



**OXFORD BROOKES UNIVERSITY**  
**BACHELOR OF SCIENCE (HONOURS)**

**AUGUST 2009 EXAMINATION**

**14<sup>th</sup> AUGUST 2009**

**U08182: INFORMATION SYSTEMS DESIGN**

**TIME : 2 Hours + 10 Minutes Reading**

**NUMBER OF PAGES : 1 Cover Sheet and 6 Pages of Questions**



**INSTRUCTIONS:**

- ☐ **Question 1 in Part A is COMPULSORY.**
- ☐ Answer any **TWO** questions from **Part B**.
- ☐ Please start every question on a new page.
- ☐ Answers will not be marked if they are illegible.
- ☐ Enter the question numbers (in the order you have attempted) in the boxes provided in the answer script.
- ☐ Write your **INDEX NUMBER** and **MODULE NUMBER** on the cover page of the answer script.

## PART A

(Compulsory Question)

### QUESTION 1

- (a) Compare the advantages and disadvantages of black-box testing and white-box testing. Discuss situations in which black box testing would be preferable to white box testing.

**[8 marks]**

- (b) A point can be represented by an x,y coordinate as A(x,y).

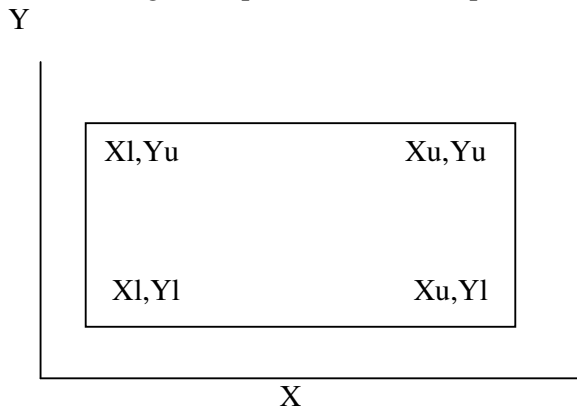
A rectangle can be represented by the coordinate of its bottom left corner (Xl , Yl) and top right corners (Xu, Yu), as shown below. Assume all coordinate values are integer.

Rectangle is a function required to determine whether a given point A(x, y) lies inside an area (Xl, Yl, Xu, Yu).

If the point lies within the rectangle then a true value is returned.

If the point lies outside the rectangle, or lies exactly on the rectangle edge then a false is returned.

Rectangle and point coordinate representation is as given below.



Rectangle has been specified in pseudo-code as

inside\_x = Xl < Ax AND Ax < Xu

inside\_y = Yl < Ay AND Ay < Yu

inside = inside\_x AND inside\_y

return inside

Devise a suitable set of tests for the black box dynamic testing of this function.

**[8 marks]**

- (c) For the given program code below, draw the flow graph and determine the McCabe Cyclomatic number.

**[8 marks]**

```
1  int a = X
2  int b = Y
3  If b < 0
4  while( !(a == b) )
5  {  if( a > b )
6      b = a*b
7  else
8      b = a/b
9  endif
10 }endwhile
11 endif
12 println(b);
```

- (d) The following is a description of a use- case for members of the library to reserve books in the Library from the Catalogue of Books shown by library web sites.

| Actor: Lecturer                                      | The system  |
|--|---|
| Member enters his/her member id and password.        | Library Management System (LMS) verifies the validity of the member id and password with the database of registered members. In case of validity, the system displays the catalogue and prompts the member click on the Book catalogue. Other wise instruct to re-login |
| The Member views the catalogue and selects the book. |   |
|  | The system displays the date of availability of the book and request for confirmation.  |
| Member confirms the reservation.                     | The system indicates the reservation made.  |

- (i) Identify the input and output variables of the system, and the data to be stored in the system using a table of the following form:

| Test data for the select Module use case |  |           |
|--|--|-----------|
| Variables                                |  | Test data |
| Input                                    |  |           |
| Output                                   |  |           |
| Stored data                              |  |           |

[6 marks]

- (ii) Make a concrete scenario from the above use-case description, and then derive test data from the scenario and fill the second column of the table above.

[6 marks]

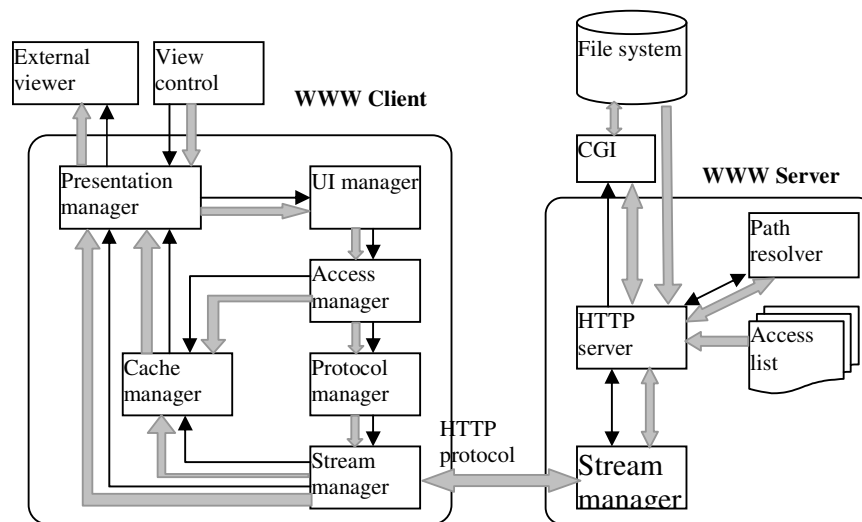
[TOTAL MARKS FOR QUESTION 1: 36 MARKS]

## PART B

(Answer Any TWO Questions)

### QUESTION 2

- (a) Why is Software Architecture important? [6 marks]
- (b) The following diagram depicts the software structure of a WWW client-server system. Represent the architecture using Software Architectural Visual Notation. [12 marks]



- (c) A Telephone company sent invoices monthly to customers. Payment made is checked periodically once in 10 days. For those invoices that have not been paid within the allowed payment time, a reminder is issued. The system will receive input from a file containing the invoices and from another file containing the payments made. It will produce an output file, containing the name of the customers who have not paid and send a reminder.

Design a Pipe and filter architecture for the billing system described above. You should identify the filters that are appropriate for the architecture.

[14 marks]

[TOTAL MARKS FOR QUESTION 2: 32 MARKS]

### QUESTION 3

A branch of a bank is located in a building. It operates with 5 teller counters in that branch and three automatic teller machines (ATM) outside. The branch works for 10 hours on business days (Monday to Friday) and six hours on a Saturday and Sunday is a holiday. The ATMs are available at all times.

The Branch provides the following services:

- Account opening and closing (only through a teller counters)
- Deposit (only through a teller counters)
- Withdrawals of any amount (only through teller counters)
- Withdrawals of a maximum of \$2000, from a single account on a single day through ATM
- Transfers between customer's account and checking through teller counters as well as ATM.

Your task is to design the software system for this bank. The system must disallow illegal transactions. The system cannot allow the customers to draw money more than the amount currently available in an account.

- (a) Give two software architecture styles (Don't give pipe and filter) for the bank system described above. Software architecture styles must identify the components and connectors that are appropriate for the architecture.

**[20 marks]**

- (b) Compare the proposed architecture styles with respect to the following factors and, based on the comparison, choose the better architecture.

- (i) changes in the processing algorithm,
- (ii) changes in data representation
- (iii) enhancement to system function
- (iv) reusability and
- (v) performance

**[12 marks]**

**[TOTAL MARKS FOR QUESTION 3: 32 MARKS]**

## QUESTION 4

- (a) A text file consists of several lines and each line consists of a sequence of words.  
It is required to develop a software system to list all words in the given text file and to determine the frequency of appearance of each word. There is no need to list the word like “a”, “the”, “is”, “are”, “has”, have and “it”.
- (i) Propose a Hierarchical heterogeneous architecture style (diagram) mixing Pipe-and-filter and any one of the data - centered architecture styles.  
**[16 marks]**
- (ii) Explain the components and connectors used in the above architecture style and the constraints on the connection between components and connectors.  
**[8 marks]**
- (b) Compare the layered architecture styles and virtual architecture styles in terms of the two factors: ‘nature of computation’ and ‘quality concern’.  
**[8 marks]**

**[TOTAL MARKS FOR QUESTION 4: 32 MARKS]**

**- END OF PAPER -**