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The Open University of Sri Lanka
Department of Electrical and Computer Engineering

ECX4237 – Software Engineering I
Final Examination – 2013/2014 *(Closed Book Test)*

Date: 16th August 2014	**Time: 9.30 – 12.30 hrs**

*You must answer **question 1** from **Part A** and **any 3 questions** from **Part B**. This paper contains **6 questions**.*

Part A

Question 1

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

The Open University wishes to increase security in its main car park. It has been decided to issue an identity card to all employees. The card records the employee's name, department and identity number.

A barrier, a card reader and a sensor are placed at the entrance of the car park. The driver inserts the numbered card into the card reader. The card reader checks the card number. If the number is valid, the reader sends a signal to raise the barrier and the vehicle can enter the car park. The sensor sends a signal to the barrier to lower when the vehicle has entered. There is an identical system at the exit.

When there are no spaces in the car park a sign at the entrances displays "Full" and is only switched off when a vehicle leaves.

Special visitor's cards, when record a number and the current date also permit access to the car park. Visitor's card may be sent out in advance or collected from reception. All visitors' cards must be returned to the reception when the visitor leaves the site so that they can be deleted from the list of valid cards.

Payments will not be handled in this module.

Please state your assumptions clearly when answering the questions.

(a) Draw a complete use case diagram to illustrate the given requirements. (10 marks)

(b) Draw a class diagram with attributes, relationships and operations to support the business processes in the use case diagram. (21 marks)

(c) Which features of the user interface will be important to make the system easy for use? (6 marks)

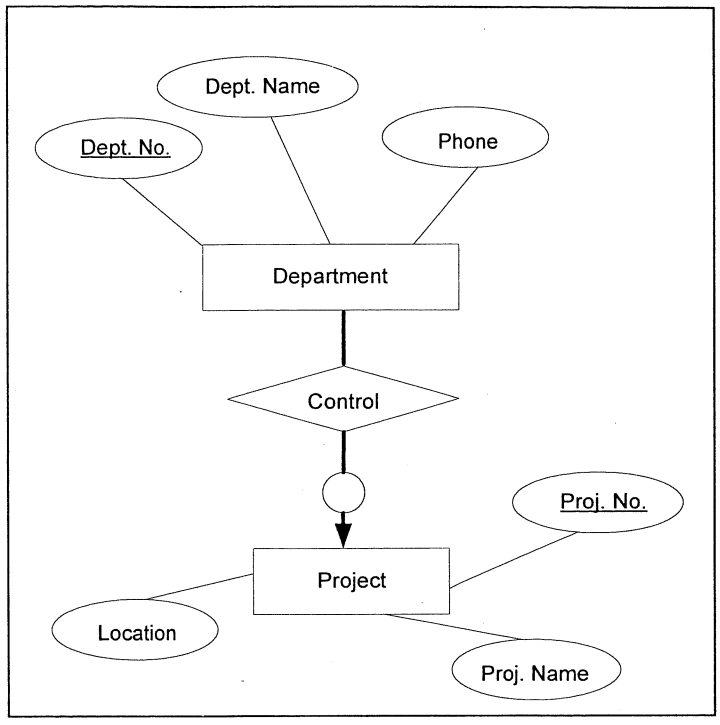
(d) If this software has successfully passed all 3 tests of Unit testing, integration testing and system testing, can you claim that the software is defect free? (3 marks)

52

Part B Answer only three (3) Questions

Question 2

Consider the E-R diagram given below to answer the questions. Here consider as ***one*** *department* controls ***many*** *projects*.



(a) Normalize the data into **Third Normal form** to be included in a set of tables of a relational database. Clearly show the primary keys and foreign keys. (8 marks)

(b) Consider a new entity added named 'employee' with following attributes {employee_no, employee_name, job_class, hourly_rate}. Following additional information on functional dependencies are given.

{Proj._no, employeeno, Dept._no} -> {Proj. _Name, employee_name, job_class, hourly_rate, Dept._name}

{employee_no} -> {employee_name, job_class, hourly_rate}

What additional tables should be there to make a set of relations in **Third Normal form**? Clearly show the primary keys and foreign keys. (12 marks)

Question 3

(a) Briefly explain three examples of software process models which use Incremental Software Development methods. (9 marks)

(b) Explain why the Waterfall Model of the software process is not an accurate reflection of software development activities. (3 marks)

(c) Explain why the process of project planning is an interactive one and why a plan must be continually reviewed during a software project. (4 marks)

(d) Briefly explain the purpose of having measurements in a software project plan. (4 marks)

Question 4

(a) Explain why a software system, which is used in a real-world environment, must change or become progressively less useful. (3 marks)

(b) Name and explain the three main types of maintenance which will need to be addressed after a software product is developed at a customer site. (9 marks)

(c) List technical and non-technical factors, which affect system maintenance costs. As a software manager how you would attempt to minimize maintenance costs in projects, which you are managing? (6 marks)

(d) Briefly describe what configuration management is. (2 marks)

Question 5

```
Procedure NumGame(x,y,z:integer)
variable  i:integer;
Begin
        i :=0;
        while x < y do
        begin
                if x<5 then
                        x =x+1;
                i  := i +1;
        end
        if (z >3) and (y >3) then
                print ('i  =', i, 'x=', x)
        else
                print ('i = ', i, 'y=', y)
end
```

(a) Draw the flow graph for the given procedure in pseudo code. (6 marks)

(b) Briefly explain what is meant by following 3 types of test coverage of a software system with examples taken from the flow graph drawn for (a) (6 marks)

i. statement coverage
ii. simple path coverage
iii. decision/condition coverage

(c) Write the minimum number of test cases required to achieve decision/condition coverage. (8 marks)

Question 6

(a) Function Points (FP) and Lines Of Code (LOC) are used as two measurements to measure the size of a software project. Briefly explain why FPs are better than LOC for this purpose.

(5 marks)

(b) You are part of the team that builds a 'Patient Observation and Control System' for an Intensive Care Unit (ICU) of a hospital. To decide whether it is sufficiently safe to use you are to write a report regarding how you incorporate the reliability features to the software system. Given that following 3 options are available for you, briefly describe the strengths and weaknesses of each:

(9 marks)

i. Failure data from debugging in 'operational testing'
ii. Design diversity
iii. Formal verification

(c) Non-functional requirements must be quantifiable or measurable. Identify three non-functional requirements for the above system. (6 marks)