

University of Swaziland
Department of Computer Science
Final Examination 2007

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

Question 1 is based on the following case study.

Hospital Database Management System

A Hospital maintains a database for assisting with administration of its wards and operating theatres, and for maintaining information relating to its patients, surgeons and nurses. The following is a description of the information in the database:

Most patients are assigned to a ward on admittance and each ward may contain many patients. However, consultants (senior surgeons) at the hospital may treat private patients who are also assigned to wards. The information to be recorded about a patient includes a unique medical number, name address, sex and age. A list of all admitted patients is kept and patients are added to this list on admittance and removed upon discharge.

Each ward has a unique ward number and name. A list of all the wards is kept. A nurse may or may not be assigned to a ward and he/she cannot be assigned to more than one ward. A ward may have many nurses assigned to it. Nurses are identified by staff number. The name and telephone number of the nurse is also recorded. A list of all nurses is kept and nurses are added to this list on employment and removed on termination of employment.

For each patient the medical history is recorded which include information such as the date of admission, a description of the treatment received and its cost, the medication given to the patient and the cost to the client., and the discharge date.

Question 1 – 25 marks

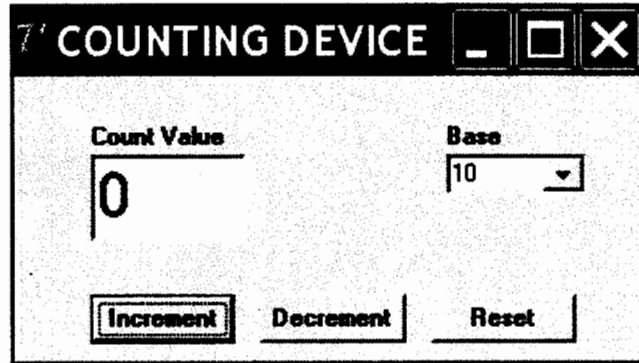
(Compulsory)

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

Question 2 – 25 Marks

INTEGER COUNTING DEVICE

Consider a small integer counting device with the following features: A count value is displayed on a small display unit on the surface of the device as shown in sample figure below.



The Increment and Decrement buttons are used to increment and decrement the count value, respectively. The Reset button is used to reset the count to zero. The device can be used to count in different integer modes like base 2, 4, 8 etc. The desired mode or base is chosen using the base selector spin button.

- (a) Using Delphi notation (components) design a suitable problem domain component (PDC) class diagram for the counting device described above. 10 marks.
- (b) Using Delphi notation (components) design a suitable human interaction component (HIC) class diagram for the integer counting device described above. Show the inter-relationship between the HIC and PDC. 15 marks.

Question 3 - 25 Marks

- (a) "Software Design is a wicked problem". Briefly discuss the general characteristics of wicked problems and clearly how they are manifested in software design process. Explain a general approach to solving wicked problems.

15 marks

- (b) Consider the following insert sort routine.

```
procedure insert (a, b, n, x)
begin
bool found := true;
  for I := 1 to n do
    if a[i] = x
      then found := true; goto leave endif;
  Enddo;
leave:
  if found
    then b[i] := b[i]+ 1
    else n := n + 1; a[n] := x; b[n] := 1; endif;
end insert;
```

- (i) Draw a control graph of the sort routine as described above. 5 marks
- (ii) Compute the cyclomatic number for the graph obtained above. 2 marks
- (iii) Compute the cyclomatic complexity for the graph obtained above. 1 marks
- (iv) Write a possible set of linearly independent paths for this graph. 2 marks

Question 4 – 25 Marks

- a) Discuss the main advantages of Object-Oriented software development methods versus traditional structured methods *5 marks*
- b) Explain/describe how the following design principles are enforced in object-oriented modeling
- (i) Information Hiding *2 marks*
 - (ii) Loose Coupling *3 marks*
- c) Discuss the contribution of Object-Oriented software development in the following aspects of software development.
- (i) Implementing Rapid Application Development strategies. *5 marks*
 - (ii) Incremental development. *5 marks*
 - (iii) Improving the quality of the final software system. *5 marks*

Question 5 – 25 Marks

- (a) Describe the following categories of test techniques
- (i) Coverage-based testing *3 Marks*
 - (ii) Fault-based testing *3 Marks*
 - (iii) Error-based testing. *3 Marks*
- (b) What is the difference between black box testing and white box testing? *2 Mark*
- (c) What is a test adequacy criterion? *2 Marks*
- (d) What is a test objective? Briefly explain the three categories of test objectives. *3 marks*
- (e) Briefly explain each of the following test techniques and state the test objective that it satisfies.
- (i) Mutation Testing *3 marks*
 - (ii) Fault Seeding *3 marks*
 - (iii) Stepwise abstraction *3 marks*

Question 6 – 25 Marks

- (a) Explain the importance of having a well-designed user interface. *5 marks*
- (b) Discuss the role of the following techniques in the design of a user interface
- (i) User profiling. *4 marks*
 - (ii) Task profiling. *3 marks*
 - (iii) Prototyping. *4 marks*
- (c) Give some advantages and disadvantages of the following interaction styles.
- (i) Menu based interface *3 marks*
 - (ii) Form Fill-in. *3 marks*
 - (iii) Natural Language *3 marks*