the learning pyramid suggesting percentage of knowledge retention associated with each method. [3 marks]
   b. Give one example for each method suggesting how it can be implemented in a traditional campus based class and in an e-Learning environment. [1×7=7 marks]

2. a. Name all six categories in ‘Bloom’s revised taxonomy’ (in sequence). [½×6+1=4 marks]
   b. Give two examples of digital activities for each of the six categories of Blooms’ Digital Taxonomy. [(½×2)×6=6 marks]
3.

a. Kolb's learning styles model proposes four learning styles. Name and describe each of the four learning styles suggesting how learning happens in each of these learning styles. [1x4=4 marks]

b. VAK learning styles are based on modalities, (i.e., channels) learners use to receive and learn new information/experience. Name each learning style and give two example activities (for each learning style) best suited to the learners of that particular learning style. [1x3=3 marks]

c. In your opinion can the learning styles help ensure a better learning outcome? Justify your opinion. [1 mark]

d. Give an example to illustrate how learning styles can be used in an e-Learning environment to improve student engagement and learning outcome. [2 marks]

4.

a. Suggest any three scenarios with suitable examples when traditional face-to-face classroom based learning or blended learning is a better choice than other models of e-learning. [1x3=3 marks]

b. In your opinion, is there a minimum age for a learner below which any e-Learning environment might not be suitable to him/her? Justify your opinion. [2 marks]

c. Is there any difference between e-Learning and m-Learning? Justify your answer. [1 mark]

d. Discuss two merits and two demerits of m-Learning. [1x4=4 marks]

5.

a. In your opinion, is instructional design an art or science? Justify your opinion. [2 marks]

b. With a suitable example explain Krathwohl's taxonomy of affective learning. [1x5=5 marks]

c. What are the six stages of behavioural change? [1/2x6=3 marks]

For each of the following questions assume that you are required to run an Information Systems study unit through an e-learning environment for an undergraduate course program (Bachelor of Science (Honours)).

6.

a. Which e-learning model would you recommend for your e-learning design? Write each e-learning model and justify why (or why not) it is the best choice. [1+5=6 marks]

b. How is your selected e-learning model a better choice than the classical face-to-face classroom based environment:
i. Give four advantages you might have as a learner. \( [\frac{1}{2} \times 4 = 2 \text{ marks}] \)

ii. Give two advantages you might have as an instructional designer/facilitator. \( [\frac{1}{2} \times 2 = 1 \text{ mark}] \)

iii. Write two merits of running the study unit in the classical face-to-face classroom based environment. \( [\frac{1}{2} \times 2 = 1 \text{ mark}] \)

7. Moore defined three types of interactions that a learner can take part in. E-learning added one more type of interaction.
   a. Name each of these four interactions. \( [\frac{1}{2} \times 4 = 2 \text{ marks}] \)
   b. Suggest how each type of interaction would happen to facilitate learning in the study unit you are offering through the e-learning platform. \( [\frac{1}{2} \times 4 = 2 \text{ marks}] \)
   c. Suggest how each type of interaction would happen to facilitate learning in the study unit if it is offered in a classical face-to-face classroom based environment. \( [\frac{1}{2} \times 4 = 2 \text{ marks}] \)
   d. Contrast the differences between presentation and interactivity. \( [2 \text{ marks}] \)
   e. Would you like to have presentation or interactivity or both in the study unit you are offering through e-learning? Justify your answer and suggest how you would implement your choice. \( [1 + 1 = 2 \text{ marks}] \)

8. The route map for an e-learning program defines readings, resources, activities, assessments and feedback. For the study unit you are offering through the e-learning platform suggest what readings, resources, activities, assessment methods and feedback mechanism you would include. \( [2 \times 5 = 10 \text{ marks}] \)

9.
   a. What are the three essential components of a Virtual Learning Environment? Write the functions of each of these. \( [1 \times 3 = 3 \text{ marks}] \)
   b. Write two merits and two demerits of using a cloud computing infrastructure to implement an e-Learning system. \( [1 \times 4 = 4 \text{ marks}] \)
   c. Explain the importance of careful Human Computer Interface design for an e-Learning system. \( [2 \text{ marks}] \)
   d. In your opinion, does the ease of use of an e-Learning system affect the learning outcome? Justify your opinion. \( [1 \text{ mark}] \)

10.
   a. Would you use digital games in the study unit you are offering through e-learning? Justify your answer. \( [1 \text{ mark}] \)
   b. Write two merits and two demerits of using digital games in e-learning. \( [(\frac{1}{2} \times 2) + (\frac{1}{2} \times 2) = 2 \text{ marks}] \)
c. Would you use regular videoconferencing in the study unit you are offering through e-learning? Justify your answer. [1 mark]

d. Write two merits and two demerits of using videoconferencing in e-learning. \([\frac{1}{2} \times 2 + \frac{1}{2} \times 2 = 2 \text{ marks}]\)

e. Would you use pre-recorded videos in the study unit you are offering through e-learning? Justify your answer. [1 mark]

f. Write two merits and two demerits of using pre-recorded videos in e-learning. \([\frac{1}{2} \times 2 + \frac{1}{2} \times 2 = 2 \text{ marks}]\)

g. Would you use animated multimedia in the study unit you are offering through e-learning? Justify your answer. [1 mark]

11.

a. Would you include the following with Virtual Learning Environments (VLE) for the study unit you are offering through e-learning? Justify your answer:

i. Simulations

ii. Mind-maps

iii. Wikis

iv. Blogs

v. Discussion forums

vi. Podcasts

vii. Instant messaging

viii. RSS feeds

\([1 \times 8 = 8 \text{ marks}]\)

b. In your opinion, can Second Life help improve the e-Learning experience? Justify your opinion and write two merits or two demerits of using Second Life in e-Learning. \([1 + \frac{1}{2} \times 2 = 2 \text{ marks}]\)

12.

a. Where would you place the study unit in the Impact Matrix? Justify your choice.

\([2 \text{ marks}]\)

b. In your opinion, is the e-learning environment more prone to cheating than an offline (classroom based) learning environment? Justify your opinion. \([2 \text{ marks}]\)

c. Discuss strategies to minimize cheating in e-learning. \([3 \text{ marks}]\)

d. Compare Blackboard Learn LMS with Moodle. \([3 \text{ marks}]\)

13. In class some time was spent discussing eLearning standards. The evolution of standards over the last 30+ years was discussed and a brief online exploration of object repositories was conducted. The results were not what were promised when standards such as SCORM were promoted in the late 90s and early 2000s but this has not stopped the
promotion of standards and the formation of new ones (for example SCORM's successor, the TinCan standard).

Given what was discussed and discovered during the exploration of eLearning standards:

a. Are eLearning standards making a beneficial impact on eLearning? [5 marks]
b. What are the benefits of a widely followed eLearning standard? [5 marks]
UNIVERSITY OF MALTA
Faculty of Information and Communication Technology

Department of Computer Information Systems

_CIS3101 Cloud Computing_

Date: 12\textsuperscript{th} June 2015  
Time: 10.00-12.05 hrs
CIS3101 - Cloud Computing

Instructions.

1. There are a total of six questions. The first one (Q1) is mandatory. Choose any three of the remaining five questions to answer.

2. Read all questions carefully.

3. Put answers in spaces provided. Plenty of space has been provided for answering each question. Note that the amount of space provided does not imply that you must use it all, answer each question to the best of your ability. NOTE: There is extra space provided at the end of the exam should you require it. PLEASE make it clear what question is being answered there if you use it.

4. No calculators or other electronic devices.

<table>
<thead>
<tr>
<th>Section</th>
<th>Points</th>
<th>Your Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td></td>
<td></td>
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<tr>
<td>Mandatory Questions (Layfield Mix feat. Vella &amp; Vella, Xuereb, Porter &amp; Depasquale)</td>
<td>25</td>
<td></td>
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<tr>
<td>Choose 3 of the Following 5</td>
<td></td>
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<tr>
<td>IaaS/SaaS/PaaS</td>
<td>25</td>
<td></td>
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<tr>
<td>History / Business case for Cloud</td>
<td>25</td>
<td></td>
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<tr>
<td>Virtualisation</td>
<td>25</td>
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<tr>
<td>Database in the Cloud</td>
<td>25</td>
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<tr>
<td>Security in the Cloud</td>
<td>25</td>
<td></td>
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<tr>
<td>TOTAL</td>
<td>100</td>
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</tbody>
</table>
Question 1 - Mandatory  [25 marks]

(a) What does consistency mean and entail, in the presence of replicated data?

(b) Consider the following setup for an e-commerce service: 4 HTTP servers are currently handling user requests, with a load-balancing rule directing user traffic to the first available (or least loaded) server. What issues should you expect if a user is adding products to a shopping cart during a high-load period?
(c) What concerns do consumer organisations often require or wish to have adequately addressed prior to making the transition to the Cloud?

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(d) Do you agree with the following statement? "It’s wise to wait until Cloud services are perfectly secure before migrating to the public Cloud". Briefly justify your position.

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(e) ‘Multiprogramming and virtualisation both require hardware support.’ Give a criticism on the accuracy of this statement.
Question 2 - IaaS/PaaS/SaaS [25 marks]
You have been sub-contracted by snapchat.com to build their new permanent-snap feature whereby user messages (containing video, photos, drawings and text) are uploaded onto snapchat’s servers and subsequently shared with a closed set of recipients. However, unlike traditional snaps, all messages will be stored forever and users may be able to retrieve old snaps and re-view them at will. At the moment there are around 750 million snaps uploaded and shared every day (assume 50KB per Snap message). Using any diagramming notation of choice, provide a first-cut design of how the above feature could be developed over Azure’s PaaS (Platform as a Service). You are not expected to provide any low-level code, however pseudo-code can be used to provide algorithmic details.
What should you consider?

- How will snaps be processed (i.e. filtering, resizing, etc)?
- How and where will snaps be stored?
- How can the different PaaS Roles assist to ensure:
  1. Scalability (from the service providers perspective)
  2. Responsiveness (from the user’s perspective)

Use the space provided to sketch your architecture and annotate where necessary.
Question 3 - History / Business case for Cloud  [25 marks]

(a) The concept of utility computing was raised some time ago by visionaries such as Professor John McCarthy and Internet pioneer Leonard Kleinrock. The evolution of computing paradigms from that time (the 1960s) to today has seen many changes in technological capabilities and patterns of usage of computing power. Briefly, describe how the advance of technology since those times to today has enabled Cloud Computing to come into being and likely be the leading competing paradigm for years to come. Discuss not only the change in technology but also how technology has been employed over the years and creating the catalyst to enable Cloud Computing to come into being in its current form.
(b) To a consumer organisation, what are the main business benefits of Cloud Computing?

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(c) How do these benefits (as outlined in (b)) affect the traditional IT function and its staff within the consumer organisation?
[4] (d) Given that there are supposedly so many potential advantages for the consumer, discuss how this can still be good business for the provider.
Question 4 - Virtualisation [25 marks]

Clearly distinguish between abstraction and virtualisation. Your answer must include development of the following themes:

[2] (a) The problem which abstraction addresses

[4] (b) Characterisation of the solution which abstraction provides to the problem referred to in (a)

[2] (c) The limitations to the solution

[4] (d) Formulation of these limitations in formal statements that describe these limitations as a new problem

[4] (e) How virtualisation provides solutions to the problem referred to in (d)

[3] (f) A taxonomy of virtualisation (please use the box provided)

[6] (g) For each node of your taxonomy, very briefly describe the particular form of the solution (referred to in part (e)) in terms of the formal statement described in part (d)
Question 5 - Database in the Cloud [25 marks]
Your answer in this question must be in a database transaction processing over replicas context.

(a) What are the aims of a consensus protocol?

(b) What is exactly the problem of the two phase commit vis-a-vis fault tolerance?

(c) Name a product that uses a variant of “Paxos” and what is its main function.
(d) How is consensus reached in “Paxos”? (Reference to “Basic Paxos” version is adequate).
Question 6 - Security in the Cloud  [25 marks]

(10) (a) Given you have a lead role in a company’s ICT operations, enlist and fully justify three concerns you may have about migrating your applications to the public cloud. [3 Marks for each concern: 1 for clarity].
(b) Given that business requirements actually dictate the move, for each identified concern explain how you would mitigate the risk involved. [5 Marks for each concern mitigation].

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EXTRA SPACE - If you use this PLEASE MAKE IT CLEAR WHICH QUESTION/PART the answer refers to. Use this only if you feel you do not have enough space to put an answer OR if you make a mistake and need to rewrite your answer to a question.
Instructions:
1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted except for translators.
3) This exam paper contains SIX questions, you are to attempt 4 out of 6 questions.

Section A

1

a) Define the terms scientific visualisation, particle system, composition and core shadow:
[8 marks (2-each term)]

b) Discuss the customisation of pre-existing 3D models and the use of MATs in Daz Studio.
[7 marks (3-customisation;4-MATs)]

c) Describe the normal Daz Studio workflow procedure for a static scene. How would this be modified for creating an animation?
[10 marks (1-each step;2-animation)]
[Total 25 marks]

2

a) AlistApart.com wrote about the ideal Flash embedding methods, especially to avoid lock-in, compatibility problems and patent issues. List which problem existed as a result of the Eolas patent infringement.

List three Markup Combination Methods used to embed flash content in (X)HTML and explain them briefly. Which publically available script is commonly used to implement this including bypassing the Eolas problem?
[17 marks (1-list which problem;15-list three and explain;1-mention]

b) Daz Studio can be used to create movies using the old container format avi. Briefly describe how you would be able to make a Matroska format video from a sequence of images (generated by a raytracer) or from an XviD avi generated by Daz Studio.
[8 marks]
[Total 25 marks]
3

a) It is required to find the position of a ball travelling in a straight line in terms of the current frame. Knowing that the initial and final positions are 6 and 30, work out a formula to do this using the LERPING method.

[8 marks (8-work out;)]

b) What is the traditional role of the in-betweener?
   What are characteristic frames in an animation?
   What is a worm-eye’s view?
   What is a bird-eye’s view?

[8 marks (2-Per definition)]

What is the organisational process of creating an animation?

[9 marks (3-per described part of the organisational process)]

[Total 25 marks]

4

Given the following 3D shape (as identified by the bold lines):

![3D Shape Diagram]

a) Prepare the Vertex List, the Edge List and Face List using an Edge-based representation.

[16 marks (5-vertex;5-edge;6-face)]

b) Verify that the polyhedron is homeomorphic to a sphere.

[4 marks]

c) Is the verification of this condition sufficient for all objects?

[5 marks]

[Total 25 marks]
5  a) What is a non-realistic image? What is anti-aliasing?  
                                           [4 marks]

b) When clothing figures in Daz Studio it happens that there are problems getting them to “fit” properly. Discuss both the old and newer way to solve this issue.  
                                           [11 marks (5-Old; 6-New)]

c) Describe ambient light, specular reflection, lambertian reflection, diffuse reflection and raking light in terms of light illumination.  
                                           [5 marks (1-per term)]

d) What is uv bounding?  
                                           [5 marks (2-Definition; 3-Visual example)]
                                           [Total 25 marks]

6  Assuming the following L-grammar with alphabet \{A, B, [, ], (, )\} and the two production rules 
1. A → AA[B]AA(B)  
2. B → BB  

given that the first starting generation (axiom) is A, (i) write down and draw the graphical representation of the first three generations. (ii) What would be a useful modification to the above L-grammar?  
                                           [25 marks (10-write; 10-draw; 5-What would..)]  
                                           [Total 25 marks]
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions: Choose any four questions; each question carries the same amount of marks. If a question has a section with sub-sections, then, if not otherwise indicated, each sub-section carries equal marks.

1 a) Consider the simple relational schema in appendix (i.e. one). Determine the order of table tuple uploads so as to address data dependency issues. [ 7 marks ]

b)  
   i  What is, according to Kimball, a conformed dimension?
   ii  Give two examples of conformed dimensions.
   iii What mapping is required to map a data source look-up values into a data warehouse conformed dimension? [ 12 marks ]

c) Given that a data source provides an address as a long text data value, give a high level plan on how to transform and encode this into a high quality address dimension? (i.e. must consider a location hierarchy). [ 6 marks ]
2 Consider the following example and very simple fact table: fsales(date, product, store, qty, sale). Both qty and sale are numeric and date, product and store functionally determine qty and sale.

a) Give an example of the data output expected from an OLAP roll-up query on dates. [5 marks]

b) Give an example of the data output expected from an OLAP slice over a product. [5 marks]

c) Give an example of the data output expected from an OLAP dice over date, store and product. [5 marks]

d) Give an example of the data output expected from an OLAP drilling down on product (produce a product hierarchy). [5 marks]

e) Give an example of the data output expected from an OLAP pivot table on product and store. [5 marks]

3 Materialised views are able to deliver impressive query processing performance.

a) In what specific ways can materialised views help in query processing and query optimisations? (Mention two ways). [4 marks]

b) Explain how and what needs to be specified in a materialised view definition. Use of an SQL DDL is expected. [5 marks]

c) Consider the following simple fact table: f(a, b, c, m) with m being the numeric part of it. Create materialised views on the fact table provided for (a, b, c), (a, b), (a), and ALL. The aggregate to compute in each materialised view on attribute f.m are sum(), count(), min() and max(). [16 marks]

4 a) i Explain differences between tightly coupled and loosely coupled distributed systems.

ii Give an example of a loosely coupled distributed system. [6 marks]

b) We have a multidatabase across libraries. One participating library only allows one book on a loan (i.e. loans are shown in a single table). Implement a schema integration technique that would allow this library to seemingly adhere to the multidatabase agreed loans system whereby a loan can include many books. [6 marks]
c) What are the generic steps a multidatabase query must pass for its processing? [8 marks]

d) Explain the term global transaction and what are the main difficulties in terms of techniques and processes? [5 marks]

5 a) List and explain in detail how database techniques are useful in a data mining project. [7 marks]

b) Explain association rules and implement the a-priori algorithm through database artefacts. Your response must include first normal form relations and SQL statements. Also a thorough explanation of confidence and support levels needs to be clearly shown in the algorithm’s workings. [18 marks]

6 a) Name two generic data clustering techniques. [2 marks]

b) What role does a “distance” function have in a clustering technique? [3 marks]

c) If we are to interpret a “distance” as geo-spatial (distances on the surface of Earth) then explain why we still need different “distances” functions? [5 marks]

d) List and explain three “distance” measures used in geo-spatial distances. [9 marks]

e) What type of data design and data queries are required to cluster geographical regions? [6 marks]

7 This question is based on the material indicated and discussed in class. Specifically the paper is called “A data warehouse in an e-health system” by Di Bitonto et al, in Recent Advances in Energy, Environment, Biology and Ecology, 2012.

a) Identify two data collection modes and their respective frequency of uploads (i.e. into the data warehouse). [2 marks]

b) Identify the two main fact tables and any two dimensions. [2 marks]

c) List three tools used in this project by its developers and end users. [3 marks]
d) The project development mirrored the hub-and-spoke distribution paradigm, where the services are located at the spokes and each specialised service, or specialist, is located at a hub.
   i  How did the hub-and-spoke distribution model influence the data warehouse design?
   ii What type of operations are expected at a hub and spoke of the distribution model? (Relate these queries to the data warehouse design.)
      [ 8 marks ]

e) The data warehouse was provided with a number of readily defined report formats. Describe two of these. Response must indicate the nature and details of the query that drives each report.
      [ 2 marks ]

f) A third hub is to be introduced in the project’s scope (e.g. Endocrinology expertise for diabetes hub is to be integrated). Write a high level plan on how this hub is to be introduced and deployed in the data warehouse.
      [ 8 marks ]
One: OLTP relational schema
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) Answer any two questions.

1a. Governments have realized that to become more effective they have to go digital in providing services to the public. Discuss some of the issues they face and the actions they have to take in becoming digital organizations. [25 marks]

1b. Malta has shown itself among small countries to be a leader in driving an ambitious digital strategy. In particular it has developed a National Digital Strategy 2014-2020. Write a summary report showing the main thrust of this strategy and outlining the main challenges it faces and the opportunities it creates. [25 marks]

2a. As we increasingly become a globalized information society, new issues are arising which generate novel legal issues and ethical dilemmas.

Discuss and give examples and where applicable quote cases and Acts of internet related legal and ethical issues in three of the following areas:

(i) Data Privacy and Data Protection;

(ii) Freedom of Information;

(iii) Child Protection on the Web;

(iv) Equal Access and Opportunity in an Information Society. [10 marks each]

2b. Select two other legal areas which you have not discussed in 2a. above and which you consider merit discussion especially because they involve international issues and involve different legal jurisdictions or international agreements in their resolution. [10 marks each]

3. The internet is changing the way society and citizens interact with the State and the Media.

Write an essay which discusses these changes, transformations and new forms of citizen interaction.

[hint: Your essay should consider among others, issues such as: a citizen e-ID, citizen democracy, the social media, minority rights and blogs, and being a EU digital enabled citizen. [50 marks]
UNIVERSITY OF MALTA
Faculty of Information and Communication Technology
Department of Computer Information Systems

CIS1002 Electronic Commerce 2

Date: 10th June 2016
Time: 10.00-11.35 hrs
CIS1002 - Electronic Commerce II

Instructions.

1. Answer all questions.

2. Read all questions carefully.

3. Put answers in spaces provided. Plenty of space has been provided for answering each question. Note that the amount of space provided does not imply that you must use it all, answer each question to the best of your ability.

4. No calculators or other electronic devices are allowed.

<table>
<thead>
<tr>
<th>Section</th>
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<tr>
<td>Multiple Choice</td>
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Section 1: Multiple Choice [40 marks]

**CIRCLE** the letter of the **BEST** answer.

[2] (a) A(n) __________ is a connection that uses public networks and their protocols to send data in a way that protects the data as well as a private network would, but at a lower cost.
   
   A. Public Network
   B. Virtual Private Network
   C. Virtual Public Network
   D. Private Network

[2] (b) IPv6 uses a __________ number for addresses.
   
   A. 32 bit
   B. 64 bit
   C. 128 bit
   D. 256 bit

[2] (c) A newer eMail protocol that performs the same basic functions as POP, but includes additional features, is known as __________.
   
   A. IMAP
   B. IPOP
   C. SMTP
   D. AOL Mail

[2] (d) __________ are sets of words that are assigned to specific IP addresses.
   
   A. Octets
   B. URLs
   C. Piconets
   D. Domain Names

[2] (e) The ability of a network to connect devices that use different operating systems is called __________.
   
   A. Uniform Connectivity
   B. Device Interconnection
   C. Client/Server Compatibility
   D. Platform Neutrality

[2] (f) __________ server has dominated the Web since 1996 because it is free and performs very efficiently.
   
   A. Apache HTTP
   B. Microsoft IIS
   C. UNIX
   D. Solaris Web Farm

[2] (g) A(n) __________ file on a Web site is one that is not linked to any page.
   
   A. Lost
   B. Index
   C. Orphan
   D. Independent
(h) generally includes all purchasing activities, plus the monitoring of all elements of purchase transactions.
   A. Procurement
   B. Transaction
   C. Logistics
   D. Production

(i) The Web is enabling the shift from hierarchical to network forms of ____________.
   A. Community Organisation
   B. Social Organisation
   C. Relationship Organisation
   D. Economic Organisation

(j) Because EDI transactions are business contracts and often involve large amounts of money, the existence of an independent audit log helps establish ____________.
   A. Secrecy
   B. Integrity
   C. Nonrepudiation
   D. Privacy

(k) ____________ often offer web server management and rent application software to businesses.
   A. Static Catalog Providers
   B. Client Service Providers
   C. Knowledge Management Providers
   D. Commerce Service Providers

(l) Larger business often prefer to use a ____________ application system that separates the presentation logic from the business logic.
   A. Monolithic
   B. Component-Based
   C. Database-Driven
   D. Client-Based

(m) ____________ packages allow the merchant to have explicit control over merchandising choices, site layout, internal architecture, and remote and local management options.
   A. Web Hosting
   B. Basic Electronic Commerce
   C. Midrange
   D. CSP
[2] (n) ________ refers to preventing unauthorised data modification.
   A. Integrity
   B. Secrecy
   C. Necessity
   D. Completeness

[2] (o) ________ is the protection of individual rights to nondisclosure.
   A. Secrecy
   B. Privacy
   C. Necessity
   D. Sensitivity

[2] (p) ________ encryption encodes a message with an algorithm that uses a single numeric key, such as 3094820393, to encode and decode data.
   A. Hash Coding
   B. Asymmetric
   C. Symmetric
   D. Tranformative

[2] (q) A(n) ______ is a program hidden inside another program or Web page that masks its true purpose.
   A. Mask Program
   B. Hidden Route
   C. Hacker Application
   D. Trojan Horse

[2] (r) What payment method dominates online transactions today?
   A. PayPal
   B. Gift Cards
   C. Credit Cards
   D. Prepaid Cards

[2] (s) ________ is spending a particular piece of electronic cash twice by submitting the same electronic currency to two different vendors.
   A. Double Dipping
   B. Double Spending
   C. Fraudulent Spending
   D. Illegal Shopping

[2] (t) When a cardholder successfully contests a charge, the acquiring bank must retrieve the money it placed in the merchant account in a process called a ______.
   A. Refund
   B. Chargeback
   C. Reverse Charge
   D. Digital Justice
Section 2: Short Answer  [60 marks]

[5]  (a) What is the difference between a public and a private network?

[5]  (b) Explain the difference between a dynamic Web page and a static Web page.

[8]  (c) Governments do not typically sell products or services to customers, they perform many functions for the individual citizens, businesses, and other organisations that they serve. However, Governments may operate business-like activities. The use of eCommerce, in this context, by Governments is often called eGovernment. Give 4 examples of types of transactions that an eGovernment implementation may support.
(d) You've been hired as an eCommerce technology manager for The Hammer & Anvil, a small ironmongery here in Malta. They are looking to expand and offer the sale of goods online (for goods with a reasonable shipping profile). Describe how you would go about getting their website online (including how it would be hosted) [4 Marks]. Name three (3) features that would be required [6 Marks].
(e) Digital certificates are used for many different types of online transactions. You realise that the The Hammer & Anvil eCommerce site you have helped setup (previous question) will need one in order to give shoppers confidence that the activity on the website is secure so that they can see with whom they are dealing. What steps would you need to take in order to secure a digital certificate for the site (including information you may need to provide, especially for the newer more secure certificates [SSL-EV])?
(f) As discussed in class many online businesses have to be vigilant against various security threats. One such example explored was that of the iGaming industry, specifically online betting eCom-merce sites. It is not uncommon for them to deal with the threat of DDoS (Distributed Denial of Service), thus interrupting their business activities. Computer security is generally considered to include three main elements. Name and describe these three elements [9 Marks]. Which of these elements would be violated in a DDoS attack and how? [3 Marks]
(g) Describe the basic structure of a phishing attack.
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination/Assessment Session

CIS1004: Computing for Chemists and Pharmacists 22nd June 2016

10.00-12.05

Instructions:

1) The first 5 (five) minutes of the exam is reading time.
2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.
3) Total marks add up to 102%, which will be scaled to 100%
4) General instructions:
   Answer three out of five questions (34 marks per question)

Question 1 SPREADSHEETS

A pharmacy retail chain has collected a set of very important data via its Sales system over the past five years. The data is in the form of rows and columns - each row represents an individual sale and the columns consist of the attributes for each sale i.e.

Cash sale number, Data of sale, Name of Product,
Qty Sold, Unit Price, Total Price and Name of Outlet

The management wish to generate a set of three reports from this set of data, as follows
i) a breakdown of sales by product
ii) a breakdown of sales by product and retail outlet
iii) a breakdown of sales by product and month

a) If you were to use the pivot-table function to produce these reports, describe the main components of the pivot table for each of these reports i.e.

   i) which attributes (columns) from the dataset would you use to aggregate (group) the data for each report? (2 marks x 3 reports – total 6)

   ii) which attribute (column) would you choose as the value to be analysed? (2 marks x 3 reports – total 6)

   iii) what arithmetic operation would you choose to apply on the value? (2 marks x 3 reports – total 6)

b) In report iii) there is no attribute (column) specifying month. How would it be possible to produce this report just the same? (3 marks)

c) How would it be possible to visualise the reports other than in a tabular format? (3 marks)
d) Suggest a type of data visualisation that would be suitable for each of the three reports
   (2 marks x 3 = total 6)

e) The tables output from the analysis need to be included in a wordprocessed document. How can this be achieved without having to type in the values again and how can the data be updated automatically if the values in the source spreadsheet change over time? (4 marks)

Question 2 DATABASE MANAGEMENT SYSTEMS (DBMS)

A large retail pharmacy chain company is planning to consolidate the recording of customer orders for medicinals from all its retail outlets in one single shared system.

a) Mention two advantages of sharing such data through a single database system. (2 marks per advantage - 4 marks total)

b) How can unauthorised access to this shared database be restricted? (2 marks)

c) The following items of data will be stored for each sale in the system:
   
   date of order, order number, name of product, quantity ordered, quantity issued, 
   name of patient, contact number of patient, address of patient

You have been tasked with designing the layout of the data for the common database.
Specify the following:
   i) the tables to create, (2 marks)
   ii) the fields in each table, (8 marks)
   iii) the type and maximum number of characters or digits, (6 marks)
   iv) the primary key and any foreign keys in each table. (4 marks)

d) What are two of the benefits of using separate tables and foreign keys to store the data? (4 marks)

e) The following three reports were requested - a full list of orders by client, an analysis of orders per product and retail outlet and a list of orders not fully delivered. Mention two functions of a database management system that can be used to generate these reports. What is the main purpose of each of these two functions? (4 marks)

Question 3 DATA WAREHOUSING AND GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

An international agency has been tasked with monitoring the spread and control of infectious diseases on a global level collecting data about a chosen set of diseases from the health authorities of different countries on a regular basis. This generates a very large volume of data which is difficult to analyse and interpret.

a) The use of a Data Warehouse was recommended. Why do you think this would help - as opposed to a regular database management system? (5 marks)

b) How could Data Mining techniques and other data analytic technologies be able to help in this situation? (7 marks)

c) Discuss briefly how feedback from these analytic components could be used to update/improve the source systems of the data. (6 marks)
d) Give an example of one type of Data Mining technique that could be used in this context and specify what kind of output could be produced using this technique.  

(6 marks)

e) Another type of Information Systems is the Geographical Information System (GIS). What basic characteristic of a GIS distinguishes it from other Information Systems?  

(3 marks)

f) Give an example of how a GIS can help this agency in its task of monitoring spread of diseases.  

(7 marks)

Question 4 SECURITY and GROUPWARE

a) All organisations that make use of Information Systems are exposed to a variety of risks from loss of data which can cause various degrees of harm to its operation as well as its owners, its employees and its clients.

The following are three types of threats to data security:

- Threat A: Infections by Computer viruses
- Threat B: Data loss through faulty software
- Threat C: Unauthorised access via WIFI (fly-by hacking)

For each of the above threats to Information Systems:

i) briefly describe what the threat consists of,
ii) how it can come about,
iii) the effect it can have on the organization, and
iv) what means exist to minimise the risk of data loss through these threats.

(7 marks each threat x 3 threats, plus 1 overall = Total 22 marks)

b) A group of researchers are working on a new pharmaceutical product. The group is operating via different teams across a number of research centres across the world.

Discuss the benefit of using Groupware in terms of cost, efficiency, security and accessibility for three of the following activities:

- holding of regular meetings between the separate task groups
- sharing of research results and related material
- holding frequent and informal information exchanges in between researchers
- keeping track of all documentation gathered and developed by the different teams during the project's lifetime
- issuing important notifications to all groups

In each case mention specific groupware functionalities that could be used.

(4 marks per activity x 3 activities - Total 12 marks)

Question 5 DATA MINING

a) Mention three steps in the process Knowledge Discovery and explain how they depend on each other.

(4 marks x 3 steps - 12 marks total)
b) A research study was carried out on the use of a specific antibiotic and the following data was collected on a set of patients who used the product:

date of birth, age, gender, symptoms presented, weight, height, dose and degree of relief from symptoms.

A model to represent the knowledge about the effectiveness of the product was developed using a Decision Tree technique provided by a Data Mining application.

i) Which of the attributes could have been used as the input variables for this technique? (3 marks)

ii) What could have been the target value? (2 marks)

iii) It was found that the use of the date of birth column gave rise to very complex and 'shallow' decision trees. It was decided to create a new column called age. How could this be done? (4 marks)

iv) The age data was further transformed to a range value in steps of 10 years, e.g. 0-9 years, 10-19 years, 20-29 years, ... How could this second transformation done? (4 marks)

v) How could the accuracy of the model created be tested? (4 marks)

vi) If the accuracy of the model developed was not good enough, what other steps could be taken to improve its accuracy? (5 marks)
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Calculators are allowed.

3) Dictionaries are allowed for foreign students.

4) General instructions:
   
   Students must attempt question 1 (compulsory) and any other question from section A, and any two questions from section B – four questions in all.

   Use a separate script for each section.

   Each question carries 25 marks.

   Three hours.

SECTION A – You must attempt question 1 and any other question from this section

Question 1 (Compulsory)

a) i) Is MergeSort \( \Theta(n^2) \)? Explain your answer.

ii) Is MergeSort \( O(n \cdot \log n) \), \( O(n^2) \) or both? Explain your answer.

iii) Define running time function and give two examples.

iv) Show that the running time function \( 7n^2 \) is \( \Theta(n^2) \).

v) What do you understand by the time and space complexity of an algorithm?

vi) What does it mean for an algorithm to be intractable? Give an example. 

\[ 3+3+3+2+3+2 = 16 \text{ marks} \]

b) Give a formal definition for the \( \Theta \) notation and explain what it is used for. 

[3 marks]
c) Write a recursive function, \( add(m,n) \) that adds 2 positive integers. You may use either Java, C\#, or pseudocode.

\[ add(n, m) \] is defined by the following two equations:

i) \( add(n, 0) = n \)  
ii) \( add(n, m) = 1 + add(n, m-1) \)  

[3 marks]

d) Explain how a postfix expression can be evaluated using a stack.  

[3 marks]

Total marks for question one: 25 marks

Question 2 (Selectable)

a) Using a simple diagram and an example, define the tree data structure.

(i) What data structure would you use to represent (store) a tree that has no structure conditions (i.e. an unrestricted tree)? Illustrate by means of an example.

(ii) What are the best and worst case heights of an unrestricted tree? Explain your answer (you may use diagrams).

(iii) What is the time complexity of searching a BST Tree? Explain your answer.

(iv) What is the time complexity of traversing a BST Tree? Explain your answer.

(v) What is the output if one performs an in-order traversal of a BST?

(vi) What are the best and worst case heights of a binary search tree (BST)? Explain your answer (you may use diagrams).

(vii) Define expression tree and give an expression tree for \((x / y) + ((a + c) \times (a + d))\).

(viii) Explain in-order, post-order, and pre-order traversals for binary trees and give pseudo-code for each. Give the post-order traversal of the expression above.

\[ 2 + 2 + 2 + 2 + 2 + 3 + 3 = 18 \text{ marks} \]

b) Define B-Tree. Explain what it is used for. Does it have any advantages over an AVL tree?

\[ 3 + 2 + 2 = 7 \text{ marks} \]

Total marks for question two: 25 marks

Question 3 (Selectable)

a) Describe the Shell Sort algorithm. You can use pseudocode, Java, or C#.

[4 marks]

b) What is the worst-case time complexity of Shell Sort.

[2 marks]

c) Describe the Quick Sort algorithm. You can use pseudocode, Java, or C#.

[6 marks]

d) What are the worst-case and best-case time complexities of Quick Sort? Explain your answer.

[4 marks]
e) What are the space complexities of both algorithms – Shell Sort and Quick Sort? [2 marks]

f) Suppose you have to sort 1 million integers twice – once using a Bubble Sort algorithm with a time complexity of \( n^2 \) and once using Quick Sort (assume best-case). How much faster would Quick Sort be over Bubble Sort? [5 marks]

g) Why is Quick Sort generally preferred over Merge Sort? [2 marks]

Total marks for question three: 25 marks

SECTION B - You must attempt any two questions from this section

Question 4 (Selectable)

a) What do you understand by programming paradigm? Why is it useful to have different programming paradigms? [7 marks]

b) Describe the Functional and Logic (Declarative) programming paradigms. For each paradigm, name one programming language that implements that paradigm. [6 marks]

c) In the context of Prolog:
   i. Explain unification
   ii. How are disjunction and conjunction expressed in Prolog.
   iii. What is arity?
   iv. Write the factorial function in Prolog. [3 + 3 + 2 + 4 = 12 marks]

Total marks for question four: 25 marks

Question 5 (Selectable)

a) Hash tables:
   i. Describe the hash table abstract data type. [3 marks]
   
   ii. Describe the (a) bucket, (b) chaining, (c) linear probing, and (d) double hashing implementations of a hash table. [3+3+3+3 = 12 marks]

b) String distance:
   i. Describe the Levenshtein string distance algorithm. [4 marks]
ii. What is the time and space complexity of the algorithm described in (i) above?  
   (3 marks)

iii. Use the algorithm (i) to find the distance between the strings "world" and "weld".  
    (3 marks)

Total marks for question five: 25 marks

Question 6 (Selectable)

a) Graphs:
   i. Write down an algorithm to detect whether an undirected graph is connected.  
      [4 marks]

   ii. What is the time complexity of the algorithm (i) above? Make sure to explain yourself.  
       [4 marks]

   iii. Write down an algorithm to detect whether a directed graph contains cycles.  
        [4 marks]

   iv. What is the time complexity of the algorithm (iii) above? Make sure to explain yourself.  
       [4 marks]

b) Heaps:
   i. Describe an implementation that uses a fixed-size complete binary tree to implement a 
      max-heap. You may assume that you are dealing with a heap of integers.  
      (4 marks)

   ii. Describe the algorithms for enqueuing and dequeuing objects in the heap you described 
       in (b.i) above.  
       (5 marks)

Total marks for question six: 25 marks
CIS1041 Introduction to Databases

14th June 2016

10.00am – 12.05am

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

   Answer Question A11 and any other THREE questions from Section B.

   Total marks possible 100.

   State any assumptions you make.

   SQL syntax from a wide variety of DBMS are accepted: eg Oracle, Postgresql, Microsoft SQL Server and Microsoft Access. It is best if a student declares which syntax she is opting for.

   For procedural extensions to SQL one can, as in SQL Syntax, choose his own. Again it is best if a student declares which syntax he is opting for.

   If question has sub-sections then the sub-section marks are equally allocated if not otherwise indicated.
Section A

A11 The database contains data pertaining to an experimental forestry program lasting over many years and involving many different trees of different species, in different forests; in addition many measurements are carried out on these trees. The following are the tables that make up the database schema:

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</tr>
<tr>
<td></td>
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Notes:
C(N) and I stand for Character(N) and Integer type respectively.
P.K. and F.K. are abbreviations for primary and foreign keys respectively.

(a)  
i  Write a SQL construct for the following query:  
Print all species’ names.

ii  Write a SQL construct for the following query:  
Print a unique list of species’ wood types.

iii Write a SQL construct for the following query:  
Print the sum, minimum and maximum values of forest areas.  

[ 6 marks ]
(b) Write a SQL construct for the following query:
Output all tree instances that have been planted in the nineties (use function toyear(date)-> integer) and have a known parent. The output must include tree number, forest, location, species, and age (use function currentyear()->integer to extract the current year, i.e. currentyear()=2016, and compute age). Output should be sorted by forest, location and age.

[ 4 marks ]

c) i Write a SQL construct for the following query:
List forest name, forest location, tree number and tree location for all trees of species ‘Oak’ (i.e. Tr_species='OAK').

ii Write a SQL construct for the following query:
We have a measure type for acidity around a tree (i.e. me_type='ACID'). Calculate the average, count, maximum and minimum for all forests with size greater than 20000 (i.e. fo_size>20000) and whose wood type is soft (i.e. sp_woodtype='SOFT').

iii Write a SQL construct for the following query:
List trees that are co-located (i.e. tr_loc values are identical) and where one tree is the “granddaughter” of the other. The output should include the number of each tree, their common location, and forest name.

[ 12 marks ]

d) Write a SQL construct for the following query:
Give a list, i.e. one list, of all forest locations (i.e. fo_loc) and all tree locations (i.e. fo_loc). In the output indicate the table from which a row is coming from; either forest or tree.

[ 6 marks ]

e) Write a SQL construct for the following query:
For every measure type (i.e. me_type), wood type (i.e. sp_woodtype), and forest location (i.e. fo_loc) calculate the minimum and maximum. Furthermore ensure that computation only refers to measures taken in the nineties (see A11.b) and that there are actually more than 10 measurements to report their min and max.

[ 6 marks ]

(f) Write a SQL construct for the following query:
Consider only measures taken in the year 2015 (see A11.b) and for those of type ‘ACID (i.e. me_type='ACID') Output the measure number, tree number, the actual measure recorded (in the year 2015). Together with this output, include alongside the average measure over all the measures data (not only for 2015).

[ 6 marks ]
Section B

B11 (a) Develop an Entity-Relationship Model Diagram for the following application (state any assumptions made).

A number of firms owning cinema venues have formed a co-operative. One good reason for their collaboration is their desire to decrease administrative expenses by introducing a booking system for their clients that can either walk into each venue or phone in or browse to make their enquiries and reservations.

You have been enlisted to propose a first cut high-level conceptual design that respects, at least, the following initial requirements:

- The co-operative is made of companies each owning sites that have at least one cinema venue;
- Shows are held at specific time spans and cinemas. With each show we associate a number of films (most shows ran one feature film, but double and day long feature shows are a good market to accommodate);
- Superficial details on films, trailers, spots and documentaries are to be held (Hint: for this exercise you can use one table for all of these);
- Reservation details must also be held – assume each reservation can book a number of seats;
- The management would like to introduce, from time to time, a number of ticket types (e.g. normal, late-night, season etc.) for their shows.

A reservation is to have details of show, ticket type and number of seats.

Marks are allocated equally for entities, attributes and relationships [20 marks]

B12 (a) 

i Give an example of a table in 1NF but not in 2NF.

ii Give an example of a table in 2NF but not in 3NF.

iii Give an example of a table in 3NF. [15 marks]

(b) Prove that any relation schema (i.e. table) with one attribute primary key is in 2NF. [5 marks]

B13 (a) What are integrity constraints? [3 marks]

(b) 

i How would one encode a multi attribute primary key in SQL’s DDL?

ii How would one encode a check that an attribute’s value is between 0 and 100 in SQL’s DDL?

iii How would one encode a multi attribute candidate key in SQL’s DDL? [9 marks]

(c) 

i How are ‘one to many’ referential constraints implemented in SQL’s DDL?

ii Give an example of an ERM binary relationship (adorned with cardinality and participation indications) that cannot be implemented with SQL’s DDL. Indicate how this could be implemented without using DDL constructs? [8 marks]
B14 Use relational schema of question A11 where applicable.

(a) Which are the basic relational algebraic operators and what do they do?  
[ 5 marks ]

(b) How can you execute set intersection with diff and union operators?  
[ 5 marks ]

(c) Write a relational algebraic expression for: retrieve all tree species that are found in all forests.  
[ 5 marks ]

(d) Describe how one can implement the project algebraic operator in your favourite programming language? Make sure to denote its running costs.  
[ 5 marks ]

B15 a) What are database cursors when used in stored procedures?  
[ 4 marks ]

b) Give a brief, but annotated example in PGPSQL, of declaring, opening and retrieving database entity instances through a cursor definition.  
[ 6 marks ]

c) Write a PGPSQL procedure to compute a ten year moving average of trees in forest ‘BUSKET’ and for measure ‘HEIGHT’. Report also the max and min at the end of the scan.

Notes: use function toyear(me_date) to extract the year from a date attribute; given a sorted sequence of values, a moving average is a new sequence defined by taking the arithmetic mean of subsequences of the original (e.g. in this case 10 years).  
[ 10 marks ]
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

   Answer Question A11 and Question A12 and any other THREE questions from Section B.

   Total marks possible 130. This will be scaled to 100.

   State any assumptions you make.

   SQL syntax from a wide variety of DBMS are accepted: eg Oracle, Postgresql, Microsoft SQL Server and Microsoft Access. It is best if a student declares which syntax she is opting for.

   For procedural extensions to SQL one can, as in SQL Syntax, choose his own. Again it is best if a student declares which syntax he is opting for.

   If question has sub-sections then the sub-section marks are equally allocated if not otherwise indicated.
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(a) i Write a SQL construct for the following query:
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ii Write a SQL construct for the following query:
Print a unique list of species’ wood types.

iii Write a SQL construct for the following query:
Print the sum, minimum and maximum values of forest areas.

[ 6 marks ]
(b) Write a SQL construct for the following query:
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(f) Write a SQL construct for the following query:
Consider only measures taken in the year 2015 (see A11.b) and for those of type ‘ACID (i.e. me_type='ACID'). Output the measure number, tree number, the actual measure recorded (in the year 2015). Together with this output, include alongside the average measure over all the measures data (not only for 2015).
A12  (a)  i  What does ‘A’ stand for in ACID transaction processing requirements?  
ii  What does ‘D’ stand for in ACID transaction processing requirements?  

[ 6 marks ]

(b)  Clearly describe a transaction’s state transition diagram.  

[ 4 marks ]

(c)  i  Why do we need interleaved processing of transactions over a database?  
ii  Give an example of an inconsistent read during uncontrolled transaction processing.  

[ 6 marks ]

(d)  Describe the conservative two-phase locking (2PL) use in a centralised DBMS.  
Indicate the requirements and properties of this protocol.  

[ 10 marks ]

(e)  Define two simple and overlapping transactions over a database.  Write a  
schedule following a conservative 2PL.  

[ 4 marks ]
Section B

B11 (a) Develop an Entity-Relationship Model Diagram for the following application
(state any assumptions made).

A number of firms owning cinema venues have formed a co-operative. One good reason for their collaboration is their desire to decrease administrative expenses by introducing a booking system for their clients that can either walk into each venue or phone in or browse to make their enquiries and reservations. You have been enlisted to propose a first-cut high-level conceptual design that respects, at least, the following initial requirements:

- The co-operative is made of companies each owning sites that have at least one cinema venue;
- Shows are held at specific time spans and cinemas. With each show we associate a number of films (most shows ran one feature film, but double and day long feature shows are a good market to accommodate);
- Superficial details on films, trailers, spots and documentaries are to be held (Hint: for this exercise you can use one table for all of these);
- Reservation details must also be held – assume each reservation can book a number of seats;
- The management would like to introduce, from time to time, a number of ticket types (e.g. normal, late-night, season etc.) for their shows.

A reservation is to have details of show, ticket type and number of seats.

Marks are allocated equally for entities, attributes and relationships [20 marks]

B12 (a)  

i  Give an example of a table in 1NF but not in 2NF.
ii  Give an example of a table in 2NF but not in 3NF.
iii  Give an example of a table in 3NF.  

(b)  Prove that any relation schema (i.e. table) with one attribute primary key is in 2NF.  

[15 marks]  

[5 marks]

B13 (a)  What are integrity constraints?  

[3 marks]

(b)  

i  How would one encode a multi-attribute primary key in SQL’s DDL?
ii  How would one encode a check that an attribute’s value is between 0 and 100 in SQL’s DDL?
iii  How would one encode a multi-attribute candidate key in SQL’s DDL?  

[9 marks]

(c)  

i  How are ‘one to many’ referential constraints implemented in SQL’s DDL?
ii  Give an example of an ERM binary relationship (adorned with cardinality and participation indications) that cannot be implemented with SQL’s DDL. Indicate how this could be implemented without using DDL constructs?  

[8 marks]
B14 Use relational schema of question A11 where applicable.

(a) Which are the basic relational algebraic operators and what do they do? [5 marks]

(b) How can you execute set intersection with diff and union operators? [5 marks]

(c) Write a relational algebraic expression for: retrieve all tree species that are found in all forests. [5 marks]

(d) Describe how one can implement the project algebraic operator in your favourite programming language? Make sure to denote its running costs. [5 marks]

B15 a) What are database cursors when used in stored procedures? [4 marks]

b) Give a brief, but annotated example in PGSQL, of declaring, opening and retrieving database entity instances through a cursor definition. [6 marks]

c) Write a PGSQL procedure to compute a ten year moving average of trees in forest ‘BUSKET’ and for measure ‘HEIGHT’. Report also the max and min at the end of the scan.

Notes: use function toyear(me Date) to extract the year from a date attribute; given a sorted sequence of values, a moving average is a new sequence defined by taking the arithmetic mean of subsequences of the original (e.g. in this case 10 years). [10 marks]
Instructions:

1) The first 5 (five) minutes of the exam is reading time.
2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.
3) General instructions:
   Answer ALL questions on the given script.

1. (a) Describe the main functions of the three basic components that make up a computer system.
   (6 marks)
   (b) Explain what each of the following code translators does:
       Assembler
       Compiler
       Interpreter
   (6 marks)
   (Total 12 marks)

2. (a) Outline two methods used to automate a sequence of MS Excel commands.
   (4 marks)
   (b) What are the restrictions of keyboard macros in MS Excel, that can be overcome using custom programming?
   (6 marks)
   (Total 10 marks)
3. Answer questions (a) to (f) with reference to the following general definition of a **Sub** procedure in VBA:

```vba
Sub Template ([arglist])
    [statements]
    Exit Sub
    [statements]
End Sub
```

(a) What is the name of the procedure?
(2 marks)

(b) How is `arglist` used to pass multiple parameters to the **Sub**?
(2 marks)

(c) When is the Exit Sub statement used?
(2 marks)

(d) What is the function of the End Sub statement?
(2 marks)

(e) What do the square brackets signify?
(2 marks)

(f) Why are statements required in the body of the procedure?
(2 marks)

(Total 12 marks)

4. (a) What are the main attributes of procedure variables?
(5 marks)

(b) Describe three cases when a parameter is passed by value in an argument list when calling a procedure. Illustrate your answer by examples.
(3 marks)

(c) Outline the main differences between **Sub** and **Function** procedures?
(4 marks)

(Total 12 marks)

5. (a) Suggest and describe common practice testing guidelines to ensure that the results produced by a computer program are logically correct.
(4 marks)

(b) Briefly explain three types of errors commonly encountered during program development.
(4 marks)

(Total 8 marks)
6. (a) Which VBA variable types are used to store numeric data? Give a brief description of each.
   (4 marks)

   (b) Outline the differences between a variable-length string (VLS) and a fixed-length string (FLS).
   (3 marks)

   (c) Distinguish between the usage of the statements Dim and Const in VBA?
   (3 marks)

   (Total 10 marks)

7. Variables x, y and z are initialised as follows:

   x = "The quick brown fox"
   y = "jumps over the lazy dog."
   z = "is the short pangram"

   Write the content of variable s after each of the following statements is executed:

   (a) s = "This " & Mid(z, 14, 7) & " contains:"  
       s = s & Space(1) & CStr(Len(x & y)) & " characters!"
       (4 marks)

   (b) s = CStr(InStr(x & y, "over") + Len(y))
       (4 marks)

   (c) s = CStr("This " & Mid(z, 14, 7) & " is one of ")
       s = s & Mid(z, 4, 9) & "est."
       (4 marks)

   (Total 12 marks)

8. Describe the operation of the following decision structures with the aid of examples and
   flowcharts:

   (a) If condition1 Then
       truestatements1
       [Elseif condition2 Then
       truestatements2]
       [Elseif condition3 Then
       truestatements3]
       [Else
       falsestatements]
   End If
   (4 marks)

   (b) Select Case testexpression
       [Case expressionlist1
       statements1]
       [Case expressionlist2
       statements2]
       [Case Else
       elsestatements]
   End Select
   (4 marks)

   (Total 8 marks)
9. (a) Write a Do ... Loop procedure that outputs the following sequence of numbers in a message box:

200, 196, 192, 188, 184, 180

(4 marks)

(b) How can the same sequence of numbers be generated using a For ... Next loop?

(4 marks)

(Total 8 marks)

10. (a) How is a dynamic array of decimal numbers declared, initialised and re-dimensioned within a VBA program?

(4 marks)

(b) Using the Type statement, define a data structure to hold information about the elements in the Periodic Table. Element data should include its name (a variable length string), symbol (a three-character mnemonic), atomic number (an integer) and atomic weight (a decimal number).

(2 marks)

(c) How can program data be read from disk using VBA? Illustrate your answer with an example.

(2 marks)

(Total 8 marks)
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators and dictionaries. No other electronic / smart devices are permitted.

3) This exam paper contains THREE sections.
   - From Section A you are to answer ONE question.
   - From Section B you are to answer ONE question.
   - You are to answer ANY other TWO questions.

Important: Put Sections A and C on the SAME BOOKLET, and Section B on a DIFFERENT BOOKLET.

Section A

Q1

a) What is the pipeline in FIFO pipes?
   Give an example.
   [12 marks (8-Explanation of Pipeline;4-Example)]

b) Discuss persistence in the two types of Pipes. Is it the same under a Unix-Like OS and Windows?
   Give an example of applying named Pipes in a network situation between two Windows machines.
   [13 marks (3-Discuss Persistence;2-Persistence under Unix-Like OS;8-Example)]

Q2

a) Discuss the main differences between Unix-Like and Windows implementations of Sockets.
   [13 marks (1-For Introduction;12-For Differences)]

b) Concisely, discuss the importance of designing networks upon a layered architecture and elaborate how the International Standards’ Organisation has adopted this approach in its Open Systems of Interconnectivity Reference Model.
   [12 marks (1-For Introduction;6-For highlighting concepts behind the architecture;5-For depicting the model and explanation of each layer)]
Section B (Use a separate Booklet for this section)

Q3
a) TCP/IP is a layered suite of protocols. Concisel[y describe the TCP/IP architecture.
   [13 marks (3-For Introduction;5-For depicting figure of layered architecture;5-For explanation of each layer)]

b) Describe the addressing schemes that can be adopted in an IPv4 based TCP/IP network.
   [12 marks(2-Introduction;10-For describing the schemes)]

Q4
a) As networks have grown in size and complexity, many companies have turned to Virtual Local Area Networks (VLANs) to provide some way of structuring this growth logically. Explain how VLANs have achieved this and highlight the benefits of such architecture.
   [13 marks (3-Introduction;10-Explanation and Benefits)]

b) By providing an example, explain the difference between a physical and logical topology of a Local Area Network.
   [12 marks(3-Introduction;9-For presentation of a typical example highlighting the differences)]

Section C

Q5
a) Define Load Balancing. How does Facebook Load Balancing work? Describe its components. Discuss how Facebook is building their own network with custom built network switches and the data centre fabric.
   [14 marks (1-definition of load balancing;2-how does...;5-components;6-Discuss how Face...)]

b) Give an example of Store and Forward Packet Switching. List the goals of Services provided to the Transport Layer.
   [11 marks (6-Example;5-Goals)]

Q6
a) Define the Optimality Principle. Illustrate a sample sink tree of optimal routes.
   [10 marks (4-Definition;6-Diagram)]

b) Which major classes of routing algorithms exist? Give an example of one such class. Discuss the differences between members of another class of routing algorithm.
   [15 marks (2-per Class;2-Example of one class;3-Per Difference)]
Very important instructions and information to candidates
(Please read and heed)

Point 1 (structure)
You are allocated a total of three hours for this paper. Read any question carefully before attempting it. This paper contains seven questions in all. The questions are divided into two sections (A & B). You are to attempt all the questions in Section A and any two questions from Section B. This paper will be marked out of 100, but carries an 80% weighting of the mark obtainable for this study-unit as a whole. Your coursework carries the remaining 20%.

Point 2 (clarity)
It is important that you use legible handwriting and understandable English grammar. Please be warned that work presented in unintelligible handwriting and/or unclear English will not be considered for marking. The same applies to diagrams and other non-textual representations. ALL WRITTEN AND DRAWN ENTRIES MUST BE IN INK. Entries in pencil will NOT be considered for marking.

Point 3 (maturity)
You should present your thoughts on paper in a mature and reasoned fashion, using interplay of concepts expounded in class. Arguments should not just be stated but should follow from fundamentals. This is a key consideration and will be highly valued.

Point 4 (presentation)
You should keep all parts of any given question together. Scattered answers will be penalised or may even not be considered at all when marking.

Mark allocation by question.

Section A:
Question 1 – Compulsory : 25 marks
Question 2 – Compulsory : 25 marks

Section B:
Question 3 – Selectable : 25 marks
Question 4 – Selectable : 25 marks
Question 5 – Selectable : 25 marks
Question 6 – Selectable : 25 marks
Question 7 – Selectable : 25 marks

Obtainable total: 100 marks (i.e. A=25+25; B= 25+25)

The use of calculators is allowed
Section A – Two compulsory questions (type may vary).

Question 1 [Generic] (a compulsory question for 25 marks)
(a) A common adage is one that says “Any tool used wrongly hinders rather than helps”. Apply this nugget of wisdom to software development. Explain all your reasoning and mention one concrete example.

[8 marks (2-application; 3-explanation; 3-example)]

(b) Due to the need to consolidate services and a rise in fragmented competition, company “X” working in the field of transport management systems now also needs to diversify into the field of traffic control systems. While before dealing with solutions that assist the administration of transport-related matters, now it must enter the arena of solutions that control actual traffic movement. What shift in quality attribute emphasis would you propose to company “X”? Justify your proposal(s).

[9 marks (4-proposal/s; 5-justification)]

(c) One sometimes hears the statement “Nowadays, the availability of data is both a blessing and a curse.” What does this mean? What would you do to try and shift it towards more of a “blessing” than a “curse”? Explain your reasoning which must be based on class-discussed approaches and techniques.

[8 marks (3-meaning; 5-explanation)]

Question 2 [Generic] (a compulsory question for 25 marks)
(a) A common understanding is that it takes a minimum of three supporting points to stabilise an object. Apply this view to software development and explain which are and what are the “three supporting points” any developer should consider as aspects when modelling a software solution.

[8 marks (3-points; 5-which & what)]

(b) The same can be said about communication as was said about data (see question 1(c) above). Repeat the same tasks as were specified for question 1(c) – only, in this case, reapplied to communication instead of data.

[7 marks (3-meaning; 4-explanation)]

(c) Most software developers take phased development for granted today and therefore do not appreciate the many issues such a relatively simple action as phase definition actually resolves for software engineers. To make sure that in some way at least you do appreciate, relate the notion of software solution quality to the use of phases in the development process. Provide one concrete example of how a monolithic software development process can adversely affect a software product.

[6 marks (4-relate; 2-example)]

(d) With reference to software development phases, differentiate between analysis and design.

[4 marks]

--- End of Section A (Section B on next page) ---

[Intentional blank space]
Section B – Four selectable scenario-based questions from which to select any two.

Question 3 [Modelling and Process] (a selectable question for 25 marks)
Company “X” seems to be encountering problems when it comes to client “Y”’s confidence in the resulting product. Due to “Y”’s history, their expectations are such that they want to be in the loop of how development is progressing and they also want to be able to see tangible artefacts along the way.

As things stand, company “X” interacts with “Y” at requirements elicitation stages, then provides access to development models, and then interacts with “Y” at the time of testing, and onwards as necessary.

Imagine you are tasked with trying to satisfy “Y”’s requests, draw up a strategy, made up of any changes in attitude, structure, procedure, process, methods and/or tools, that in your opinion would go towards satisfying your client’s requests as stated in the first paragraph of this question.

All your reasoning should be based on matters, issues and situations brought up and discussed during class. All decisions and statements must be reached or made in a logical and sequential manner and must be justified, through relation with lecture material, to be accepted for assessment. This is an objectively assessable exercise and therefore cannot be a showcase of personal opinion.

Any assumptions you choose to make must be stated at the start of your answer to this question.

[25 marks (6-overall strategy;8-procedures & processes;6-methods & tools;5-validity)]

Question 4 [Control and Data] (a selectable question for 25 marks)
The data flow model in figure 1 describes part of a commonly-used solution. Even though the model may seem disjoint, i.e. in two parts, it is not. One of the following tasks will require you to join them. Now, do the following three tasks:

i) Explain in clear terms what the diagram in figure 1 is describing and its functionality?

[5 marks (2-overall description;3-functional detail)]

ii) Insert all the necessary control processes and flows to unify the model in figure 1 and to render full clarity to its functionality (clear and complete labelling is a must; NO STDs/FSMs are required);

[14 marks (8-overall CFD;3-meaningful labelling;3-logical correctness)]

iii) Propose a DSD describing the data on the flow labelled “Weather data”. Accompany the DSD with any free text you might feel justifies and/or explains the decisions embodied in your DSD.

[6 marks (4-model;2-validity)]

[PLEASE NOTE: FIGURE 1 IS ON THE NEXT PAGE]

[Intentional blank space]
Question 5 [Systems and Solutions] (a selectable question for 25 marks)
(a) Company "X" has been in the business of developing software solutions for the meat products packaging industry since its creation as an off-shoot from a parent meat-production enterprise. Lately, parent company management detected a rise in network traffic towards porn sites from employees in your company during working hours and approached you and your team to try to find a way to curtail this activity without unduly restricting actual Internet access for employees.

Part of the solution you initially decide to implement relies on the filtering of certain keywords relating to nudity and other sexually-explicit activity. Within a month of this solution coming on-line, management promptly detects a drastic drop in poultry and fowl-game orders and other fowl-related business. If you had to take a step back and think about this initial solution and its implications logically and practically, what went wrong? Explain the misjudgement. How would you remedy?

[10 marks (2-reason;4-explanation;4-remedy)]

(b) Keeping software developers efficient and updated is something that benefits both an organisation and the developers themselves. As one of the internal exercises that company “X” embarks on to gauge the type and level of training that best suits its developers, is a comparative assessment of the algorithmic complexity of the solutions that are being produced using existing programming technologies and environments. Unlike functional sophistication, algorithmic complexity is not a solution’s selling point, quite the contrary. Explain what this means and its implications on overall software solution quality.

[6 marks (2-meaning; 4-implications)]
(c) Further to question 5(b), as a seasoned software developer, you are asked to actually design the comparative assessment. After a good deal of head scratching wondering how to formalise and measure such, at first glance, a subjective and multi-faceted concept as “algorithmic complexity”, you decide on a way ahead. Explain and justify your plan.

[9 marks (4-explain;5-justify)]

**Question 6 [Development Quality]** *(a selectable question for 25 marks)*

(a) Within roughly two years, the EU will start enforcing certain privacy standards on software products, to the extent, that companies not adhering to such standards and offering their products for use in areas requiring specific privacy guarantees, will be subject to some rather hefty fines. Many in your organisation express an opinion that this is something that can be left to when “the time comes” and something that can be added to existing solutions with relative ease and without a crippling cost impact. Explain what you would do to dispel this preconception. Your arguments should be, justified, sequentially structured, starting and cascading upwards from fundamental principles all the way up to higher consumer-level implications, and should, in a general sense, hinge on the notion of quality solutions.

[12 marks (5-overall plan & validity; 7-arguments & justification)]

(b) One of the software products that your organisation produces is a collaborative environment for the exchange of business information and customer data between authorised users of the system in real-time through the shared access of PC screens of user groups, i.e. employees or trusted stakeholders of a client company. This was found to be a strong selling point of the solution. It was something that immensely improved the efficiency of the client company. It was therefore considered to be one of the most attractive quality attributes of the solution. How could the advent of EU privacy regulation, as mentioned in 6(a) directly above, effect this particular software solution? Explain.

[8 marks (3-effect; 5-explanation)]

(c) A notion within some quarters of the software development community is that if a software solution is built with security in mind, i.e. as one of its stated requirements, then it follows that it can (relatively) easily be made to comply with privacy expectations. Do you agree? Explain.

[5 marks (2-agree or not; 3-explain)]

**Question 7 [Practical Development]** *(a selectable question for 25 marks)*

(a) You are to model the following system through the use of one UCD, one or more DFDs and CFDs (depending on the number of UCs used) up to level one and any FSMs as and where you deem necessary within the CFD to fully and clearly describe your development.

The system: “The system is a trivially simple task manager. It will allow users to keep track of what they have done, need to do and better plan and manage their time. It shall be given a development project name of ‘do4u’. The solution will allow the creation of new task entries and the deletion of existing ones. Editing of existing tasks is not a requirement. Task prioritisation is not a requirement. A list of either done or pending tasks over a set period of time, or pending tasks over a period of time whose deadline is still to come, or tasks that have overshot their deadline can be output on screen. Each task entry will consist of the date when it was created, the task details, and its deadline.”

**Please note: Should there be any queries about the proposed “do4u” system, in the absence of the client, i.e. me, please make and indispensable assumptions, should any be truly necessary, and state these in writing in your models.**

[21 marks (3-UCD;12-DFDs/CFDs;6-others)]
(b) In the course of modelling question 7(a), you will probably use a data flow labelled something like “task” or “task details”, or some such name. Describe the data on this flow using either DSD or BNF notation.

[4 marks]

--- No more questions ---

All scenarios and examples in this paper are hypothetical; any resemblance to existing systems, scenarios or situations is unintentional and purely coincidental.

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UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems

May/June 2016 Session

CIS1111 C Programming for Engineers 17th June 2016

1000-1205

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) This is an open book examination. You may use any hardcopy written reference material, including hard copy course notes, textbooks and dictionaries with any annotations.

3) Digital equipment is not permitted.

4) General instructions:

This paper contains 2 Sections.
Answer all questions from Section A and any two questions from Section B.
SECTION A – ANSWER ALL QUESTIONS

QUESTION 1. This is a compulsory question related to C programming constructs. You are only required to write code snippets as shown in the example below:

Sample Question: Write code that outputs on the screen fifteen asterisks on the same line.

Sample Answer: 

```c
for(i = 0; i < 15; i++)
{
    printf("*");
}
```

Answer the following questions:

a) Using only one `printf` statement, write the required code to produce the following output:

"Some people are like clouds. When they go away, it's a brighter day."

~ Anonymous

b) A variable of type `float` named `PI` holds the value 3.14159. Write a statement to output on the screen the contents of `PI` in three decimal places.

c) Using only a `for` loop and a `printf` statement, write the required code to output on separate lines the odd numbers between 1 and `n`, where `n` is a variable of type `int`.

d) Using nested loops, write the required code in order to output the following right-angled triangle made up of the letter ‘X’:

```
xxxxx
xxxx
xxx
xx
x
```

e) A variable `sNum` of type `char[5]` contains a whole number. Write the required code to convert the contents of this variable to an actual integer. The integer should be stored in a variable `num` of type `int`.

[3 marks each]
[Total of 15 Marks]

QUESTION 2. This is a compulsory question. You are required to provide a descriptive answer for each question.

Answer the following questions:

a) The aim of the program below is to calculate and output the total value of the contents stored in array `prices`. However the output is:

```c
-107374024.000000
```
#include <stdio.h>

int main(void)
{
    int i;
    float total = 0.0;
    float prices[5] = {4.56, 12.35, 34.00, 56.65, 45.05};
    for(i = 1; i <= 5; i++)
    {
        total = total + prices[i];
    }
    printf("%f\n\n", total);
}

It is clear that when the above program is executed, something goes wrong. Answer the following questions:

i. What is wrong with the above code?
ii. What is actually being outputted on the screen? [Give a descriptive answer]
iii. Write a code snippet to show how the above code can be altered in order to give the correct output.

[2 marks each]

[6 Marks]

b) When the following program is executed:

#include <stdio.h>

int main(void)
{
    char quote[39] = "What's normal anyways?" - Forrest Gump;
    puts(quote);
}

The following output is given:

[Image: Output of program]

Answer the following questions:

i. What is wrong with the above program?
ii. Write a code snippet to show how the above code can be fixed.

[3 marks + 2 marks]

[5 Marks]

c) When executed, what will this program output?

int main(void)
{
    float avg = (4 + 3 + 3) / 3;
    printf("%f\n", avg);
}

[4 Marks]

[Total of 15 Marks]
QUESTION 3. This is a compulsory question. You are required to write a complete C program.

The probability of getting a HEAD or a TAIL when tossing a coin is 50% for HEAD and 50% for TAIL. A secondary school teacher wants to demonstrate this probability theorem by simulating the process of tossing a coin for a very large number of times (say 10,000 times) using a program so that her students would be able to better understand this concept.

You are required to write a program using C that will ask the user the number of times a coin is going to be tossed, following which the program should simulate the tosses and output the final results. It is important that the result is displayed in an ordered and understandable way as shown in the screen shot below:

![Screen shot of C program simulation]

[Correct include statements 1]
[Correct use of variables 2 marks]
[Correct use of random function 3 marks]
[Correct program logic 7 marks]
[Overall program correctness 2 marks]

[Total of 15 Marks]

QUESTION 4. This is a compulsory question related to pointers. You are required to provide a descriptive answer for parts a and b and a code snippet for part c.

Answer the following questions:

a) Explain the meaning of the following three lines of code:
   
   ```c
   int *pNum;
   int num = 55;
   pNum = &num;
   ```

   [1 Mark for each line of code]

b) Consider the following four functions (including the main function):

   ```c
   void square1(int *num)
   {
     *num = *num * *num;
   }

   void square2(int num)
   {
     num = num * num;
   }

   int square3(int num)
   {
     return(num * num);
   }
   ```

   [3 Marks]
int main(void)
{
    int num = 3;

    printf("%d\n", num);
    square1(&num);
    printf("%d\n", num);
    square2(num);
    printf("%d\n", num);
    square3(num);
    printf("%d\n", num);
}

When the main function is executed, what will the program output?

[4 Marks]

[1 mark for each variable output]

c) An array nums of type int has a length of 10. Using pointer techniques (do not use array indexing with [...] and a for loop, write the required code in order to display the contents of this array on the same line, separated by a comma (,). You are not required to write the whole program but only the missing part (shown as an empty rectangle) in the code snippet below:

```c
#include <stdio.h>

int main(void)
{
    int i;
    int nums[10] = {00, 11, 22, 33, 44, 55, 66,
                    77, 88, 99};
    int *ptrNums;

    // CODE SNIPPET

    printf("\n");
}
```

[8 Marks]

[Total of 15 Marks]
 SECTION B – ANSWER ANY 2 QUESTIONS FROM THIS SECTION

QUESTION 5. This is an optional question. You are required to write a complete C program by answering the given questions.

The program that you are required to implement is related to single linked lists and structs. Consider the following struct that is used to store the details of an employee in a restaurant:

```c
typedef employee
{
    int employeeId;
    char name[20];
    char surname[20];
}Employee;
```

You are required to implement a linked list that can be used to store a list of employees. When executed, the program should display the following menu:

1. Add Employee
2. Search Employee
3. Display All Employees
4. Exit

Option 1 should allow the user to add a new employee to the linked list. Option 2 should allow the user to search for an employee using the name and surname, while option 3 should be used to display all the details of the employees on the screen. Option 4 should halt the program.

Implement this program by answering the following questions:

a) Define the struct that is required to represent the nodes for the required linked list and declare also all the global variables that might be required for this program. [2 Marks]

b) Write a function to add a new employee to the list. Make sure to include the required code to allow the user to type in the employeeId, name and surname. [3 Marks]

c) Write a function to display on the screen the details of a particular employee struct passed as a parameter. [3 Marks]

d) Write a function to search for an employee in the list using the name and surname. It is important to make your program case insensitive. The results (employees) found should be displayed on the screen. [3 Marks]

e) Write a function to display the whole list of employees. [3 Marks]

f) Write the main function of the program and other functions (if any) that you think are necessary to finalise the implementation of this program. [6 Marks]

[Total of 20 Marks]
QUESTION 6. This is an optional question related to looping structures. To answer this question you are required to write a complete C Program.

You are required to implement a program that will be used at a point of sale system for a small family owned tourist souvenir shop. Each souvenir that the shop sells has a unique code and a price associated with it. The prices are stored in an array of type double named prices. The code of each souvenir item corresponds to the index of the prices array. For example the souvenir with the code 3 costs £0.55 according to the array example shown below:

|   | 0   | 1   | 2   | 3   | 4   | 5   | 6   | ...
|---|-----|-----|-----|-----|-----|-----|-----|-----|
|   | 2.55| 12.07| 2.00| 0.55| 5.35| 8.55| 2.55| ...

Array prices

Write a program that when executed would show the following simple menu:

1. Create a new Bill
2. Exit

When the user wants to create a new bill option 1 is selected. The program should continuously ask the user to enter the code of the souvenir and the quantity purchased. If the user enters a -1 as a souvenir code that would mean that there are no other souvenirs to be purchased implying that the bill total should be calculated.

When the total is calculated, the user should also be able to give a discount. To do this, the program should ask the user to enter the actual amount of money that he/she wants to give as a discount. The bill should then be displayed on the screen. The user should then be asked to press any key to return to the main menu. The program should halt when the user enters option 2.

[10 marks for good implementation]
[10 marks for correct use of programming techniques]
[Total of 20 Marks]
QUESTION 7. This is an optional question. You are required to write the missing code.

The following code snippet illustrates the first and last part of a program that can be used to generate the game fixtures for the Euro 2016 Football games. The array teams consists of the 24 countries that are going to take part in this football tournament. The teams shall be divided into 6 groups (groupA, groupB, groupC, groupD, groupE and groupF) with each group consisting of 4 teams. The teams shall be placed in the groups randomly.

Complete the missing part of this program by writing the required code in order to place each team in a group randomly.

```c
#include <time.h>
#include <stdio.h>
#include <string.h>

int main(void)
{
                          "Czech Republic", "England", "France", "Germany", "Hungary",
                          "Iceland", "Italy", "Northern Ireland", "Poland", "Portugal",
                          "Republic of Ireland", "Romania", "Russia", "Slovakia",
                          "Spain", "Sweden", "Switzerland", "Turkey", "Ukraine", "Wales"};
    char groupA[4][20];
    char groupB[4][20];
    char groupC[4][20];
    char groupD[4][20];
    char groupE[4][20];
    char groupF[4][20];
    int i;

    printf("GROUP A\tGROUP B\tGROUP C\tGROUP D\tGROUP E\tGROUP F\n");
    for(i = 0; i < 4; i++)
    {
        printf("%s\t%s\t%s\t%s\t%s\t%s\n",
                groupA[i], groupB[i], groupC[i], groupD[i], groupE[i], groupF[i]);
    }
    getchar();
}
```

In your answer booklet you only have to write the missing code (i.e. the code that should be written in the rectangle provided.

[10 marks for good implementation]
[10 marks for correct use of programming techniques]
[Total of 20 Marks]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2016 Examination / Assessment Session

CIS1204 Networking 4th June 2016
08.30-10.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators and dictionaries. No other electronic / smart devices are permitted.

3) This exam paper contains THREE sections.
   - From Section A you are to answer ONE question. (30 marks)
   - From Section B you are to answer ONE question. (30 marks)
   - From Section C you are to answer the compulsory question. (40 marks)
   - Obtainable total marks: 100

Important: Put Sections A and C on the SAME BOOKLET, and Section B on a DIFFERENT BOOKLET.

Section A

Q1
   a) What is the pipeline in FIFO pipes? Give an example.
      [8 marks (5-Explanation of Pipeline; 3-Example)]
   
   b) What is a named Pipe? Which are the differences compared with classical anonymous Pipes, under a Unix-Like OS? Give an example of applying named Pipes in a network situation between two Windows machines.
      [7 marks (1-Explanation of Named Pipe; 2-Differences; 4-Example)]
   
   c) Discuss the usage of Shared Memory and Message Queues.
      [15 marks (7-Shared Memory; 8-MQ)]
      [Total: 30 marks]
Q2
a) Discuss how brands and organisations can optimise their usage of the Instagram mobile network. How do custom apps using the Instagram API authenticate users? Give an example of what such an app can be notified about using this API.
[12 marks (2-Facebook/Dropbox;5-Instagram;4-How;1-Example)]

Discuss briefly ways how the YouTube API can be utilised.
[4 marks (4-Ways..)]

b) Give the steps (or show the calls using a diagram) involved in a network socket connection on the CLIENT SIDE and on the SERVER side.
[14 marks (1-per Server step;2-per Client step)]

[Total: 30 marks]

Section B (Use a separate Booklet for this section)

Q3
a) Transmission Control Protocol/Internet Protocol architecture is based upon a suite of layered protocols, concisely explain this architecture.
[15 marks (1-Introduction;5-Diagram;-9-Explanation)]

b) Describe the addressing schemes that can be adopted in an IPv4 based TCP/IP network.
[9 marks (2-Introduction;7-Classes)]

c) Concisely, explain what major constraints have network engineers encountered within IPv4 based TCP/IP networks.
[6 marks (1-Introduction;5-Explanation)]

[Total: 30 marks]

Q4
a) Structured cabling systems should be considered when designing and implementing data communication systems within buildings. Concisely discuss the advantages and benefits from such systems.
[15 marks (2-Introduction;13-Advantages and Benefits)]

b) What are the building blocks and elements that constitute structured cabling systems.
[15 marks (3-Introduction;12-Building Blocks and Elements)]

[Total: 30 marks]
Section C

Q5

a) Discuss the importance of one *ipc* technology in use on the Internet today which can be seen as a foundation of most popular software like browsers, ftp clients, etc.  [11 marks]

b) Mention a security feature included in the SCTP reference implementation.  [4 marks]

c) Discuss the issues in negative feedback given to Facebook page owners and the potential for this to be subverted maliciously.  [8 marks]

d) List three different ways all new posts to a website can be automatically shared on the website’s Twitter feed.  [3 marks (1-per way)]

e) What is a Twitter hashtag and why is it important?  [4 marks]

f) What is a Share of someone else’s Twitter content called in Twitter?  [2 marks]

g) Discuss the importance of using a good filename when uploading your YouTube channel’s logo. What should be in such a filename?  [8 marks]

[Total 40 marks]
Very important instructions and information to candidates
(Please read and heed)

Point 1 (structure)
You are allocated a total of two hours for this paper. Read any question carefully before attempting it. This paper contains four questions in all. The questions are divided into two sections (A & B). You are to attempt all the questions in Section A and any one question from Section B. This paper will be marked out of 100, but carries an 80% weighting of the mark obtainable for this study-unit as a whole. Your course-work carries the remaining 20%.

Point 2 (clarity)
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Mark allocation by question.

Section A:
Question 1 – Compulsory : 25 marks
Question 2 – Compulsory : 25 marks

Section B:
Question 3 – Selectable : 50 marks
Question 4 – Selectable : 50 marks

Obtainable total: 100 marks (i.e. A=25+25; B=50)

The use of calculators is allowed.
Section A – Two compulsory questions (type may vary).

Question 1 [Generic] (a compulsory question for 25 marks)
(a) A common adage is one that says “Any tool used wrongly hinders rather than helps”. Apply this nugget of wisdom to software development. Explain all your reasoning and mention one concrete example.

[9 marks (2-application; 3-explanation; 4-example)]

(b) A common understanding is that it takes a minimum of three supporting points to stabilise an object. Apply this view to software development and explain which are and what are the “three supporting points” any developer should consider as aspects when modelling a software solution.

[8 marks (3-points; 5-which & what)]

(c) One sometimes hears the statement “Nowadays, the availability of data is both a blessing and a curse.” What does this mean? What would you do to try and shift it towards more of a “blessing” than a “curse”? Explain your reasoning which must be based on class-discussed approaches and techniques.

[8 marks (3-meaning; 5-explanation)]

Question 2 [Generic] (a compulsory question for 25 marks)
(a) The same can be said about communication as was said about data (see question 1(c) above). Repeat the same tasks as were specified for question 1(c) – only, in this case, reapply to communication instead of data.

[8 marks (3-meaning; 5-explanation)]

(b) Most software developers take phased development for granted today and therefore do not appreciate the many issues such a relatively simple action as phase definition actually resolves for software engineers. To make sure that in some way at least you do appreciate, relate the notion of software solution quality to the use of phases in the development process. Provide one concrete example of how a monolithic software development process can adversely affect a software product.

[7 marks (4-relate;3-example)]

(c) With reference to software development phases, differentiate between analysis and design, and between implementation from a developer’s point of view and from a user’s point of view.

[10 marks (5 for each pair)]

End of Section A (Section B on next page)
Section B – Two selectable scenario-based questions from which to select any one.

Question 3 [Control, Data, Systems and Solutions] (a selectable question for 50 marks)
a) The data flow model in figure 1 describes part of a commonly-used solution. Even though the model may seem disjoint, i.e. in two parts, it is not. One of the following tasks will require you to join them. Now, do the following three tasks:
   i) Explain in clear terms what the diagram in figure 1 is describing and its functionality? 
      [5 marks (2-overall description; 4-functional detail)]
   
   ii) Insert all the necessary control processes and flows to unify the model in figure 1 and to render full clarity to its functionality (clear and complete labelling is a must; NO STDs/FSMs are required); 
      [15 marks (8-overall CFD; 3-meaningful labelling; 4-logical correctness)]
   
   iii) Propose a DSD describing the data on the flow labelled “Weather data”. Accompany the DSD with any free text you might feel justifies and/or explains the decisions embodied in your DSD. 
      [7 marks (5-model; 2-validity)]

   iv) Propose an FSM for any one CFD process of your choice. 
      [8 marks (2-notation; 4-logic; 2-validity)]

![Expanded Diagram of Get Weather Process]

Figure 1.

(b) Company “X” has been in the business of developing software solutions for the meat products packaging industry since its creation as an off-shoot from a parent meat-production enterprise. Lately, parent company management detected a rise in network traffic towards porn sites from employees in your company during working hours and approached you and your team to try to find a way to curtail this activity without unduly restricting actual Internet access for employees.
Part of the solution you initially decide to implement relies on the filtering of certain keywords relating to nudity and other sexually-explicit activity. Within a month of this solution coming on-line, management promptly detects a drastic drop in poultry and fowl-game orders and other fowl-related business. If you had to take a step back and think about this initial solution and its implications logically, what went wrong? Explain the misjudgement. How would you remedy?

[14 marks (4-reason;5-explanation;5-remedy)]

Question 4 [Practical Development] *(a selectable question for 50 marks)*

(a) You are to model the following system through the use of one UCD, one or more DFDs and CFDs (depending on the number of UCs used) up to level one and any FSMs as and where you deem necessary within the CFD to fully and clearly describe your development.
The system:

“The system is a trivially simple task manager. It will allow users to keep track of what they have done, need to do and better plan and manage their time. It shall be given a development project name of ‘do4u’. The solution will allow the creation of new task entries and the deletion of existing ones. Editing of existing tasks is not a requirement. Task prioritisation is not a requirement. A list of either done or pending tasks over a set period of time, or pending tasks over a period of time whose deadline is still to come, or tasks that have overshot their deadline can be output on screen. Each task entry will consist of the date when it was created, the task details, and its deadline.”

Please note: Should there be any queries about the proposed “do4u” system, in the absence of the client, i.e. me, please make and indispensable assumptions, should any be truly necessary, and state these in writing in your models.

[26 marks (4-UCD;14-DFDs/CFDs;8-others)]

(b) In the course of modelling 4(a) directly above, you will probably use a data flow labelled something like “task” or “task details”, or some such name. Describe the data on this flow using either DSD or BNF notation.

[6 marks (2-notation;4-structure & validity)]

(c) Keeping software developers efficient and updated is something that benefits both an organisation and the developers themselves. As one of the internal exercises that company “X” embarks on to gauge the type and level of training that best suits its developers, is a comparative assessment of the algorithmic complexity of the solutions that are being produced using existing programming technologies and environments. Unlike functional sophistication, algorithmic complexity is not a solution’s selling point, quite the contrary. Explain what this means and its implications on overall software solution quality.

[8 marks (3-meaning;5-implications)]

(d) Further to 4(c) directly above, as a seasoned software developer, you are asked to actually design the comparative assessment. After a good deal of head scratching wondering how to formalise and measure such, at first glance, a subjective and multi-faceted concept as “algorithmic complexity”, you decide on a way ahead. Explain and justify your plan.

[10 marks (4-explain;6-justify)]

No more questions

All scenarios and examples in this paper are hypothetical; any resemblance to existing systems, scenarios or situations is unintentional and purely coincidental.
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UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2016 Examination / Assessment Session
CIS1217 Data Structures and Algorithms

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Calculators are allowed.

3) Dictionaries are allowed for foreign students.

4) General instructions:

   Answer question 1 (compulsory) and any two other questions (answer three questions in all).

   Each question carries 25 marks. Total marks = 25x3 = 75 MUST BE NORMALISED TO 100.

   Two hours.

Question 1 (Compulsory)

a) i) Is MergeSort $\Theta(n^2)$? Explain your answer.
   ii) Is MergeSort $O(n \log n)$, $O(n^2)$ or both? Explain your answer.
   iii) Define running time function and give two examples.
   iv) Show that the running time function $7n^2$ is $\Theta(n^2)$.
   v) What do you understand by the time and space complexity of an algorithm?
   vi) What does it mean for an algorithm to be intractable? Give an example.
   [3+3+3+2+3+2 = 16 marks]

b) Give a formal definition for the $\Theta$ notation and explain what it is used for.
   [3 marks]

c) Write a recursive function, add(m,n) that adds 2 positive integers. You may use either Java, C#, or pseudocode.

   $add(n, m)$ is defined by the following two equations:
   i) $add(n, 0) = n$  
   ii) $add(n, m) = 1 + add(n, m-1)$
   [3 marks]
d) Explain how a postfix expression can be evaluated using a stack. [3 marks]

**Total marks for question one: 25 marks**

**Question 2 (Selectable)**

a) Using a simple diagram and an example, define the tree data structure.

i. What data structure would you use to represent (store) a tree that has no structure conditions (i.e. an unrestricted tree)? Illustrate by means of an example.

ii. What are the best and worst case heights of an unrestricted tree? Explain your answer (you may use diagrams).

iii. What is the time complexity of searching a BST Tree? Explain your answer.

iv. What is the time complexity of traversing a BST Tree? Explain your answer.

v. What is the output if one performs an in-order traversal of a BST?

vi. What are the best and worst case heights of a binary search tree (BST)? Explain your answer (you may use diagrams).

vii. Define expression tree and give an expression tree for (x / y) + (((a + c) * (a + d))).

viii. Explain in-order, post-order, and pre-order traversals for binary trees and give pseudocode for each. Give the post-order traversal of the expression above.

\[2 + 2 + 2 + 2 + 2 + 3 + 3 = 18 \text{ marks}\]

b) Define B-Tree. Explain what it is used for. Does it have any advantages over an AVL tree? [3+2+2 = 7 marks]

**Total marks for question two: 25 marks**

**Question 3 (Selective)**

a) Describe the Shell Sort algorithm. You can use pseudocode, Java, or C#. [4 marks]

b) What is the worst-case time complexity of Shell Sort. [2 marks]

c) Describe the Quick Sort algorithm. You can use pseudocode, Java, or C#. [6 marks]

d) What are the worst-case and best-case time complexities of Quick Sort? Explain your answer. [4 marks]

e) What are the space complexities of both algorithms – Shell Sort and Quick Sort? [2 marks]
f) Suppose you have to sort 1 million integers twice – once using a Bubble Sort algorithm with a time complexity of \( n^2 \) and once using Quick Sort (assume best-case). How much faster would Quick Sort be over Bubble Sort? [5 marks]

g) Why is Quick Sort generally preferred over Merge Sort? [2 marks]

**Question 4 (Selectable)**

a) Hash tables:
   i. Describe the hash table abstract data type. [3 marks]

   ii. Describe the (a) bucket, (b) chaining, (c) linear probing, and (d) double hashing implementations of a hash table. [3+3+3+3 = 12 marks]

b) String distance:
   i. Describe the Levenshtein string distance algorithm. [4 marks]

   ii. What is the time and space complexity of the algorithm described in (b.i) above? [3 marks]

   iii. Use the algorithm (b.i) to find the distance between the strings “world” and "weld". [3 marks]

   **Total marks for question four: 25 marks**

**Question 5 (Selectable)**

a) Graphs:
   i. Write down an algorithm to detect whether an undirected graph is connected. [4 marks]

   ii. What is the time complexity of the algorithm (i) above? Make sure to explain yourself. [4 marks]

   iii. Write down an algorithm to detect whether a directed graph contains cycles. [4 marks]

   iv. What is the time complexity of the algorithm (iii) above? Make sure to explain yourself. [4 marks]
b) Heaps:

i. Describe an implementation that uses a fixed-size complete binary tree to implement a max-heap. You may assume that you are dealing with a heap of integers.

[4 marks]

ii. Describe the algorithms for enqueuing and dequeuing objects in the heap you described in (b.i) above.

[5 marks]

Total marks for question five: 25 marks
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination / Assessment Session

CIS2086 e-Business

30\textsuperscript{th} May 2016

10.00am – 12.05am

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

There are total six questions. Attempt any five questions. Start each question on a new page.

Question 1: (total 20 marks)

i. With suitable examples, suggest how an organization can use crowdsourcing to achieve its goals? Provide two example tasks which can effectively be delegated through crowdsourcing and articulate any two benefits. [2×2 + 2×1 = 6 marks]

ii. How is crowdfunding different from crowdsourcing? Write two advantages of crowdfunding. [2 + 1×2 = 4 marks]

iii. Describe difference between B2B, B2C, C2B and C2C? Give an example of each to support your answer. [2×4=8 marks]

iv. Is e-Marketing different from e-Business? Justify your answer with suitable reasons. [1×2=2 marks]

Question 2: (total 20 marks)

i. What is difference between ERP, CRM and SCM? How are these related with each other? Why is it important to integrate these within a single system? Justify your answer with suitable reasons. [2×3 + 2 + 2 =10 marks]
ii. What is a business process? Give any two examples of business processes. How electronic technology enhances business processes within an organization?  
\[ 2 + 2 \times 1 + 2 = 6 \text{ mark} \]

iii. Describe difference between buy side and sell side of e-business applications with suitable examples  
\[ 2 \times 2 = 4 \text{ marks} \]

Question 3: (total 20 marks)

The University of Malta is the only University in Malta. However, there are many foreign institutes/universities providing courses in Malta through eLearning mode. Assume that the University of Malta is considering starting eLearning courses. Provide the SWOT analysis of this decision of starting eLearning courses (by the University of Malta). You are required to write five strengths, five weaknesses, five opportunities, and five threats. Clearly describe each assumption you made.  
\[ 4 \times 5 = 20 \text{ marks} \]

Question 4: (total 20 marks)

Assume that you are planning to start a new business of online selling a product of your choice (or any other online business).

i. Suggest the ‘attractiveness’ of your proposed business based on Porter’s five forces.  
\[ 2 \times 5 = 10 \text{ marks} \]

ii. How would you develop a competitive strategy that best defends against the competitive forces or influences them in the favour of your business?  
\[ 1 \times 5 = 5 \text{ marks} \]

iii. What barriers to entry you might face?  
\[ 3 \text{ marks} \]

iv. Would you go for Cost leadership, differentiation, or both? Justify your answer.  
\[ 2 \text{ marks} \]

Question 5: (total 20 marks)

i. Describe how prospector, defender, analyser, and reactor strategies are different from each other.  
\[ 4 \times 2 = 8 \text{ marks} \]

ii. Contrast Mass production from Mass- customization.  
\[ 1 \times 2 = 2 \text{ marks} \]

iii. Contrast supply-oriented economies from demand-oriented economies.  
\[ 1 \times 2 = 2 \text{ marks} \]

iv. Contrast supply chain from value chain.  
\[ 1 \times 2 = 2 \text{ marks} \]

v. Contrast the top-down approach from the bottom-up approach for e-Business strategy implementation.  
\[ 1 \times 2 = 2 \text{ marks} \]

vi. Contrast markets from hierarchies assumptions for coordinating the flow of products and services  
\[ 1 \times 2 = 2 \text{ marks} \]

vii. Contrast physical asset specificity from human capital specificity.  
\[ 1 \times 2 = 2 \text{ marks} \]
Question 6: (total 20 marks)

i. You are going to another country for a holiday. Describe transaction costs involved in booking your tour with a travel agent. Also, describe the transaction costs involved in booking your tour on-line. How would the transaction costs be different? Which of these has the minimum transaction costs? [3 + 3+1+1=8 marks]

ii. Describe three functional areas of workflow systems. [3×3=6 marks]

iii. Describe three types of Workflow. [1×3=3 marks]

iv. Write any three advantages of having an online community by a business organization. [1×3=3 marks]
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) Answers need to be extensive and clear. Diagrams and code snippets are suggested. Candidate is free to choose whichever language suits this response best; (please indicate which).

4) Attempt question one and any other two. Marks tally to 100%.

1. (a) What computational characteristics do disk based storage hold? [5 marks]
   (b) For hard disk devices, compare and contrast the growth over the years in capacity to the growth in average access speed. [5 marks]
   (c) Explain the difference in reads and writes when joining two tables, say ‘a’ and ‘b’, with a nested loop between ‘a’ join ‘b’, and ‘b’ join ‘a’. [5 marks]
   (d) Explain the sort-merge algorithm for a data file. Your response must include indications of disk activity costs. [5 marks]
   (e) Explain the breakeven relationship of serial access and index access. Assume we are dealing with a data file on disk and a range query is required. [5 marks]
   (f) What are the advantages of covering indexes (or index organised tables)? [5 marks]
   (g) What are database statistics, and how are these collected? [5 marks]
   (h) How can one generate good data sets for testing query processing and transaction processing? (Give example code snippets). [5 marks]
2 Refer to the CJ Date database schema that follows:

<table>
<thead>
<tr>
<th>S (aka supplier)</th>
<th>P (aka product)</th>
<th>J (aka job)</th>
<th>SPJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>S#</td>
<td>P#</td>
<td>J#</td>
<td>S#</td>
</tr>
<tr>
<td>SNAME</td>
<td>PNAME</td>
<td>JNAME</td>
<td>P#</td>
</tr>
<tr>
<td>STATUS</td>
<td>COLOUR</td>
<td>CITY</td>
<td>J#</td>
</tr>
<tr>
<td>CITY</td>
<td>WEIGHT</td>
<td>CITY</td>
<td>QTY</td>
</tr>
</tbody>
</table>

Write SQL statements for the following.
(a) Get part numbers for parts supplied by a supplier in London to a project in London. [5 marks]
(b) Get the total number of projects supplied by supplier S1. [5 marks]
(c) Get colours of parts supplied by supplier S1. [5 marks]
(d) Get project numbers for projects whose city is first in the alphabetic list of such cities. [5 marks]
(e) Get part numbers for parts supplied to all projects in London. [5 marks]
(f) Get supplier-number/part-number pairs such that the indicated supplier does not supply the indicated part. [5 marks]

3 (a) Explain in the detail the structure of an $n$ order (i.e. max number of descendants) B Tree page structure. A schematic diagram is expected. [5 marks]
(b) How do the B Tree building rules ensure that such structures have the most discriminating root page? [5 marks]
(c) One way to shorten the depth of a B Tree is to create a structure with a larger order. Is there a method to decrease the disk reads and writes for B Tree access? (You can assume there is plenty of RAM available!). [5 marks]
(d) Build a B tree of order 5 for the following index entries:
21, 5, 9, 10, 23, 64, 65, 29, 11, 13, 1, 15, 37, 47, 22, 33, 17, 2, 57, 61
[15 marks]
Consider the following declarative query on CJ Date's database (given in question 2) in SQL SELECT syntax where it is expected that all tables are joined:

```
SELECT DISTINCT s.sname, p.pname, j.city, spj.qty
FROM s, p, j, spj
WHERE p.p# = spj.p#
AND j.j# = spj.j#
AND p.colour = 'pink'
AND s.status = 'ok'
AND j.city = 'city';
```

(a) Build a connection graph for the given query and show that in fact it is not a join between all tables. Fix this SQL SELECT statement given.  

[ 6 marks ]

(b) Translate the query fixed in 4(a) into a relational algebra expression. The permissible algebraic operators are: SELECT, PRODUCT, PROJECT, UNION and DIFF.  

[ 6 marks ]

(c) Draw the Relational Algebra Tree (RAT) for your response in (b) above.  

[ 6 marks ]

(d) Reorder the selects and projects so as to execute these as early as possible.  

[ 12 marks ]

5  

(a) What are the main advantages and disadvantages of external hashing?  

[ 8 marks ]

(b) Discuss the effect on disk reads required to retrieve a key by increasing the bucket size in external hashing.  

[ 6 marks ]

(c) Describe a hashing function which maps good codes for surnames found in Malta.  

[ 6 marks ]

(d) Assume we have a block size of three (i.e. 3) in an extensible hashing index. The first sequence of index entries to insert are the following (note the key and its hashing):

a [010000]

Build the extensible hash index and clearly explain the main steps.  

[ 10 marks ]
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) No calculators or other electronic / smart devices are permitted.

3) This paper contains FIVE questions. You are to attempt Question 1 and any other TWO questions.

This question is Compulsory

1. Throughout this question refer to the following case study. Read the entire question before answering.

You have been assigned to design an app called FINDMYJOB that allows any user to search for a job. Searching for a new job used to involve hours of looking through classified ads in newspapers and many different job posting sites. Now online job finder’s sites have improved and you are able to narrow results and streamline this process.

FINDMYJOB for Android or iOS lets you search for a job when you’re on-the-go so you can find your next employment adventure, anywhere, anytime. You can narrow the results for specific geographical regions, salary expectations or type of employment (full-time, part-time, etc.).

The FINDMYJOB app tracks your search history so you will only see the results you haven’t viewed yet. You can also upload your CV if you want to make it easier to apply for a job you’re interested in. Employers can then view your uploaded CV and see if you’re a good fit for the position.
a) Design the **FINDMYJOB** mobile application, listing the "activities" you would use. Describe in detail the **main screen** that would be required to inform the user of the information needed at the various stages. Refer to the Human Interaction Guidelines (HIG) of the respective platform you are designing for. Consider the following key aspects in your proposal:

i) Choice of platform/s you intend to design your application for and justify your approach.

ii) Key HIG being adopted in your solution.

iii) List the activities you are using for your application.

iv) Detailed diagram of the Main Screen.

*List any assumptions you will consider in your solution.*

[10 marks, (2 marks each)]

b) Create a process map template that best fits the proposed solution.

[12 marks]

c) Identify at least 6 main pain points (obstacles)

[6 marks]

d) Propose solutions to address the challenges listed in (c).

[2 marks each Total 12 marks]

*Note for Question 1: You do not need to implement the application or algorithm.*

[Total 40 Marks]
You are to choose any 2 questions from the following.

2) **Principles of GIS & Applications of GIS in Location Based Services.**

GIS is defined as a system and as a science in its own right.

a) i. Provide a detailed definition of GIS.  
(6 marks)

   ii. Mention, and explain **FIVE** functions that are enabled by GIS.  
(3 marks each Total 15 marks)

b. Provide THREE detailed examples of applications in which GIS can be used for mobile applications. Discuss the importance of the term ‘geospatial’ for each example.  
(3 marks each Total 9 marks)  
[Total 30 Marks]

3) **This question is related to designing mobile applications using the Android API guides.**

a) What is Gradle? List **five** key features.  
[5 marks]

“A Fragment represents a behaviour or a portion of user interface in an Activity. You can combine multiple fragments in a single activity to build a multi-pane UI and reuse a fragment in multiple activities. You can think of a fragment as a modular section of an activity, which has its own lifecycle, receives its own input events, and which you can add or remove while the activity is running.”  
(Android API - Fragments)

b) Describe each method you need to override when using fragments.  
(3 marks for each method Total 9 marks)

c) Draw the lifecycle of a fragment (while its activity is running).  
[4 marks]

d) Explain the following: 1) Shared preferences, 2) SQLite and 3) Cloud storage. Give a practical example when to apply each of them.  
(2 marks for explanation, 2 marks for example each Total 12 marks)  
[Total 30 marks]
4) This question refers to Context Awareness.

"Development of context-awareness applications is inherently complex. These applications adapt to changing context information: physical context, computational context, and user context/tasks. Context information is gathered from a variety of sources that differ in the quality of information they produce and that are often failure prone. The pervasive computing community increasingly understands that developing context-awareness applications should be supported by adequate context information modeling and reasoning techniques."

Claudio Bettini et al, (2008)

i. List and briefly describe any three typical spatial queries on spatial context information. 

[5 marks each, Total 15 marks]

ii. Describe in detail the differences between 1) spatial models of context information 2) Ontology based models of context information and 3) object-role based models of context information. Give one example of each.

[5 marks each, Total 15 marks]

[Total 30 marks]

5) a) This question refers to Uncertainty of Context information

"Context-aware applications use context information to evaluate whether there is a change to the user and/or to the environment situation; taking a decision whether any adaptation to that change is necessary often requires reasoning capabilities. Reasoning techniques can also be adopted to derive higher-level context information. Therefore, it is important that the context modeling techniques are able to support both consistency verification, and reasoning about complex situations."

Claudio Bettini et al, (2008)

List three mechanisms that have been proposed for reasoning on uncertainty. Describe in detail each of them.

[5 marks for each Total 15 marks]
b) This question refers to Data Management.

“Any GIS system is only as good as the data that's in it. ArcGIS provides a complete set of tools that give you the flexibility to store, edit, and manage data in a way that fits with your existing processes” (ESRI, 2016).

a. Define the concept of vector data structures; include the definition of geographic features, and their relation to the attribute table.

[3 marks for the concept + 4 marks for the geographic features and relation to the attribute table Total 7 marks]

b. State and briefly explain FOUR advantages and FOUR disadvantages of vector data structures.

(1 mark each, Total 8 marks) [Total 30 marks]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2016 Examination/Assessment Session
CIS 3022: IS Strategy Management & Practice 11th June 2016
08.30am – 11.35am

Instructions:

1. The first 5 (five) minutes of the exam is reading time.

2. No other electronic / smart devices are permitted.

3. This exam paper contains 6 Questions. You are to answer any 4 Questions.

Q 1)

a) Create a simple plan for implementing a small E-business strategy for increasing sales and customers. Describe any possible issues that can arise and briefly explain any possible solutions. 

[10 marks: (5 marks for E-Business strategy, 5 marks for issues and solutions)]

b) Why is planning important for meeting strategic objectives?

[5 marks: (1 mark per valid point)]

c) What is the difference between ‘Strategic Vision’ and ‘Strategic Intent’? Clearly explain.

[5 marks: (1 mark per valid point)]

d) How are good IT project management skills directly related to the successful implementation of IT strategy?

[5 marks: (1 mark per valid point)]

Q 2)

a) In modern organisations why does risk assessment need to be applied for new IS projects?

[5 marks: (2 marks for risk assessment, 3 marks for why it is required)]

b) What are the negative aspects of risk assessment?

[5 marks: (1 mark for each valid neg. aspect)]

c) How can different managers responsible for the IS strategic process collaborate? Clearly explain

[5 marks: (1 mark for each correct explanation)]
d) What are the key differences between Information System Planning vs long term strategic objective setting?  
[5 marks: (1 mark for each valid point)]

e) What is meant by the concept of ‘Value Added’ process as regards IS strategy? Is this important?  
[5 marks: (3 marks for value added, 2 marks for importance)]

Q 3)
a) A company is setting up and integrating some new cloud services with its already existing information systems. At what strategic level will these new services impact the organization? Outline any possible strategic factors that have to be considered.  
[10 marks: (5 marks for strategic level impact, 5 marks for strategic factors)]

b) Why is the ‘context’ of strategy important for IS? Clearly Discuss.  
[5 marks: (1 mark per valid discussion point)]

c) Quantitative and Qualitative tools are used to support and document the resources and requirements of IS strategies. Explain what is meant by this statement. How do qualitative strategies differ from quantitative ones? Clearly explain and discuss.  
[10 marks: (5 marks for quantitative, 5 marks for qualitative)]

Q 4)
a) Discuss how the CMM (Capability Maturity Model) can be modified or applied to measure the level of strategic integration an IT organization has reached.  
[10 marks: (5 marks for CMM, 5 marks for mod. and explanation)]

b) What is meant by negative strategy? Why does this happen?  
[5 marks: (2 marks for negative strategy, 3 marks for explain)]

c) Explain and discuss any three definitions of strategy.  
[5 marks: (3 marks for each, 2 marks for explain)]

d) Is training an important factor for training personnel for successful IT strategy? Clearly explain  
[5 marks: (1 mark per valid point)]
Q 5)
a) Identify three different outsourcing models. [5 marks]

b) Carry out a typical SWOT analysis on each model from an organisation perspective. [15 marks: (5 marks for each model)]

c) Show how the organisation maturity is reflected in the SWOT results. [5 marks: (2.5 marks for org maturity, 2.5 marks for how this is reflected in SWOT)]

Q 6)
a) Differentiate between stages and work packages in PRINCE2. [10 marks (5 marks for stages, 5 marks for work packages)]

b) Show how the deliverables identified in the Initiation Phase are revisited on project closure. Illustrate your replies through examples. [15 marks (5 marks for deliverables, 5 marks for revisiting on proj. closure, 5 marks for examples)]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination / Assessment Session

CIS3041 Security, Quality and Risk Issues in I.S.  28th May 2016

8.30-11.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators and dictionaries. No other electronic / smart devices are permitted.

3) This exam paper contains SIX questions, you are to answer ANY four questions. (4 out of 6)

Q1.

a) Briefly describe the data design of an OLTP. (An ERM or LDS is expected).

   [6 marks]

b) There are three well known options for providing multi-tenancy databases as SaaS on the cloud. For each option clearly explain the physical relational design requirements and how these are implemented. (Your response should include SQL scripts for database, schema, tables and users creation for each case).

   [12 marks]

c) Which one of the three options you describe in (b) would you choose to deploy your OLTP (from (a)) as a multi-tenancy SaaS? How are the relative data security mechanisms going to be implemented and managed?

   [7 marks]
Q2.

a) What is meant by the CIA triad? Namely: Confidentiality, Integrity and Availability in security management.  

[5 marks]

b) Explain the following terms and describe two measures to implement each of them in security planning:

(i) Accountability;
(ii) Non-repudiation;
(iii) Abstraction;
(iv) Data Hiding;
(v) Secure change management.

[2 marks for explanation of term + 2 marks for measures X 5 =20 marks]

Q3.

a) Why are Business Continuity Planning (BCP) and Disaster Recovery Planning (DRP) of major importance in the running of reliable information systems in a modern organisation? Give at least four reasons.  

[2 marks per reason = 8 marks]

b) Write a report to the CEO of a large organization in the online business which lacks a documented BCP/DRP plan, outlining the urgent need for such a plan and the methodology and contents to create such a plan.

[17 marks]

Q4

a) Which encryption did Julius Caesar use? Give an example of such a cryptosystem.

[7 marks (1-Encryption type;6-Example)]

b) Define the terms keylogger, rootkit, DDOS and back door.

[8 marks (2-Each term)]

c) What are the properties of a strong cryptosystem?

[10 marks (2-Per Property)]
Q5

a) State the eight Quality Management principles and give an example in each case how they lead to better quality management applications.

[2 marks for each quality principle + example = 16 marks]

b) Explain the concepts of quality assurance, total quality and continuous quality improvement in the operations phase of running ICT systems.

[3 marks each concept x 3 = 9 marks]

Q6

a) Define software engineering risk management and why must we have a formal plan for its management?

[3 marks]

b) A risk management plan cannot be static and has to be periodically reviewed. Explain why this is so.

[3 marks]

c) Risk management has a number of dimensions and perspectives. Comment on the following perspectives and give an example of each:

(i) Operations Risk;
(ii) Strategic Risk;
(iii) Business Risk;
(iv) Technical Risk;
(v) Industry Risk;
(vi) Personnel Risk.

[1.5 marks X6 = 9 marks]

d) Software development include various risk factors such as organization risk, estimation risk, personnel risk etc. Identify at least ten of these risk factors and give an example of each.

[10 marks]
UNIVERSITY OF MALTA  
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
Department of Computer Information Systems  

May/June 2016 Assessment Session  

CIS3086 Mobile Device Programming  

14th June 2016  

10.00-12.05  

Examination Instructions  

1) The first 5 (five) minutes of the exam is reading time.  

2) Calculators and digital equipment are not permitted.  

4) This paper contains SIX questions. You are to attempt FOUR questions.  

1. Throughout this question refer to the design decisions you have made when implementing the DiscoveringMalta tablet application.  

You have been assigned a job as a developer to design a mobile app for a tour operator. DiscoveringMalta is a local tour operator that in recent years has expanded its operations to a number of popular tourist sites around Malta. Different modules are needed and can be accessed through mobile devices. The modules allow clients to book tours and also allow admin staff to manage various activities as part of the backend using a mobile device.  

Tablet devices are used to better help access the activities and other required information. A number of challenges can be identified that need to be addressed when designing apps for the scenario described above.  

a) Design an architecture of your app that could be accessed through a tablet device for DiscoveringMalta.  

[10 marks]  

This part refers to the mobile strategy you have chosen when implementing your tablet-based application. Where necessary, use pseudo code to explain your design.  

b) By considering the choice of platform/s you designed your application for, justify your approach for the following:  

i) Which development environment have you chosen and why? (Example, Native, Web app hybrid, etc)  

Page 1 of 4
ii) What are the technologies used to design your app? If you used an API describe in detail its functionalities.

iii) Describe the process of how notifications are triggered when designing apps such as DiscoveringMalta?

List any assumptions you may consider in your solution. [15 marks, 5 marks each]

[TOTAL 25 Marks]

Note for Question 1: You do not need to implement the application.

2. This question is about online/offline syncing when developing mobile applications.

a) What is offline syncing? List and briefly describe 3 concepts underlying how it works. [12 marks, 4 marks each]

b) Describe in detail a step-by-step implementation of offline/online syncing. You may use pseudo code in your answer. (Refer to question 1 as a case study) [7, marks for each stage and 6 marks for pseudo code Total 13 marks]

[TOTAL 25 Marks]

3. This question is about mobile testing using “Selendroid”.

“Selendroid is a test automation framework which drives off the UI of Android native and hybrid applications (apps) and the mobile web. Selendroid can be used on emulators and real devices and can be integrated as a node into the Selenium Grid for scaling and parallel testing.” (http://selendroid.io/)

a) Draw the “Selendroid” architecture diagram. Describe in detail the process of at least 3 components (9, 6 Total 15 marks)

b) Which are the 5 requirements when running a test using “Selendroid”? Describe each requirement by referring to the case study you are testing. (5, 5 Total 10 marks)

[TOTAL 25 Marks]
4. This question is about mobile web apps.

a) Mobile web apps running in modern browsers can offer powerful native-like capabilities, including relational storage and offline capabilities. With examples, provide an argument as to why native mobile apps are better than pure HTML5-based web apps. Your discussion should include device, app and experience related capabilities (or lack thereof)  

[15 marks]

This question is about problems users encounter when using apps.

"Users tend to write reviews when they are extremely satisfied or extremely dissatisfied with a product. Poor reviews affect sales more than good reviews, because buyers are more likely to react to low ratings and complaints. We can understand more what users complain mostly about when using mobile apps."

(IEEE Computer Society, 2015)

b) What do mobile app users complain about? List 5 complaints and describe each one by giving an example for each.  

[5,5 marks for each, Total 10 marks]  
[TOTAL 25 Marks]

5. This question is related to SSO (Single Sign On)

"SSO (Single Sign On) means that when a user logs in to one application he will be "automatically" signed in to every other application, regardless of the platform, technology and domain. For example, Google implement SSO for their products: Gmail, YouTube, Analytics, etc. When you turn on your computer and access Gmail, you login for the first time. Then, if you go to YouTube you will not be prompted for credentials again. The way this works is by means of a "central service" (in the case of Google this is https://accounts.google.com). When you login for the first time a cookie gets created on this central service. Then, when you try to access the second application, you get redirected to the central service, but since you already have a cookie, you get redirected to the app directly with a token, which means you are already logged in."

(SSO AuthO, 2016)
a) Choose an SSO API of your choice and describe step by step how it works.

[2 marks for each step Total 12 marks]

b) List the five practical examples of
i) when you would apply SSO;
ii) when you would not.

[5,5 marks Total 10 marks]

c) List 3 other popular SSO API.

[3 marks]

[TOTAL 25 Marks]

6. This question is related to the concept of persuasive technology.

"Persuasive technology is the study of computer systems designed with the intent to change people's behaviors and attitudes.”

(Fogg, 2009)

a) What are the key differences between interpersonal persuasion, computer-mediated persuasion and human-computer persuasion?

[3 marks for each - Total 9 marks]

b) There are a number of requirements identified when designing requirements for a model in the context of pervasive computing systems. List and describe in detail four of them.

[4 marks for each - Total 16 marks]

[TOTAL 25 Marks]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination / Assessment Session

CIS3088 e-Learning Applications Development

08:30am – 10:35am

11th June 2016

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

- Answer any 5 questions from the following 6 questions.

- All parts of a question should be written together.

1. Name and describe each of the three M's of learning experience proposed by Michael W. Allen. Which is the fourth M of learning experience? How can you ensure each of these four M's in your e-learning application (give suitable examples preferably from your assignment)?

   \[ 2 \times 3 + 2 + 3 \times 4 = 20 \text{ marks} \]

2. Merrill's First Principles describe five principles for promoting learning. Name and describe each of the five First Principles. How can you implement each of these five principles in your e-learning application (give suitable examples preferably from your assignment)?

   \[ 2 \times 5 + 2 \times 5 = 20 \text{ marks} \]
3. What is “gamification of learning”? Write three merits and three demerits/limitations of “gamification of learning”. Can we use gamification to teach ‘Geography’ to Secondary School (Form 3 to 5) students? How or why not? Justify your answer with suitable reasons. \[3 + 2 \times 3 + 2 \times 3 + 5 = 20 \text{ mark}\]

4. You are required to run a course on ‘Mathematics’ through an e-learning environment for Secondary School (Form 3 to 5) students.
   a. Which e-learning model would you recommend for your e-learning design from Online distance learning, Blended learning, Self-paced learning, Live online learning? Justify why it is the best choice. \[4 \text{ marks}\]
   b. How is your selected e-learning model a better choice than the classical face-to-face classroom based environment:
      i. Give four advantages and four disadvantages you might have as a learner. \[1 \times 4 + 1 \times 4 = 8 \text{ marks}\]
      ii. Give four advantages and four disadvantages you might have as an instructional designer/facilitator/institute. \[1 \times 4 + 1 \times 4 = 8 \text{ marks}\]

5. You are required to run a course on ‘Biology’ through an e-learning environment for Secondary School (Form 3 to 5) students.
   a. Write advantages and disadvantages of using recorded videos or streaming videos. Justify your answer with suitable example(s). \[2 \times 2 = 4 \text{ marks}\]
   b. Write advantages and disadvantages of using recorded audio. Justify your answer with suitable example(s). \[2 \times 2 = 4 \text{ marks}\]
   c. Write advantages and disadvantages of using videoconferencing. Justify your answer with suitable example(s). \[2 \times 2 = 4 \text{ marks}\]
   d. Write advantages and disadvantages of using animated multimedia. Justify your answer with suitable example(s). \[2 \times 2 = 4 \text{ marks}\]
   e. Write advantages and disadvantages of using discussion forums. Justify your answer with suitable example(s). \[2 \times 2 = 4 \text{ marks}\]
6. In class we discussed the concept of learning objects and reusable eLearning content. When this idea was first proposed it was greeted with great fanfare and some believed it would make the design and implementation of eLearning content much easier. Why has this not happened and what challenges does eLearning face with regards to the object repositories and ease of re-use and discovery that has not materialised?

[4×5=20 marks]
Surnames: _______________________
Name: _______________________
I.D. Number: _______________________
Study-Unit Code / Title: CIS3101 Cloud Computing

UNIVERSITY OF MALTA
Faculty of Information and Communication Technology
Department of Computer Information Systems

CIS3101 Cloud Computing

Date: 8th June 2016

Time: 10.00-12.05 hrs
CIS3101 - May/June 2016 Assessment

UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems

Wednesday June 8 10:00-12:05       Final Examination       TWO HOURS

CIS3101 - Cloud Computing

Instructions.

1. There are a total of six questions. The first one (Q1) is mandatory. Choose any three of the remaining five questions to answer.

2. Read all questions carefully.

3. Put answers in spaces provided. Plenty of space has been provided for answering each question. Note that the amount of space provided does not imply that you must use it all. answer each question to the best of your ability. NOTE: There is extra space provided at the end of the exam should you require it. PLEASE make it clear what question is being answered there if you use it.

4. Calculators are allowed.

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<thead>
<tr>
<th>Section</th>
<th>Points</th>
<th>Your Score</th>
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</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td></td>
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<tr>
<td>Mandatory Questions (Layfield Mix feat. Vella &amp; Vella, Layfield, Porter &amp; Depasquale)</td>
<td>25</td>
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<tr>
<td>Choose 3 of the Following 5</td>
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<tr>
<td>IaaS/SaaS/PaaS</td>
<td>25</td>
<td></td>
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<tr>
<td>History / Business case for Cloud</td>
<td>25</td>
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<td>Virtualisation</td>
<td>25</td>
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<td>Excursions &amp; Speakers</td>
<td>25</td>
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<tr>
<td>Security in the Cloud</td>
<td>25</td>
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<td>TOTAL</td>
<td>100</td>
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Question 1 - Mandatory  [25 Marks]

(a) Web roles and web apps should be assumed to be stateless entities when adopting PaaS. This is particularly important when the latter (web-apps) need to scale out with a load-balanced set of instances. Discuss.

(b) As the CIO of a company planning to shift critical aspects of its business process automation to the cloud, you are asked to create a checklist with the necessary cloud security requirements that the eventual provider has to satisfy. Identify five (5) of these requirements.
(c) Define the three service models of Cloud Computing as defined by NIST. Give an example of a provider of these services for 2 of them. [3 Marks for definitions, 2 Marks for examples].

(d) In a SaaS set-up, what are the three options for multi-tenancy databases?
(e) A Java machine executes a class file that contains a single method. Sketch two block diagrams to compare the proceedings on a Java Virtual Machine running on Intel architecture with the proceedings on a (hypothetical) Java physical machine. Your sketch must show and identify:

1. The hardware components [1 Mark].
2. The software components [1 Mark].
3. The agent of virtualisation where relevant) [2 Marks]
4. The section of memory where the Java text and data are stored [1 Mark].
Question 2 - IaaS/PaaS/SaaS  [25 Marks]

Assuming a cloud-based event-driven architecture, provide a first-cut design for any system that might need to sustain a massive amount of potentially processor-hungry requests. Be creative, use diagrams and think in terms of cost-effective scalability, especially when scaling out rather than up.

Use the space provided to sketch your architecture and annotate where necessary.
Question 3 - History / Business case for Cloud  [25 Marks]
You are the resident ‘technological evangelist’ for McLovin Cellular and Wireless Corp, a new telecomm provider in the Maltese islands specialising in corporate communication needs that has been in business for three years. The data centre currently has a Total Cost of Ownership (TCO) as follows:

<table>
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<tr>
<th>Item</th>
<th>Annual Charge</th>
<th>Three Year Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Storage</td>
<td>€100,000</td>
<td>€300,000</td>
</tr>
<tr>
<td>Facilities</td>
<td>€60,000</td>
<td>€180,000</td>
</tr>
<tr>
<td>Full Time Equivalent (Labour)</td>
<td>€600,000</td>
<td>€1,800,000</td>
</tr>
<tr>
<td>Network Hardware</td>
<td>€30,000</td>
<td>€90,000</td>
</tr>
<tr>
<td>Server Hardware</td>
<td>€400,000</td>
<td>€1,200,000</td>
</tr>
<tr>
<td>Server Maintenance</td>
<td>€20,000</td>
<td>€60,000</td>
</tr>
<tr>
<td>CRM Licenses</td>
<td>€40,000</td>
<td>€120,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>€1,250,000</strong></td>
<td><strong>€3,750,000</strong></td>
</tr>
</tbody>
</table>

Currently the company hosts an in house CRM system for their sales and customer relationship team (license fee item in TCO above) but is entertaining moving this software to a Cloud based offering, salesshark.com that charges on a per seat basis. The company also currently hosts their own email, content management and other IT functionality but is not looking at moving it at this time. If the company was to move their CRM to this alternative hosting strategy they would no longer have to pay the CRM Licensing fee as outlined in the TCO above. It is also estimated the server hardware annual cost would be reduced by €30,000 and the maintenance costs would decrease annually by €5,000. However, the cloud based service would charge €50,000 per year (it has additional services of value to the company above and beyond what the current CRM is capable of).

[5]  (a) What will be the new TCO be for this model? Include both the annual and three year charge.
(b) Is this a good investment? Use one of Payback, ROI or Net Present Value to justify your answer. Assume the initial outflow (or investment) is €150,000 for any calculations you make. Show your work. [1 Mark for investment opinion, 4 Marks for justification employing one of Payback/ROI or NPV].

(c) How could McLovin potentially further enhance cost reductions via the employment of cloud computing?
(d) Many analysts and industry observers often remark that Cloud Computing can lower the barrier of entry for start up companies. Explain what they mean by this phrase and how Cloud Computing can help smaller companies compete with larger and more mature organisations. Give one example [3 Marks explanation. 2 Marks example].

(e) In the early age of computing, visionaries such as Professor John McCarthy and Leonard Kleinrock observed that, potentially, one day computing will be treated as a utility. Explain what they meant by this and give 2 examples [2 Marks meaning, 2 Marks per example].
Question 4 - Virtualisation  [25 Marks]

During treatment of virtualisation, the role of the interface has been examined. It has been seen that abstraction produces an interface. This interface is the meeting place between a producer and a consumer.

Within the context of full system (machine) virtualisation, services are requested by the "guest" at the interface and are provided by the host. The "guest" consists of an operating system and the application software which is controlled by the operating system. The host consists of a Virtual Machine Monitor (VMM) and a physical machine (platform). Jointly, the VMM and the physical machine provide the virtualised interface.

Consider the context of network virtualisation.

[9] (a) For the particular case of network virtualisation implemented using an OpenFlow system of components, with the aid of a labelled diagram and a supporting description, show:

1. The switching hardware (and software, if any) [3 Marks]
2. The control hardware (and software, if any) [3 Marks]
3. The entity that virtualises the network [3 Marks]

Question 4 - Virtualisation

Page 10 of 20
Comment upon the efficiency of operation of the virtual network, by referring to the overhead to which the network is subject during operation.

Using your work up to this point, identify the virtualised interface, its producer (the host) and its consumer (the guest).
Question 5 - Excursions & Speakers  [25 Marks]

(a) Data Centres are expensive installations to set up and to run. Discuss the reasons for this, and why a company might prefer to outsource their infrastructure function to a professional data centre operator.

(b) Major Cloud Computing providers, such as Amazon and Microsoft, can deliver IaaS, PaaS and SaaS - which covers a very wide spectrum of services. In this new business environment, how can data centre operators (such as BMIT and MITA) compete with these vendors – and not only continue to survive, but also to thrive?
(c) What are the benefits of Cloud Computing to a small (less than 25 employees) software house that, for example, sells website templates and an online booking engine to the hospitality industry worldwide?

(d) When dealing with a global industry, as in the above case, a company has to guarantee very high levels of service. How does Cloud Computing enable this, and how can this be “sold” to potential customers?
(e) Very often, the benefits of Cloud Computing are thought to be financial - but when one looks at the associated monthly costs, they invariably look very expensive. Justify the expense and how, in fact, Cloud Computing does deliver both business and financial benefit.
Question 6 - Security in the Cloud  [25 Marks]

As a renowned computer security expert you have been called to carry out a pen-test (simulated attack) on a virtual host-based CDN infrastructure, and which hosts various domains offering authenticated access. Describe a plan detailing how you will go around:

1. Collecting hosted domain and TLS setup information [5 marks]
2. Identifying potential vulnerabilities [10 marks]
3. Demonstrating successful exploitation of web-based authentication [10 marks]
EXTRA SPACE - If you use this PLEASE MAKE IT CLEAR WHICH QUESTION/PART the answer refers to. Use this only if you feel you do not have enough space to put an answer OR if you make a mistake and need to rewrite your answer to a question.
CIS3104: Computer Graphics Applications

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators and dictionaries. No other electronic / smart devices are permitted.

3) This exam paper contains SIX questions; you are to answer ANY four questions. (4 out of 6)

Q1. Given the following 3D shape (as identified by the bold lines):

![Diagram of a 3D shape with coordinates (0,0,0), (0,0,8), (8,0,0), and (8,8,8).]
a) Prepare the Vertex List, the Edge List and Face List using an Edge-based representation. [16 marks]

b) Verify that $v - e + f = 2$ [4 marks]

c) Can a curved shape object be represented using an edge-based representation? [5 marks]

Q2

a) When creating animations using Daz Studio the typical output format is avi. How could you convert an XviD avi thus created into a Matroska format video and using the H264 codec. [8 marks]

b) It is required to find the intermediate position of a spherical object travelling in a straight line in terms of the current frame. Knowing that the initial and final positions are 8 and 40, work out a formula to do this using the LERPING method. [9 marks (9-work out)]

c) Define the terms rendering, gouraud shading, magnetize pose and MAT. [8 marks (2-each term)]

Q3

a) Discuss how an existing 3d model could be altered in Daz Studio. How can MATs be used and created in relation to this purpose? [7 marks (4-customisation; 3-Information about MATs)]

b) Given a static render, how would you follow the normal workflow in Daz Studio. Determine how this would need to change for creating an animation instead. [18 marks (2-each step; 2-animation)]
Q4 Assuming the following L-grammar with alphabet \{A, B, [, ], (, )\} and the two production rules

1. \( A \rightarrow A A[B]A(B) \)
2. \( B \rightarrow BB \)

given that the first starting generation (axiom) is A, write down and draw the graphical representation of the first three generations.

What would be a useful modification to the above L-grammar?

[25 marks (10-write;10-draw;5-What would..)]

Q5

a) What is an opacity map in Daz Studio? Other programs refer to transparency. How can you translate from the transparency property to opacity?

[10 marks (8-Opacity map;2-Translate transparency to opacity)]

b) Discuss both the old and newer ways to solve the problems of “fitting” clothes to figures, especially with clothes not made for a particular 3d model.

[11 marks (5-Old;6-New)]

c) Describe the terms: **spline**, **storyboard**, **bird-eye's view** and **keyframe**.

[4 marks (1-per term)]

Q6

a) What is the traditional role of the in-betweener?

What are characteristic frames in an animation?

What is a pencil test?

What is a worm-eye's view?

[8 marks (2-Per definition)]

b) What is the organisational process of creating an animation?

What is an exposure sheet?

[12 marks (3-per described part of the organisational process;3-exposure sheet)]

c) What is the “web safe” palette and what is its status today.

[5 marks (3-Definition;2-Status)]
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination / Assessment Session

CIS3107 Advanced Databases: Data Mining and Warehousing 1st June 2016

14.30-17.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Calculators and electronic or smart devices are not allowed.

3) General instructions:
   Choose any four questions. Each question carries the same amount of marks.
   If a question has a section with sub-sections then, if not otherwise indicated, each sub-section carries equal marks.

1 a) Consider the simple relational schema in appendix one. Identify the main data source for a fact table’s numeric fields.

   [ 4 marks ]

   b) i  What is, according to Kimball, a conformed dimension?

   ii  Give one example of a conformed dimension from appendix one.

   [ 6 marks ]

   c) Create a DWH for the OLTP in appendix one. Use Kimball’s dimensional modelling. Optimise design for intensive query processing. State where data redundancy issues are being introduced.

   [ 15 marks ]

2 Consider the following example and very simple fact table: ftsales(date, product, store, city, qty, sale). Both qty and sale are numeric and date, product, store and city functionally determine qty and sale.
  a) Give an example of the data output expected from an OLAP roll-up query on dates.

   [ 5 marks ]

  b) Give an example of the data output expected from an OLAP slice over a product and a city.

   [ 5 marks ]

  c) Give an example of the data output expected from an OLAP dice over city, store and product.

   [ 5 marks ]
d) Give an example of the data output expected from an OLAP drilling down on product (produce a product hierarchy). [5 marks]

e) Give an example of the data output expected from an OLAP pivot table on city and store. [5 marks]

3 Materialised views are able to deliver impressive query processing performance.
   a) In what specific ways can materialised views help in query processing and query optimisations? (Mention two ways). [4 marks]

   b) Explain how and what needs to be specified in a materialised view definition. Use of an SQL DDL is expected. [5 marks]

   c) Consider the following simple fact table: \( f(a, b, c, d, m) \) with \( m \) being the numeric part of it. Create materialised views on the fact table provided for \( f(a, b, c) \), \( f(a, b) \), \( f(a) \), and ALL. The aggregate to compute in each materialised view on attribute \( f.m \) are \( \text{sum()} \), \( \text{count()} \), \( \text{min()} \) and \( \text{max()} \). [16 marks]

4 a) Explain differences between tightly coupled and loosely coupled distributed systems. [5 marks]

   b) We have a multidatabase across service call centres – where a household asks for house related maintenance jobs. Implement a schema integration technique that would allow this service call centre to seemingly adhere to the multidatabase agreed between service providers. [12 marks]

   c) What are the generic steps a multidatabase query must pass for its processing? [8 marks]

5 a) List and explain in detail why database techniques are useful in a data mining project. [7 marks]

   b) Explain association rules and implement the a-priori algorithm through database artefacts. Your response must include relational relations and SQL statements. Also a thorough explanation of confidence and support levels needs to be clearly shown in the algorithm’s workings. [18 marks]
6 a) What role does a “distance” function have in a clustering technique? [4 marks]
b) If we are to interpret a “distance” as geo-spatial (distances on the surface of Earth) then explain why we still need different “distances” functions? [5 marks]
c) List and explain three “distance” measures used in geo-spatial distances. [9 marks]
d) What type of data design and data queries are required to cluster geographical regions? [7 marks]

7 This question is based on the paper called “A data warehouse in an e-health system” by Di Bitonto et al, in Recent Advances in Energy, Environment, Biology and Ecology, 2012.
a) Identify two data collection modes and their respective frequency of uploads (i.e. into the data warehouse). [2 marks]
b) Identify the two main fact tables and any two dimensions. [4 marks]
c) List three tools used in this project by its developers and end users. [3 marks]
d) The project development mirrored the hub-and-spoke distribution paradigm, where the services are located at the spokes and each specialised service, or specialist, is located at a hub.
   i How did the hub-and-spoke distribution model influence the data warehouse design? [8 marks]
   ii What type of operations are expected at a hub and spoke of the distribution model? (Relate these queries to the data warehouse design.)
e) The data warehouse was provided with a number of readily defined report formats. Describe two of these. Your response must indicate the nature and details of the query that drives each report. [2 marks]
f) A third hub is to be introduced in the project’s scope (e.g. Endocrinology expertise for diabetes). Write a high level plan on how this hub is to be introduced and deployed. [6 marks]
Appendices:

One: OLTP relational schema
UNIVERSITY OF MALTA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Department of Computer Information Systems

May/June 2016 Examination / Assessment Session

CIS5106: I.S. Graphics - Applied 3D Modelling In I.S. 28th May 2016

08.30-11.35

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are allowed to use scientific calculators and dictionaries. No other electronic / smart devices are permitted.

3) This exam paper contains SIX questions, you are to answer ANY four questions. (4 out of 6)

1.

a) The combination of photos and computer generated images is a powerful technique used in many areas including recent movies.

When creating your 3d models you may find photos of texture patterns quite useful. Discuss how best to maintain such photos and use them in the 3d modeller Hexagon.

Discuss the potential issues which arise from the source of such images.

[15 marks (11-Discuss how best.;4-Discuss the potential..)]

b) Discuss the benefits arising from the creation of UV Maps in 3d modelling. What happens if a UV map is not created?

List the Groups of Primitives available in Hexagon.

[10 marks (7-Benefits;1/2 per Group)]
2.

a) Discuss the Euler-Poincare' Formula and its application to 3d modelling.  
[4 marks]

b) How would you define a Primitive in Bryce and how would they be converted or exported for use in other graphics applications?  
[4 marks]

c) List the groups of Primitives available in Bryce.  
[3 marks (1-Per Group of Primitives in Bryce)]

d) The raytracer Bryce can perform CSG (Constructive Solid Geometry). List the Boolean Set operators available in Bryce for this purpose. What is CSG used for?  
[14 marks (Primitives-8;Usage of CSG-6)]

3.

Consider this quote from Sid Karen (the former director of the San Diego Supercomputing Center) which aptly describes the state of distributed computing over a grid:

"As we enter the 21st century, the traditional model of stand-alone, centralized computer systems is rapidly evolving toward grid-based computing across a ubiquitous, continuous, and pervasive national computational infrastructure."

Discuss how the successful analysis of huge amounts of data may be helped using a combination of data visualisation, computer graphics and grid computing.  
[25 marks]

4.

a) A MAT is best described as a skin for your 3D model. Viewed in a graphics viewer, it looks like someone stretched out the model and flattened it. Discuss the creation of your own custom MATs for use in Daz Studio (or Poser), and the purpose of using them instead of the ones a daz figure comes with.  
[10 marks (8-Discuss;2-describe)]

b) Discuss the distribution issues and concerns with customisation of an existing 3d model to create your edited MAT. Can you redistribute it? Could the original creator give you permission to do this? Discuss the use of transparency maps and Bump maps.  
[15 marks (5-Distribution..;1-permission;3-Transparency maps;6-Bump maps)]
5.

Consider the Virtual Camera Control algorithm by Abdullah et al:

a) List the two main levels which Abdullah et al divides the problem of composition into.
   
   [4 marks (2-per level)]

b) Mention the four composition rules derived from photography and cinematography which the algorithm implements rating functions for.
   
   [8 marks (2-per composition rule)]

c) What is the rendering approach, and what is its disadvantage?
   
   [13 marks (10-discussion on rendering approach; 3-disadvantage)]

6.

Consider ‘Virtual Camera Composition with Particle Swarm Optimization’ by Burelli et al (2008):

a) In 3d visualisation, which situations might cause occlusion of an object and lead a scientist to make inaccurate conclusions?
   
   [8 marks]

b) Which 3d model did Burelli et al use to set their problems in?
   
   [5 marks]

c) List two Camera-Related properties and an Image Property used by Burelli et al and give their meaning.
   
   [12 marks (1-per name of property listed; 3-per explanation of a property given)]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2016 Examination / Assessment Session

CIS 5107 IS Risk, Quality, Audit and Control
4th June 2016

08:30am -10:35am

Instructions:

1. The first 5 (five) minutes of the exam is reading time.

2. Calculators are allowed. No other electronic / smart devices are permitted.

3. Instructions:

   This exam paper contains FIVE questions, you are to attempt 3 out of 5 questions.

1a.

The ISO 9001 quality model is based on eight basic quality management principles. State these eight principles and comment briefly on each.

[2 marks for each principle and comment = 16 marks]

1b.

Draw an appropriate diagram to describe the main features of the ISO 9001:2008 structured requirements for compliance to its Quality Management System. Comment briefly on the four main chapters of the standard.

[10 marks for diagram + 2 marks for each chapter comment = 18 marks]

2.

Quality management and assurance of ICT systems is a major responsibility of an ICT department and must be planned and structured accordingly. Write a report to the senior management of a business organisation which manages a number of department stores within the EU, outlining the recommendations of a quality management study with a view of obtaining ISO 9000 certification for the ICT development and operations department.

[Hint: your report should discuss the quality management structure, quality plans, documentation, resource plans, quality audit and control and follow up plans].

[5 marks for each component + 4 marks for overall structure = 34 marks]
3a.

(i) What is the function of access control in enhancing the security of ICT systems? [5 marks]

(ii) Comment on the following access control mechanisms:

1. Password controls;
2. Token and Ticket controls;
3. Biometric controls;
4. Encryption;
5. Social Engineering Controls;
6. Physical controls. [2 marks each=12 marks]

3b.

(i) Discuss why auditing and control of online activities is necessary in order to hold users accountable for their ICT activities. [7 marks]

(ii) List and briefly comment on the audit requirements which data tracking should comply with according to the National Institute of Standards and Technology. [At least 10 audit requirements should be listed] [10 marks]

4a.

What is the relation between risk situations and risk behavior in ICT? [At least four types of risky situations should be mentioned] [8 marks]

4b.

Draw a diagram of the just-in-time risk activity model and comment on its six components. [6 marks for diagram and 6 marks for discussing components = 12 marks]

4c.

Comment from the perspective of the strategic risks, operational risks, technical risks, business risks, and stakeholder risks, on two concerns which need to be addressed. [2 marks for each risk type = 10 marks]

4d.

Explain why the risk profile of an organisation changes over time and the relevance of this to the software risk manager. [4 marks]
5a.

Describe the structure and features of the Software Engineering Risk Management Methodology (SERIM) and discuss 3 of its main strengths and 2 of its weakness points.

[13 marks for SERIM structure 3 marks for strengths and 2 for its weaknesses = 18 marks]

5b.

Describe how you would apply in practice the SERIM methodology in quantitatively assessing the risk profile of a proposed innovative software development project in A.I. and in identifying areas of weakness in the various risk factors.

[10 marks]

5c.

From an owner point of view, why is it important to ask for the risk profile of a proposed system from the developer before awarding the project tender?

[3 reasons at least = 6 marks]
UNIVERSITY OF MALTA  
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
Department of Computer Information Systems  
May/June 2016 Examination / Assessment Session  
CIS 5108 IS Strategic Analysis and Enterprise Computing  

11^th Jun 2016  
08:30am – 10:35am

Instructions:

1. The first 5 (five) minutes of the exam is reading time.

2. No other electronic / smart devices are permitted.

3. This exam paper contains 7 Questions. You are to answer a total of 4 Questions, (2 from Section A and 2 from Section B)

Section A – 4 Questions. You are to Answer any 2 Questions from this Section

Q1
Strategic planning is a must for large companies. In the past decades the rate of change in IS systems and new IT policies have instigated important strategic approaches that require many levels of commitment and support. Your task is to create and develop an IS collaborative strategic plan that suggests several important approaches. The IS strategic plan should investigate different approaches like i) collaborative, ii) participative. The idea of structured vs unstructured strategy needs to be presented along with several reasons for choosing different methods based on the context of the organisational culture.

[25 marks: 5 marks structure, 5 marks approach suggestion and explanation, 5 marks for different approaches, 5 marks for appreciating the differences between structured and unstructured strategy, 5 marks for the clarity and explanation of the overall plan]

Q2
a) List and discuss several advantages of having a ‘SBU’ (strategic business unit) in an organisation.  

[5 marks: 2.5 marks for list, 2.5 marks for discussion]

b) What is meant by the term ‘Information Intensity’ mentioned in several papers discussing IS strategies?  

[5 marks: 2.5 marks for explain, 2.5 marks for discussion]

c) In your opinion does ‘Value Added’ planning strategy require greater maturity than ‘Integration’ (data oriented) strategy? Clearly explain your reasoning.  

[5 marks: 2.5 marks, for answer, 2.5 marks for reasoning]
d) In some works about IS strategy it has been stated that 'unfortunately there is no generally agreed use of the terms IS strategy and IT strategy'. Clearly explain the implications of this statement.

[5 marks for valid arguments- 1 mark each]

e) Briefly explain how the ROI (return on investment) for a particular IS strategy can be measured.

[5 marks for valid answer and explanation]

Q3

a) Explain how Business Process Improvement can increase the value of business activities.

[5 marks: 1 mark for each valid point]

b) "As IT becomes more closely tied to business objectives, firms need to adopt multiple approaches to IT investment. Successful investment strategies consider two dimensions: technology scope and strategic objectives". Explain and discuss the validity of this statement.

[10 marks: 5 marks for explain, 5 marks for discuss]

c) Explain what is an IT investment framework. What are the main components of an IT investment framework?

[10 marks: 5 marks for IT Investment framework, 5 marks for components]

Q4

a) List and explain which new initiatives can be generated through a i) transformational investment, and ii) experimental investment used for IT strategy.

[10 marks: 5 marks for transformational, 5 marks for experimental]

b) How can automation improve a strategic process? Discuss

[5 marks : 1 mark for explanation, 4 marks for discuss]

c) How can industry measure the level of ‘information planning maturity’ for typical organizations?

[5 marks : 1 mark for each valid point]

d) What is the contribution of the CIO (Chief Information Officer) at setting IS strategies at board level? Explain

[5 marks : 1 mark for each valid point]
Section B – 3 Questions You are to Answer any 2 Questions from this Section

Q5
a. What is Business Process Engineering (BPR), and why should one consider this (as a possibly important) step prior to the implementation of an Enterprise Resource Planning (ERP) system?  
   [8 marks]

b. ERP systems tend to be one-size-fits-all, requiring the ERP adopter to change its processes to fit the system as opposed to the other way around. However, ERP vendors can, at additional cost, customise their system to more closely fit the needs of their customers. From the ERP adopter’s perspective, discuss the advantages, disadvantages and possible pitfalls of this approach.  
   [8 marks]

c. ERP systems have a reputation for being expensive to implement, and for this reason for many years were only implemented by large multi-national companies. In more recent years, however, ERP vendors have developed products applicable to the majority of organisations, large or small, public or private, whether focused on product or service delivery. With respect to one (or more) of these organisation types, describe the main factors that drive ERP adoption. How do these relate to issues of technology, performance/competition and business strategy?  
   [9 marks]

Q6
a. Describe an approach to selecting an Enterprise Resource Planning (ERP) system for an organisation.  
   [15 marks]

b. What are the advantages and disadvantages of the approach described?  
   [10 marks]

Q7
Enterprise Resource Planning (ERP) systems are known to be expensive, complex and risky to implement. In particular, the business and social/cultural context may play a part in adding to the overall complexity of such projects.

a. Give an example of a particular context that could have a bearing on the way one might approach such a project.  
   [1 mark]

b. With respect to a particular context or otherwise, list and discuss eight (8) or more Critical Success Factors (CSFs), and the possible impact these could have on project success.  
   [24 marks - 3 marks per CSF]
UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems
May/June 2016 Examination / Assessment Session

CIS5113 Large Scale Databases 28th May 2016
8.30am – 10.35am

Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) Students are not allowed to use scientific calculators. No other electronic / smart devices are permitted.

3) General instructions:

*This paper contains FIVE questions. You are to attempt question 1 and any two questions.*

All questions expect the candidate to describe and include data modelling, query modelling and stored procedures constructs required in their responses. SQL dialects are usually sufficient; but where low level access methods or other data languages, e.g. MongoDB, are more appropriate candidates are urged to use them.

All assumptions must be stated. All text, code and diagrams must be clear and concise.

If question has sub-sections then the sub-section marks are equally allocated if not otherwise indicated.

1 a) Describe two methods one can employ to “pack” data items prior to writing them to storage. [5 marks]

b) What can ensure scalability for a B-tree index structure (or B-tree genera)? [5 marks]

c) How is disk access modeled to calculate its effort to fetch a block? [5 marks]

d) Describe an effective method to generate a dataset with particular attributes; e.g. number, width, foreign key distribution. [5 marks]

e) Discuss scalability issues of the two-phase commit for distributed database transaction atomicity. [5 marks]

f) Why is 2PL not usually indicated for distributed transaction management? [5 marks]
2. a) Describe outer joins in SQL. \[5 \text{ marks}\]
b) In post relational SQL one can have a type constructor typing an attribute. Give an example of using an array type constructor (e.g. definition and manipulation) and how can one convert to, and back to, basic domains. \[5 \text{ marks}\]
c) Show how SQL reads, manipulates and validates external data; either CSV, JSON or XML. \[5 \text{ marks}\]
d) Define a moving average; construct an SQL query to calculate it. \[5 \text{ marks}\]
e) Give an example of a non-recursive common table expression in SQL. \[5 \text{ marks}\]
f) Give an example of a recursive common table expression in SQL. \[5 \text{ marks}\]
g) A data view is defined through a GROUP BY query. How can one update through it? \[5 \text{ marks}\]

3. a) Compare and contrast serial and sequential access of an external file. \[5 \text{ marks}\]
b) Explain the method and costs, in terms of disk reads and writes, for a nested join between two tables. Assume the tables are of a different size. \[10 \text{ marks}\]
c) Explain the method and costs, in terms of disk reads and writes, for a sort merge between two tables. Assume the tables are of a different size. \[10 \text{ marks}\]
d) Explain the method and costs, in terms of disk reads and writes, for an indexed join between two tables. Assume the tables are of a different size. \[10 \text{ marks}\]

4. a) Give the general characteristics of these external indexes:
   i. B-trees (or B+ tree);
   ii. Extendible hashing;
   iii. Bitmapped indexes. \[18 \text{ marks}\]
b) Which type of data retrieval is advantaged in:
   i. Extendible hashing?
   ii. Bitmapped indexes? \[10 \text{ marks}\]
c) For a single attribute primary key index we have bulk upload requirements. Currently we have a B-tree specified. How can we improve the indexing during bulk upload? \[7 \text{ marks}\]
Please study the logical design of an OLTP system in appendix one. This question is about designing a data warehouse.

a) i. Define its dimensions.
   ii. Define its conformed dimensions. [10 marks]

b) Define a fact table for sales; ensure any design anomalies are stated. [18 marks]

c) If physical implementation is a concern and one is to avoid join processing then what design should be adopted for dimensional modelling? Give such a Data Warehouse design for appendix one. [7 marks]
Appendices:

One: OLTP relational schema
Instructions:

1) The first 5 (five) minutes of the exam is reading time.

2) No calculators or smart devices are allowed.

3) General instructions:

This exam paper contains THREE questions, you are to attempt 2 out of 3 questions

1a.

“One definition that has been proposed for e-strategy is that it is an iterative and incremental process to create or change an organization’s model for e-business and beyond.” Discuss this statement in the context of a local technologically intensive company wanting to expand and grow its business globally.

[Hint: in your answer discuss some possible business models]

[25 marks]

1b.

“E-strategy focusses on creating or adding long term value for the organization”. Discuss this statement in the context of transforming the business and adding value through an expanded virtual value chain. Give two examples of such possible transformations.

[15 marks for discussion and 5 marks for each example = 25 marks]
2.

The Johnson and Scholes model develops Information systems and e-strategy in the context of strategic analysis, strategic choice and strategic implementation.

(i) Discuss in the context of this model one methodology or technique for strategic analysis, one for strategic choice and one for strategic implementation.

[8 marks for each technique = 24 marks]

(ii) Write a short report based on the Johnson and Scholes model to the Board of Directors of a major local hotel industry group who intend to change their e-business and make it more on-line driven and innovative in the services it offers.

[8 marks - format and structure, 6 marks - local issues and 12 marks - content = 26 marks]

3a.

(i) Explain why the business paradigm for organizations is moving from e-business to a wider networked model of i-business. Give one example.

[7 marks for explanation, 3 marks for example = 10 marks]

(ii) Explain how web mediated Supply Chain Management is changing efficient replenishment strategies and creating internetworked markets of cooperation among organisations. Give one example.

[7 marks for explanation and 3 marks for example = 10 marks]

(iii) List ten (10) relevant questions which one would ask in defining a strategy for i-business.

[1 mark per question = 10 marks]

3b.

Describe the importance of Information Economics in appraising the value of a web project. How does it differ from traditional Return on Investment (ROI) appraisal methods? Give an example of the use of this balanced scorecard approach to deciding among two alternative web investment projects being assessed by a bank.

[6 marks for importance, 6 marks for difference and 8 marks for example = 20 marks]