

University of Swaziland
Department of Computer Science
Supplementary Examination
July 2012

Title of paper : Software Engineering II

Course number : CS452

Time Allowed : Three(3) hours

Instructions :

- *Each question is worth 25 marks.*
- *Answer question 1.*
- *Answer any three (3) questions from questions 2 to 6*

This paper may not be opened until permission has been granted by the invigilator

Questions 1, 2 and 3 are based on the following textual description

Matsapha Community Libray System (MCLS)

Matsapha community library has books, videos, and CDs that it loans to its users. All library material has an identity number and a title. In addition, books have one or more authors, videos have one producer and one or more actors, while CDs have one or more entertainers. The library maintains one or more copies of each library item (book, video or CD).

Copies of all library items can be loaned to users. Reference-only material is loaned for 2 hours and cannot be removed from the library. Other material can be loaned for 2 weeks. For every loan, the library records the user, the loan date and time, and the return date and time. For users, the library maintains their name, address and phone number.

Users may make many inquiries of the librarian. Typical questions include: Is the book entitled "*The richest man in Babylon*" available? Which videos did actor Tom Cruise appear in? Do we have any CDs on the subject of Human rights in Africa?

The community library employs a librarian who is able to help users when the takeout (borrow) or return items. Each loan transaction is recorded and the appropriate indexes are updated to indicate the status of the item. The librarian is also able to answer these queries by inspecting the loans file, the actor index, the title index and subject index. In addition to the above duties, the librarian also receives new items and adds them to the library collection. On receipt of a new item, the librarian makes out a label and attaches it to the item's cover or video/CD sleeve. The relevant entries into the indexes should also be updated. Similarly, older items are destroyed and relevant entries in the index are updated. The librarians are also responsible for house-keeping, like amending the list of users like adding/deleting user or updating user details.

Question 1 – 25 marks

(Compulsory)

- (a) Using UML notation, draw a USE CASE diagram for the MCLS system explained above. 10 marks
- (b) Using UML notation, draw a class diagram for the MCLS system as described above. Show suitable classes, structures, attributes, services, instance and message connections. 15 marks

Question 2 – 25 marks

- (a) Draw a clearly labeled rough-sketch of a possible windows based user interface for a program that could be used by the MCLS librarian in executing his/her duties. 6 marks
- (b) Draw a general human interaction component (HIC) model based on the rough sketch in (a) above. 12 marks
- (c) Using the principle of rapid application development, add clearly labeled (*with a brief explanation of each*) Delphi/Java specific components to your HIC model in (b) to illustrate how the interface may be implemented using the Delphi/Java's IDE. 7 marks

Question 3 – 25 marks

- (a) Briefly describe role of the following UML diagram structures
- (i) Component diagram 3 marks
 - (ii) Deployment diagram 3 marks
 - (iii) Activity diagram 3 marks
 - (iv) State diagram 3 marks
 - (v) Sequence diagram 3 marks
- (b) Based on the description of MCLS, draw a sample sequence diagram showing the sequence of events when a user returns an items. 10 marks

Question 4 - 25 Marks

- (a) What are the three categories of software quality factors distinguished by McCall? 4 marks
- (b) Briefly describe the following quality factors in McCall's taxonomy of attributes
- (i) Correctness 2 marks
 - (ii) Reliability 2 marks
 - (iii) Flexibility 2 marks
- (c) Briefly describe the following quality criterion in McCall's taxonomy of attributes
- (i) Access control 2 marks
 - (ii) Completeness 2 marks
 - (iii) Traceability 2 marks
- (d) What are some of the criticisms of McCall Taxonomy? 4 marks
- (e) Describe the maturity levels of the Capacity Maturity Model. 5 marks

Question 5 - 25 Marks

With the aid of examples, discuss the following fundamental principles of user-interface design

- (a) state visualization *5 marks*
- (b) short cuts *5 marks*
- (c) focus *5 marks*
- (d) grammar *5 marks*
- (e) safely *5 marks*

Question 6 – 25 Marks

- (a) Describe the following categories of software testing
 - (i) Correctness testing *3 Marks*
 - (ii) Performance testing *3 Marks*
 - (iii) Reliability testing. *3 Marks*
 - (iv) Security testing *3 Marks*
- (b) Consider the following routine

```
Procedure Shiftdown (var A:Array of integer; k,n:integer);
Var parent, child, insert, Ak : integer;
begin
  Parent := k; child := k+k;
  Ak := A[k]; insert := Ak;
loop
  if child > n then exit end;
  if child < n then
    If A[child] > A[child+1] then child := child + 1 end
  end;
  if Insert <= A[child]
    then exit
    else A[parent] := A[child];
        Parent := child; child := child+child
  end
end;
A[parent] := Ak
end;
```

Assume the routine is tested using the following input:

N=5, k=2

A[1] = 80, A[2] = 60, A[3] =90, A[4] = 70, A[5] =10

Determine if the above test will yield a 100% statement coverage. If not, provide one or more additional test cases that a 100% coverage is obtained from. *13 Marks*