



OXFORD BROOKES UNIVERSITY
BACHELOR OF SCIENCE (HONOURS)

AUGUST-2009 EXAMINATION

MARKING SCHEME

U08182: INFORMATION SYSTEMS DESIGN

TIME : 2 Hours + 10 Minutes Reading

NUMBER OF PAGES : 1 Cover Sheet and 10 Pages of Answers



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]

Answer:

Black-box

Advantages:

- i) tests against the functional specification and hence discovers errors in requirements analysis, design and implementation,
- ii) easy and less costly to perform since it tests only specification.
- iii) It avoids complexity in analysis of the internal structure and implementation details.

Disadvantages:

- i) does not explore internal structure of the program
- ii) incapable of detecting faults in the implementation..

Any two advantages and one disadvantage -[2+1 marks]

White-box testing:

Advantages:

- (1) considers program internal structure and code details into consideration
- (2) detects faults in the implementation

Disadvantages:

- (1) complex and labor intensive;
- (2) limited capability to detect faults due to errors made during requirements analysis and design stage.

Any two advantages and one disadvantage -[2+1 marks]

Which black box testing would be preferable to white box testing

- i) Suitable when internal details of the software are not available.
- ii) If internal structure of the software is not highly complicated, testing against the specification can be quite adequate
- iii) Sufficiently achieve the required reliability.
- iv) When white-box testing is too expensive to be practically applicable

Any two reasons - 2 marks

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

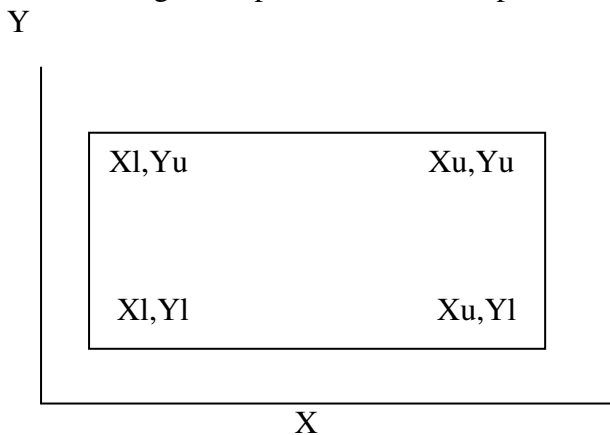
A rectangle can be represented by the coordinate of its bottom left corner (Xl , Yl) and top right corners (Xu, Yu), as shown below. Assume all coordinate values are integer.

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.

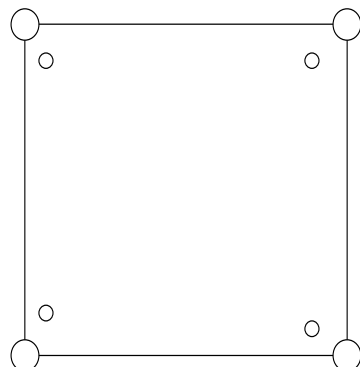
[8 marks]

Answer:

4 Inner points within rectangle that return True

4 Corner points on rectangle corners returns false

8 points -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);
    
```

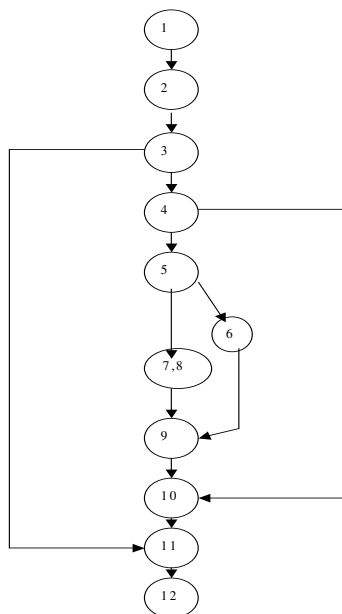
Answer:

$$\begin{aligned}
 C &= 13 - 12 + 1 \\
 &= 13 - 12 + 1 \\
 &= 2
 \end{aligned}$$

Flow graphs - 6 Marks

McCabe Cyclomatic number.- 2 Marks

Total – 8 Marks



- (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]

Answer:

Example : Test data for to reserve a book

Variables		Test data
Input	Member Id	M3455678-2005
	Password	*****
	Selection of book Conformation book	Title
Output	Validity of the Member yes/no	Yes Direct to re-login

	Catalogue of the Book Reservation Confirmed	Book –Catalogue Title of the Book and Date of reservation
Stored data	Database of Registered Member Database of Book catalogue	Database of registered member Database of Book catalogue
	Reservation Database	Member id , Title of the books and date of reservation

- (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]

Answer:

Example Concrete scenario:

Actor: Member	LMS
Member enters his/her member id s M3455678-2005 and password *****	LMS verifies whether the member id and password are correct If yes – prompt the member to click the book catalogue. If No- prompt to re-login
Member click the Book catalogue	LMS display the list of book And Prompt to select the title.
Member select the title as Database by Elmasari	The system notices member the availability of the , date Prompt to confirm reservation .
Member Confirms	System Reserves

Input, output and stored data – 6 marks

Concrete scenario - 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]

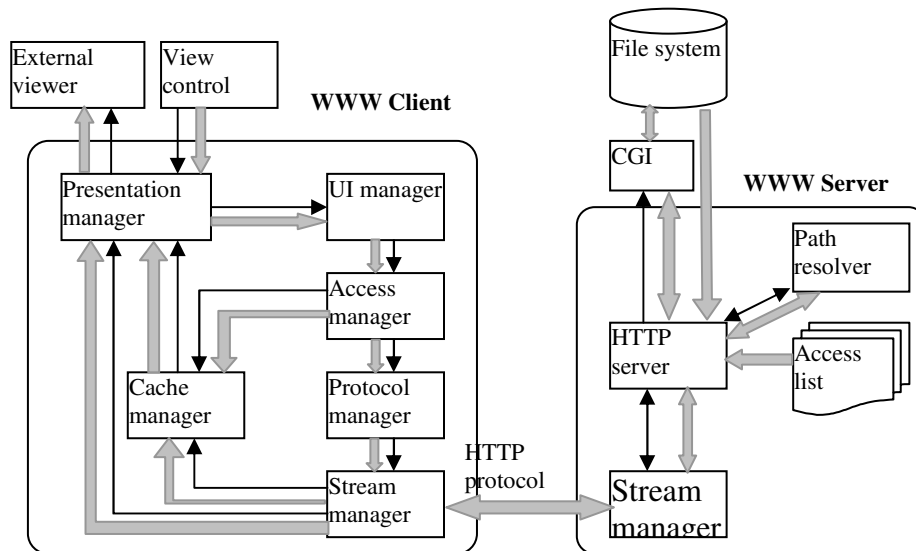
Answer:

- Communication among stakeholders:
 - Customers, managers, designers, programmers.
- Documentation of early design decisions:
 - Constraints on implementation
 - Organizational structure
 - Guides evolutionary prototyping
- Transferable abstraction of a system to similar systems (reuse):
 - Program families share a common architecture
 - Architecture can be the basis for training.

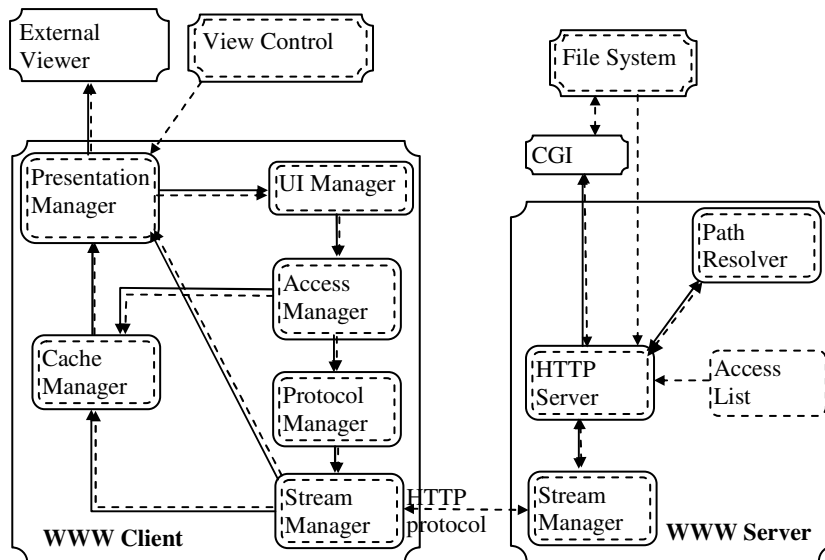
Three valid reasons [3 x 2 = 6 marks]

- (b) The following diagram depicts the software structure of a WWW client-server system. Represent the architecture using Software Architectural Visual Notation.

[12 marks]



Answer:



**Use of correct notations for processes – 6
and lines for connections- 6 marks**

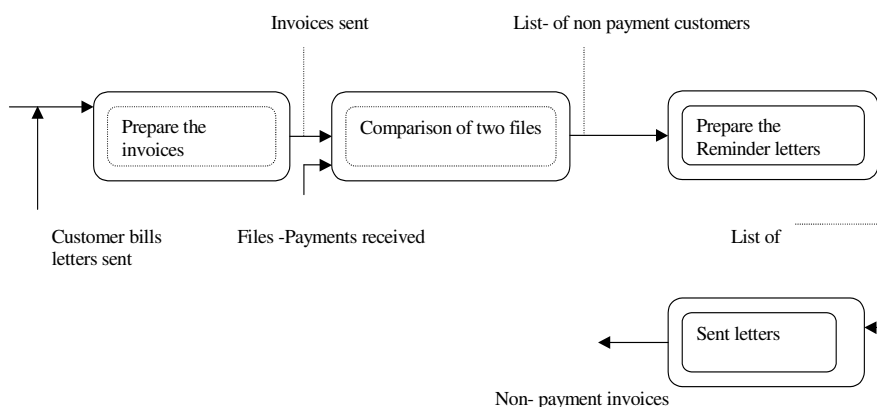
- (c) A Telephone company sent invoices monthly to customers. Payment made is checked periodically once in 10 days. For those invoices that have not been paid within the allowed payment time, a reminder is issued. The system will receive input from a file containing the invoices and from another file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

Answer:

Sample Diagram: Pipe and Filters



Components – 4 marks
 Connectors – 4 marks
 Outputs - 4 marks
 Input - 2 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]

Answer may give any two architecture styles from Data centered repository and Call and Return groups.

Two architecture styles:

Diagram - 2 x 10 = 20 marks

Any other styles from independent components may be given.

Attribute- Architecture	Data centered	Main program and subroutine
Changes in the transaction algorithm	Yes	--

Changes in data representation	Yes	Yes
Enhancement to system function	Yes	yes
Reusability	Yes	Yes
Performance	yes	---

Comparison with respect to the quality attributes - 10
Selection of a better style- 2marks.

[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]**

Answer:

Diagram 2 * 6 = 16 marks
Heterogeneous architecture style
– Repository + Pipe-and-filter
OR
-Black Board + Pipe-and-filter

Explanation on: [8 marks]
The types of components in the style
The types of connectors in the style;
The constraints on the connections between the components and the connectors

- (b) Compare the layered architecture styles and virtual architecture styles in terms of the two factors: ‘nature of computation’ and ‘quality concern’. **[8 marks]**

Answer:

Style	Nature of Computation	Quality Concerns
Layered systems	The computational tasks	Portability across

	can be divided between those specific to the application and those generic to many applications but specific to the underlying computing platform	computing platforms. Reuse of an already developed computing infrastructure layer, such as operating system, network packages, etc.
Virtual machine	Data consists of two parts; one is the information to be processed and the other controls how the first part is to be processed	Portability of the processing of the data in different hardware and software platforms.

Nature of Computation 2 x 2 = 4 marks

Quality Concerns 2 x 2 = 4 marks

[TOTAL MARKS FOR QUESTION 4: 32 MARKS]

- END OF MARKING SCHEME -