

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

May/June 2018 Examination/Assessment Session

CIS1108 - Introduction to Software Engineering

4th June 2018

14:30-16:35

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) Your organisation has generally been involved in the production of software solutions for environment control in large closed arenas. Due to local market realities, arena management is increasingly requiring integrated solutions which bring together arena environment control, access management and ticketing systems. Your organisation therefore needs to understand what impact expanding their activity into these additional types of software solutions would entail in terms of 1) development life cycle(s); and 2) quality considerations. You are asked to provide a report on this.

*Suggestion: Please note the relatively high mark associated with this question. You are expected to provide a well-structured, well-reasoned and justified treatment based on several issues explained and discussed during class.*

*[20 marks (6-SDLCs; 5-quality; 9-reasoning)]*

(b) Explain how regression testing impacts solution maintainability in terms of Lehmann's 1<sup>st</sup> and 2<sup>nd</sup> laws.

*[5 marks]*

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

(a) Many people tend to conflate (i.e. confuse and interchange the meaning of) "On-Line", "Real-Time" and "Embedded" systems. Can you help clearly differentiate between these three types of system by giving separate explanations for each type of system making sure to highlight any differences that may exist? Furthermore, there seems to be a prevailing feeling amongst developers that formal specification would benefit types of system differently. Do you agree with this? Explain your reply and also provide one concrete and practical example in support of your explanation.

*[14 marks (6-explain types; 3-differences; 2-applicability of formalism; 3-example)]*

(b) Within your organisation, you find that the benefits of prototyping are not being fully evidenced due to the unclear usage and interaction 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? One of the most important features of the Spiral SDLC is that it addresses a gap that is found in Rapid Prototype development. What would this gap be? Explain how the Spiral SDLC addresses this issue.

*[11 marks (6-prototyping techniques; 2-gap; 3-addressed)]*

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—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 Specification]** *(a selectable question for 25 marks)*

Consider a bank account. Say, **you need to formally prove the following two cases** for the software solution for which you are responsible and that will be managing access to this bank account. Use formal algebraic specification equivalence descriptions to achieve this.

CASE 1: Trying to withdraw funds from an empty account will yield an error.

CASE 2: If €100 are payed in to an empty account and then €50 are withdrawn, the resulting account will contain €50.

*[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 (4-roles; 4-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]*

(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-distinguish})]*

- (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 —————

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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