



OXFORD BROOKES UNIVERSITY
BACHELOR OF SCIENCE (HONOURS)

MAY 2011 EXAMINATION

11th MAY 2011

U08182: INFORMATION SYSTEMS DESIGN

TIME : 2 Hours + 10 Minutes Reading

NUMBER OF PAGES : 1 Cover Sheet and 7 Pages of Questions

☞ INSTRUCTIONS :

- ☐ Answer any **THREE** questions.
- ☐ **PART A QUESTION IS COMPULSORY.**
- ☐ Choose 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

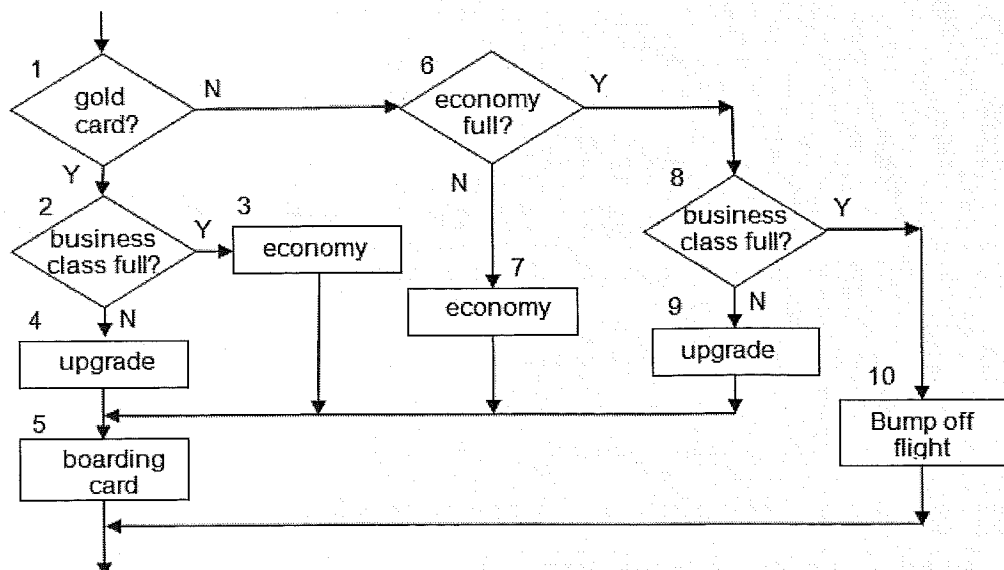
- (a) Consider the following section of code

```

10 Print "Hello"
20 If Condition C1 is true, then GOTO 30; Else GOTO 40
30 Accept Input; then GOTO 50
40 If Condition C2 is true, then GOTO 50; Else GOTO 60
50 While Condition C3 is true, GOTO 10; Else GOTO 70
60 Accept Input; then GOTO 70
70 Print "End of program"

```

- (i) Draw a labeled flow graph for the above source code. [6 marks]
- (ii) Based on the Basis Path Testing technique, calculate the value of cyclomatic complexity using all three methods of calculation. Ensure that all working is clearly shown for the three methods (e.g. predicate nodes and regions clearly highlighted). [6 marks]
- (iii) Based on the value of cyclomatic complexity calculated, derive the set of basis test paths. [4 marks]
- (b) The below diagram gives the control flow diagram for a flight check-in system. If passengers are flying with economy tickets there is possibility to upgrade to business class, especially if they hold a gold card in the airline's frequent flyer program. If passengers are economy and don't hold a gold card then there is the possibility that they will be bumped off the flight if it is full and they check in late.



The following three tests have been run:

Test 1: Gold card holder who gets upgraded to business class

Test 2: Non Gold card holder who stays in economy

Test 3: A passenger who is bumped from the flight

By considering the control flow diagram and tests that have run, determine: the statement coverage, and the path coverage achieved by these three tests. Then specify the additional tests needed to achieve 100% coverage in each case.

[7 marks]

- (c) An ATM system has been developed and you are to devise a test plan based on use case testing for the card validation subsystem. The card validation process is as follows:

The customer inserts their card. If the card is invalid a message is displayed and the card is rejected and returned to the customer. If the card is valid the customer is prompted to enter a PIN code. If the PIN is not valid the system displays a message to re-enter the PIN. If a valid PIN code is entered access to the customers account is allowed. If an incorrect PIN code is entered a third time then the card is retained in the ATM.

- (i) Using the card validation description above specify a set of use cases for the main flow and the alternative flows for this system.

[9 marks]

- (ii) Explain how your list of use cases in part (i) can be used to test this system.

[4 marks]

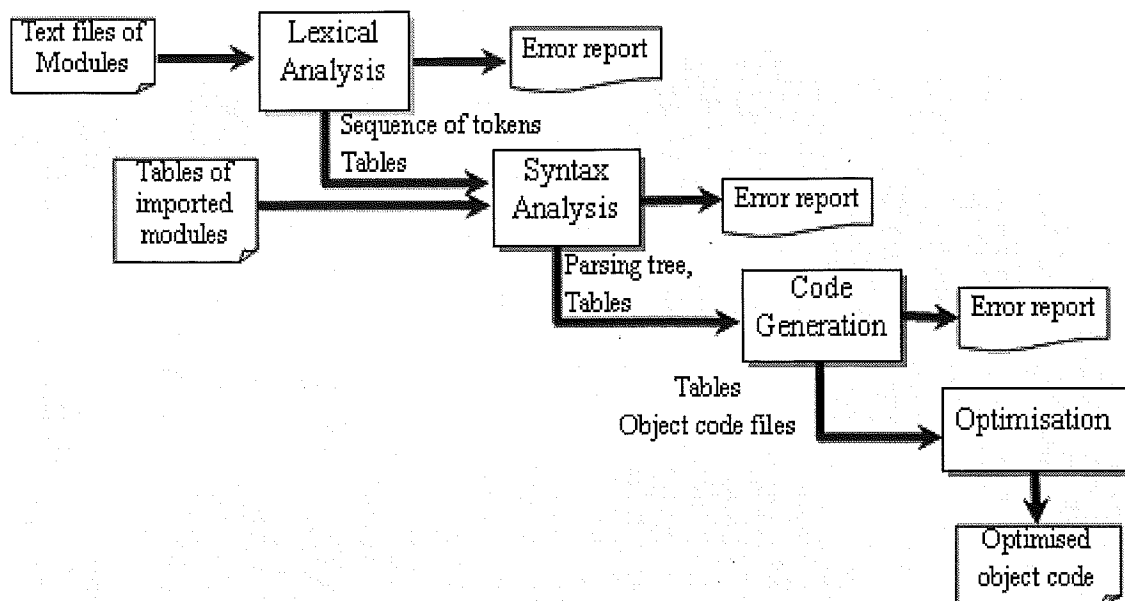
[TOTAL MARKS FOR QUESTION 1: 36 MARKS]

PART B

(ANSWER ANY TWO QUESTIONS)

QUESTION 2

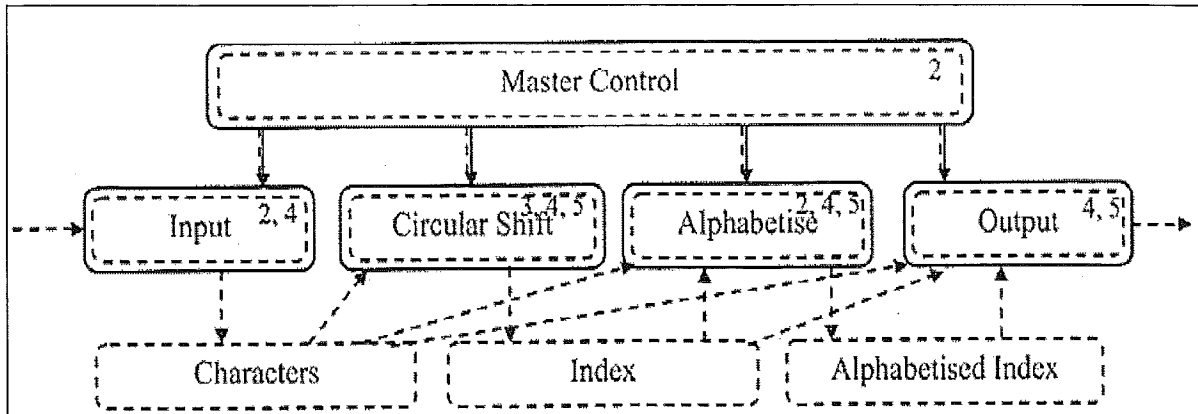
- (a) In a compiler, the lexical analysis phase reads in the source code of the modules to be compiled, which are in the form of a sequence of characters stored in a text file. It generates a table of identifiers and a sequence of tokens, where each token represents a lexical element in the source code. The outputs are stored in a number of files. These files together with files previously generated in the compilation of the imported modules are passed to the syntax analysis phase. The syntax analysis phase parses the sequence of tokens into a parsing tree and generates some more tables. For example, there could be a table to associate variables with their types. These outputs are also stored in files for consumption by the code generation phase. The code generation phase reads in these files and produces object code and more tables, such as tables providing information about the exported procedures, variables and types for the linker program. These outputs are also stored into files. The optimisation phase is optional, which improves the efficiency of the object code. Of course, in each phase, errors in the source code of the program may be discovered. In such cases, an error report may be generated and either displayed on the screen or written into an error report file. The compilation will terminate after an error is discovered.



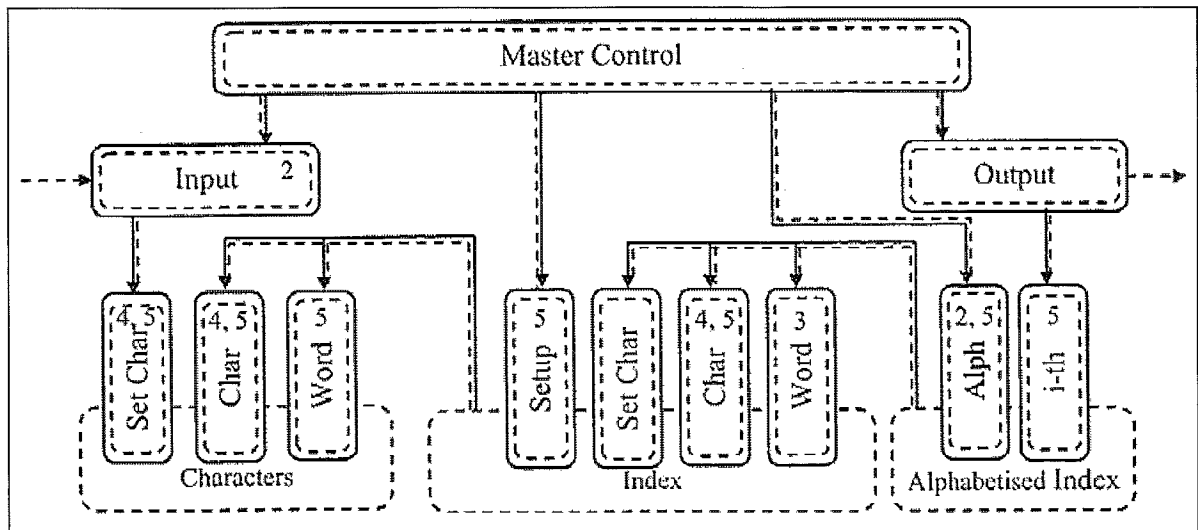
- (i) List and explain software architecture notation used in the architecture style. [8 marks]
- (ii) Use a suitable software architectural style to describe the compiler. [8 marks]

- (b) The Keyword in Context (KWIC) index system accepts an ordered sequence of lines of text. Each line is an ordered sequence of words, and each word is an ordered sequence of characters. A line might be circularly shifted by repeatedly removing the first word and appending it at the end of the line. The KWIC index system outputs a listing of all circular shifts of all lines in alphabetical order. Below is the revealing scenario interaction based on scenario evaluation.

Revealing Scenario Interaction for Design 1 based on quality requirement



Revealing Scenario Interaction for Design 2 based on quality requirement



- (i) By using the Software Architecture Analysis Method (SAAM), evaluate the both designs by fill up the following tables:

[10 marks]

Scenario			Modification Cost	
No.	Description	Weight	Design 1	Design 2
1	To operate in the batch fashion	10%		
2	To operate in an incremental fashion	20%		
3	To eliminate noise words in shifted lines	15%		
4	To change the internal representation of lines	25%		
5	To change the internal representation of intermediate data structures.	30%		
Overall				

- (ii) Compare two candidate designs to see which one satisfies its quality requirement on modification better.

[6 marks]

[TOTAL MARKS FOR QUESTION 2: 32 MARKS]

QUESTION 3

- (a) 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.

[12 marks]

- (b) By using the Layered Style, design the architecture for the following basic function of a Bank. The bank prints the monthly statement for all customers. Then bank makes use of its letterhead to print the account statements in addition to the bank logo, disclaimer and regulations. The printing makes use of the customer particulars and the account.

[10 marks]

- (c) A text consists of a sequence of paragraphs separated by the 'new line' symbol; each paragraph consists of a sequence of words that are separated by spaces and punctuation symbols such as ',' and '.'. Each word is a sequence of letters. A paragraph can contain an arbitrary number of characters and letters. To display the text on screen or to print the text on pages, the text must be wrapped. That is, the paragraphs must be decomposed into a number of lines to fit into the width of the screen or page. Such decompositions should not break in the middle of a word. It should also let each line contain as many words as possible. Assume that all letters and characters take the same size of space when displayed or printed; design the architecture of a program that performs the text wrapping.

- (i) Present your design with a suitable architecture style using appropriate visual notation.

[6 marks]

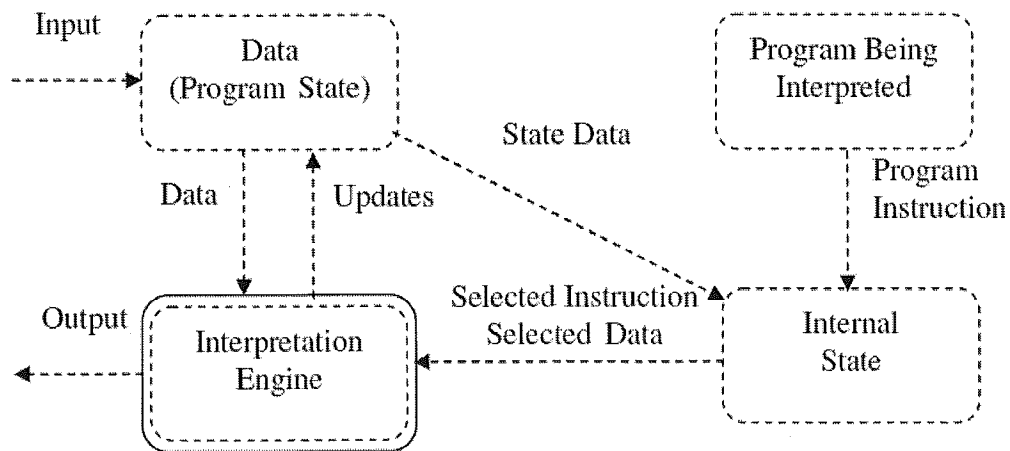
- (ii) Give the reasons why the architectural style that you selected is appropriate.

[4 marks]

[TOTAL MARKS FOR QUESTION 3: 32 MARKS]

QUESTION 4

- (a) Discuss how software architecture affects software performance. [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]
- (c) Propose a Hierarchical heterogeneous architecture style (diagram) mixing with main program and subroutine architecture styles for one of the components of the Virtual machine architecture styles given in below figure. [16 marks]



[TOTAL MARKS FOR QUESTION 4: 32 MARKS]

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