UNIVERSITY OF LONDON

B.Sc. Examination 2005
FOR EXTERNAL STUDENTS

COMPUTING AND INFORMATION SYSTEMS

CIS210 Software Engineering and Development

[Western]

Duration: 3 hours

Date and time: Thursday, 12 May 2005 : 10.00am – 1.00pm

- *Full marks will be awarded for complete answers to FOUR questions. Do not attempt more than FOUR questions on this paper.*

- *Electronic calculators may not be used.*

THIS EXAMINATION PAPER MUST NOT BE REMOVED

FROM THE EXAMINATION ROOM

TURN OVER

Question 1.

a) Contrast the reliability characteristics of software systems and hardware systems. Your answer should include graphs of reliability for hardware and for both well designed and poorly designed software. **[7]**

b) What is meant by internal and external qualities of software products? Describe three of the principal external qualities of software. **[7]**

c) Distinguish between direct and indirect metrics used for measuring software complexity. Name two of each. **[6]**

d) Explain each of the following phases of the planning process: Bounding, Decomposition, Planning. **[5]**

Question 2.

a) Explain each of the following concepts:

      i)   architectural design
      ii)   procedural design
      iii)   data design
      iv)   user-interface design   **[8]**

b) Design a flowchart for software design of a Point-of-Sale Terminal (POST) system.

The POST system serves for recording sales and handle payments in a retail store. This system should be designed to exhibit the following behaviour:

> when a *customer comes* he presents his basket of items to the store officer who *initialises the system* by pressing the start button;

> the store officer processes the sale items, and more precisely the system *reads the code* of each sale item one-by-one until he examines all items in the customer basket;

> after the basket is emptied, the officer asks the client for his credit card, and *inserts his card into the system*;

> POST system checks whether the *card is valid*, if not a *request for another card* is made;

> if the response is positive the system checks whether the *user has money* in his account;

> if the user has no money POST asks him whether does he want a balance statement and prints it if so, otherwise it *terminates the transaction*;

> if the user has money the system, the POST system *calculates the total cost*, withdraws it from the customer account, and *dispenses cash*;

> finally the POST system *prints a receipt*.

Your answer should include the following structured programming constructs: sequence, if-then-else, selection, repetition.

                                                            [17]

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Question 3.

a) What information can be gleaned from a critical path analysis of a software design process? **[8]**

b) Consider the task of developing a software library information system. The scheduling of this system must account for the following requirements:

The following tasks are necessary
- (T1) make a control terminal class, maximum time 3 days
- (T2) design student user, maximum time 3 days
- (T3) design faculty user, maximum time 4 days
- (T4) design protocol, maximum time 4 days
- (T5) design of network management routines, maximum time 5 days
- (T6) make a database called library directory, maximum time 3 days
- (T7) design overall control, maximum time 7 days
- (T8) definition of university users, maximum time 5 days
- (T9) definition of university staff, maximum time 5 days
- (T10) testing, 7 days

The time dependencies are given by

> T2 cannot start until T1 is finished; T3 cannot start until T1 is finished; T4 cannot start until T2 is finished; T5 cannot start until T4 is finished; T6 cannot start until T2 is finished; T7 cannot start until both T5 and T6 are finished; both of T8 and T9 need T7 to finish before they begin and T10 needs T8 and T9 to finish before it starts.

Develop a Task Network for scheduling the development of this task where each subtask is associated with its starting time, assuming the start time for the whole system is 7/9/2005.

[10]

(c) What is the earliest time you can schedule T7 to begin? Explain your answer. **[7]**

Question 4.

a) What are the main components of a State Transition Diagram (STD)? **[5]**

b) Draw an STD for a coffee and tea dispensing machine. The machine can dispense tea or coffee. The machine takes in coins valued at 10p and 20p. Coffee costs 40p and tea costs 30p. The machine will give change if you put in too much money. **[20]**

Question 5.

a) Differentiate between white-box and black-box testing. What is each used for?   **[6]**

b) Consider a program that is meant to take in two strings (of length less than or equal to 32 characters) and decide if they are identical. That is, the programme will return true if and only if the two input strings have the same number of characters, the number of characters is less than or equal to 32 and the strings have the same characters in each place.

   Discuss how you would arrive at a test set for a black box test of the program.   **[7]**

c) Consider the following program fragment:

```
int test( double ask, int b[] )
{
  int i, y;

  x = 0;
  for (i=0; i<5; ++i)
  {
    if (ask == b[ i ] )
      y = y + 1;
        printf( "cycling" );
  }
        if ( y == 0 )
          printf( "unsuccess" );
        else
          printf( "success" );
  return y;
}
```

i) Make the McCabe control flow-graph of this program fragment.   **[8]**

ii) Determine the cyclomatic number of this fragment using the number of regions in the flow graph.   **[4]**

Question 6.

(a) Briefly describe the main features of a Booch Class Diagram. **[10]**

(b) Draw a Booch class diagram that describes *Books4U Bookshop sales system*:

The book hierarchy in the sales system the abstract class `Book` has two subclasses: `FictionalBook` and `NonFictionalBook`; the class `ScienceBook` inherits from `NonFictionalBook`.

A private attribute of the `Book` class is `stock`; a public method is `ReturnPrice`. The `Book` class serves to keep track of the basic public information about the `ISBN number, title, and author, and price`, which next may be provided for storing into the database.

The available books are maintained in a public class variable `listofbooks` in a `BookDatabase`. The particular `Bookitems` could be loaded with information about their author, title, ISBN number, and price.

The `InventoryController` has the responsibility of tracking sales of each book and maintaining an appropriate supply. Aggregated within `InventoryController` is one supporting class `MarketAnalysis`. The `MarketAnalysis` has private functions for `CalculateDailySales` and `CalculateMonthlySales`, as well as a public function `ReturnSalesInfo`.

[15]

END OF EXAMINATION

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