UNIVERSITY OF MALTA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
Department of Computer Information Systems

June 2019 Assessment Session

CIS1108 - Introduction to Software Engineering ***20th June 2019***

08:30 – 11:35 **Calculators are Allowed**

Very important instructions and information to candidates

(Please read and heed – ignore at your own risk)

Point 1 (structure)

You are allocated a **total of two 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 the allocated study-unit written examination percentage weighting of the final obtainable mark for this study-unit. Your study-unit course-work carries the remaining percentage.

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.

Point 5 (issues)

Any issue and/or incorrectness one might feel exists in any question or part of, should be flagged to the respective invigilator for onward transmission to the study-unit co-ordinator.

All your reasoning should be based on concepts, issues, and situations brought up and discussed during class. To be accepted for assessment, all decisions and statements must be reached, made or expounded in a logical and sequential manner and must be justified in relation to class discussion. This is an objectively assessable exercise and therefore cannot be a showcase of personal opinion.

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

Obtainable total: 100 marks *(i.e. A=25+25; B=25+25)*

The use of calculators is allowed.

Section A – Two compulsory questions (various topics).

Question 1 [Generic] *(a compulsory question for 25 marks)*

(a) In your organisation the notion of trying to qualify a software product in terms of concretely defined quality attributes is something that many do not believe is worth pursuing. This, they say is, because of the fact that software is basically human thought and one can never objectively qualify human thought as this is subjective by nature. What would you say to this? Your reasoning must also include a concrete example in support of your arguments.

Suggestion: Please note the relatively higher mark associated with this question. You are expected to provide a well-structured, well-reasoned and justified treatment based on quality-related issues as explained and discussed during class and from your personal reading.

[14 marks (4-stance; 6-reasoning; 4-example)]

(b) After taking on a project for a new client with stringent quality expectations, a developer comes up to you and tells you not to worry, because they will build "business as usual" and then beef-up the quality of the product once it takes shape. Is this cause for alarm? Explain and state you own point of view regarding this matter.

[8 marks (4-explain; 4-own PoV)]

(c) What is quality from the stand point of a software production process manager?

[3 marks]

Question 2 [Generic] *(a compulsory question for 25 marks)*

(a) Now that your organisation has decided to undertake a project that, due to necessary security and reliability requirements, necessitates a distributed solution, you are wary that many developers tend to neglect the additional development considerations that distributed solutions bring with them. You decide to explain the situation, specifics, risks and the way ahead to them. How would you do that? Explain your strategy and also provide one concrete and practical example in support of your planned actions.

Suggestion: Please note the relatively higher mark associated with this question. You are expected to provide a well-structured, well-reasoned and justified treatment based on distributed system considerations issues as explained and discussed during class and from your personal reading.

[16 marks (4-situation; 5-specifics; 3-risks; 4-example)]

(b) Within your organisation, you find that the benefits of prototyping are not being fully exploited due to the unclear understanding and usage of evolutionary and throwaway prototyping techniques. How would you go about explaining to developers the best way to use and the best way to combine these two techniques to gain their maximum benefit in development? Prototyping techniques suffer from one specific drawback. What would this be? Explain why this is a drawback in the context of the whole software development process.

[9 marks (6-techniques & interaction; 3-drawback)]

End of Section A (Section B on next page)

Section B – Four selectable scenario-based questions from which to select any two.

Question 3 [Formal reasoning] *(a selectable question for 25 marks)*

Consider a wine cellar. Say, **you need to formally prove the following three cases** for the software solution for which you are responsible and that will be managing the contents of this cellar. Use formal algebraic specification equivalence descriptions to achieve this.

CASE 1: Trying to search the cellar for a wine that is not in it will yield the value "false";
CASE 2: If 3 bottles of wine are placed into an empty cellar, account of the number of wine bottles in the cellar will yield a value of "3";
CASE 3: Removing 1 bottle from a cellar containing 1 bottle will result in an empty cellar.

[25 marks (5-signatures; 8-axioms; 12-proofs)]

Question 4 [Agile development] *(a selectable question for 25 marks)*

(a) The Agile Philosophy is governed by nine principles. Choose *three* of these nine principles and in your own words describe the benefits in terms of development and product quality for each of the principles you select.

[9 marks (3 each)]

(b) When considering the Agile Process (Life-cycle), in your own words explain the difference between Vertical Prototyping and Horizontal Prototyping? Provide one concrete and practical example of each case.

[8 marks (3-difference; 5-examples)]

(c) In an Agile Team, there are several roles. For example, the role of "Facilitator". Select *two* Agile Team roles and for each of the selected roles, *list and explain three* responsibilities associated with that role.

[8 marks (5-roles; 3-responsibilities]

Question 5 [Big Data] *(a selectable question for 25 marks)*

A local bank needs a way to monitor transaction logs in real-time to detect fraud and take the appropriate action as soon as possible. The logs contain details about the parties involved in the transaction, the countries of origin and destination, the currency involved as well as other relevant information, such as the account numbers involved and the transaction amount.

(a) Describe what is meant by streaming data and identify which "V" of Big Data it refers to. Give two examples to demonstrate your understanding.

[6 marks (2-definition & Big Data aspect; 2-for each example]

(b) In the context of the given example, describe *two requirements* that a stream processing system should support.

[6 marks (3-for each requirement)]

(c) Describe two aspects where a Database Management System (DBMS) differs from a Data Stream Management System (DSMS).

[8 marks (4-for each aspect)]

(d) Why are non-blocking operators essential for Data Stream Processing Systems?

[5 marks]

Question 6 [Testing] *(a selectable question for 25 marks)*

(a) Describe and distinguish between the following types of testing?

i) "Blackbox" testing, and "Whitebox" testing

ii) Experience-based testing, and Specification-based testing

[10 marks (5 marks each {3-description; 2-examples})]

(b) You have been hired by a bank to test its new Internet Banking system. In one module, the system accepts information about a customer and determines whether or not she is eligible for a loan. The decision is made on the basis of two parameters: *age* and *annual income*. Only a person who is aged between 18 and 45 (inclusive) who earns at least €23,000 a year can take out a loan.

Provide a set of test cases in the form {(age,annual income)} (e.g. {(23,€15,000), (23,€50,000),…)}) to adequately test this part of the system. Name and explain the test case design strategy you used to specify these test cases.

[9 marks (4-test cases; 5-test design strategy)]

(c) The following code snippet places students in a category according to their age:

```
public String categoriseStudent(int age) {

  String result = "Unknown";

  if (age >= 13 && age <= 19) {
    result = "Teenager";
  } else if (age > 19) {
    result = "Mature";
  }

  return result;
}
```

Provide a set of test cases in the form of values of the parameter *age* that you would input into the system (e.g. {52,5,25}) that would provide the following:

i) 100% statement coverage but not 100% branch coverage;

[3 marks]

ii) 100% statement coverage and 100% branch coverage.

[3 marks]

No more questions