THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF TECHNOLOGY – LEVEL 04
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECX 4237 – SOFTWARE ENGINEERING I

Final Examination – 2015 / 2016 *(Closed Book Test)*

Date: 17th December 2016	**Time: 9.30 – 12.30 hrs**

<INSTRUCTIONS>

1. Answer **Question 1** in **Part A**, which is compulsory.
2. Answer **3 questions out of 4** given in **Part B.**
3. This is a closed book exam and no reference books and materials are allowed.

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*You must answer **question 1** from **Part A** and **any 3 questions** from **Part B**.*

Part A (Compulsory question 40 marks)

Answer all parts of question 1 considering the scenario given below.

Softwave travels is a large ferry service provider established in Asia Pacific region. They operate in several countries within the region. Currently they are planning to replace their legacy system with a new enhanced web portal. Following are the key business processes they expect to be in the new system.

- *The portal should be accessible from anywhere in the world*
- *Softwave Travels have two (2) types of customers: tourist and non-tourist*
- *Customers should be able to get registered through the web portal.*
- *Once successfully registered with the system, customer is provided a one-time password which is sent to the provided email address.*
- *Customer should be able to login to the portal with the passport number as the user name, and is asked to change the password at first login.*
- *Softwave Travels offers discounts to customers who have travelled more than once. To claim the discount customers have to navigate to 'Discounts' page and enter required information.*
- *Discount given is added to the bill payable by the customer*
- *Customers have to pay on-line by credit card.*
- *A helpdesk is maintained at the main office where customers can call to verify if an issue happen with the on-line system. So the helpdesk staff can view the progress of the registration process of a customer.*
- *Network manager is responsible for generating data analytic reports based on customer details.*

Question 1

a) Draw a complete use case diagram to illustrate the given requirements. (20 marks)

b) Draw a class diagram with attributes, relationships and operations to support the business processes in the use case diagram. (20 marks)

(State your assumptions clearly)

Part B Answer only three (3) Questions (20 marks each)

Question 2

a) What are the types of costs that must be taken into account when estimating the cost of a software project? (3 marks)

b) Compare and contrast the two (2) methods: Function Points (FP) and Line of Code (LOC), which are used to measure the software effort of a program. (4 marks)

c) 'Software maintenance' of many current systems is believed to be diverging an excessive amounts of human and other resources away from development of new projects. Briefly explain three reasons why software maintenance is needed? (6 marks)

d) As a project manager, what steps can you take to ensure preventive maintenance? (4 marks)

e) What is the importance of configuration management? (3 marks)

Question 3

a) You have been appointed as the first reliability engineer in a product company which use large amount of software to control them. How would you respond to a query given below from one of your colleagues?

"It is obvious why you need to describe the hardware failure process. There is an inherent randomness about when a particular component will change. However, it is not true for software" (3 marks)

b) What is the use of reliability models? (2 marks)

c) Using an example, briefly explain three (3) fault tolerance techniques that you can use in the design stage to guard against hardware failure, software failure and other possible causes of system malfunction. (9 marks)

d) If you are to decide that a particular safety critical software system is sufficiently safe to use, briefly describe three measures that you may use. (6 marks)

Question 4

a) Compare and contrast static testing and dynamic testing. (6 marks)

b) Cyclomatic Complexity is a software testing metric. What does it indicate? (2 marks)

c) Draw a flow graph for the procedure given below (figure 1) (5 marks)

d) Determine Cyclomatic Complexity of the resultant flow graph in c) (3 marks)

e) What are the test cases that can be used to validate the inputs for CA_mark and Final_exam_mark? (4 marks)

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Procedure CALC_FINAL_MARK ()

CONSTANT minimum = 0, maximum = 100;
Int total_input = 0, total_valid =0;
int CA_mark, int Final_exam_mark, No_of_students;

student_no = 1
Input No_of_students
DO WHILE  student_no  =< No_of_students
        Input CA_mark
        Input Final_exam_mark
        Increase student_no  by 1
        IF CA_mark  >=  40
                THEN increment total_pass by 1;
                Final_mark = average (CA_mark and final_exam_mark)
        ENDIF
        Else Final_mark = final_exam_mark
END DO
IF total_pass  > 0
        THEN print "Total Pass students", total_pass
ELSE print 'No pass students'
ENDIF
END procedure CALC_FINAL_MARK
```

Figure 1: Procedure (CALC_FINAL_MARK)

Please turn over to Question 5.

Question 5

Consider following scenario given regarding a computer manufacturing company.

A computer manufacturer buys components of computers from different suppliers and assembles different models of computers. These machines are then sold to island wide distributors. The manufacturer records the supplier number, name, and address as well as details of the distributors. Computers are identified by model numbers.

In order to be precautious, the manufacturer always make sure that at any given component type is supplied by at least 2 different suppliers. A component type is identified by item code. Any component can be used in several different models of computers.

One distributor can receive and resell many different models of computers. For each model of computer the selling price must be recorded.

State your assumptions clearly.

a) Explain why Normalization is important in database design. (3 marks)

b) Draw an E-R diagram illustrate the given scenario. (9 marks)

c) Convert the E-R diagram to a set of Normalised tables indicating primary and foreign keys. (showing details of three (3) tables is sufficient) (8 marks)