



**SERANGOON JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION 2008**

COMPUTING

9754/01

Higher 2

Paper 1

**Friday
22 August 2008**

3 hours

Additional materials : Answer paper

INSTRUCTIONS TO CANDIDATES:

Write your name and CT group in the spaces provided on this cover sheet.

Answer **all** questions.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

INFORMATION FOR CANDIDATES:

The number of marks is given in brackets [] at the end of each question or part question. You are reminded of the need for good English and clear presentation in your answers.

Name: _____

CT_Group: _____

This question paper consists of 5 printed pages (including this page).

1 The Central Processing Unit (CPU) consist of the Control Unit (CU), the Arithmetic Unit (ALU) and some registers such as :

- Memory Data Register (MDR)
- Memory Address Register (MAR)
- Instruction Register (IR)
- Program Counter (PC)
- Accumulator (ACC)

a) What is meant by fetch-execute-cycle? [2]

b) Describe the purpose of the above registers in relation to the fetch-execute-cycle. [5]

2 Hexadecimal is a numeral system that is commonly used in Computer Science. It consists of 16 unique symbols: the numbers 0 to 9 and the letters A to F.

For example, the decimal number 15 is represented as F in the hexadecimal numbering system.

a) Write a BNF grammar for a valid hexadecimal numerals of any length. [4]

b) Modify the above rule to disallow leading zeros but to allow trailing zeros.

E.g. 0A1C is invalid but F250 is fine. [2]

3 a) Why is packet switching the network of choice for data networks? [2]

b) Describe **two** disadvantages that are inherent in packet-switch networks. [2]

c) How can the above disadvantages be minimized? [2]

d) Describe the characteristics of the following devices:

- Bridge
- Switch
- Router

[6]

e) Why is a star topology a preferred choice of Local Area Networks (LAN) today? [3]

- 4 a) Discuss **three** advantages of using functions in your program. [6]
- b) Variables can be declared as global or local. Explain the underlined terms. [2]
- c) Why is the use of global variables discouraged? [2]
- d) How can the problems associated with global variables be overcome? [2]
- 5 For many computer applications the choice of a suitable file structure is an important consideration. Three ways of organizing a file are serial, sequential and random.
- a) Briefly describe each of these file structures, making clear the differences between them. [6]
- b) For each of these file structures, describe with reference to a specific application, a situation in which that file structure would be appropriate. [6]
- c) What factors affect the choice of file organization for a given application? [4]
- 6 Explain the difference between security and integrity of data. Give two different types of problem for security and two different reasons for a failure of integrity which the student might use to demonstrate the difference between the meaning of these two items. [4]
- 7 a) Why are there different types of Operating Systems (OS)? [2]
- b) Describe **three** types of OS and for each, give an example of an application that would use them. [6]
- c) Give **two** main reasons why we need an OS? [2]
- 8 a) Draw a diagram of a linked list to show the codes for the following examination papers when they are stored in numerical order.
- 9754.01 9740.02 9746.03 9745.04
- [2]
- b) i) Explain what is meant by LIFO and FIFO data structures. [2]
- ii) Give one advantage and one disadvantage of using a linked list structure to store a queue rather than using an array structure. [2]
- iii) Explain why a linked list is a more sensible structure than an array for storing a stack. [3]

- 9 A list of words is held in a sorted binary tree structure. The words are represented in a computer system by 3 one-dimensional arrays.

Associated with each word is a left-link and a right-link pointing to other elements on the tree. When a new word is added, it is placed in a free location and links are changed, as necessary, to maintain the alphabetical sequence.

The corresponding arrays are shown below for a list of eight words. The system keeps a record of the subscript of the root of the tree, in this case 2, and the head of the list of free spaces, in this case 7.

		word	left	right
	1	EMU	3	5
Root →	2	COW	4	1
	3	DOG	0	0
	4	ANT	0	6
	5	GNU	9	8
	6	BEE	0	0
Free →	7		10	
	8	MAN	0	0
	9	FLY	0	0
	10		11	
	11		12	

- Draw the binary tree for the above definition. [2]
- Show clearly
 - how the computer could search efficiently for the word FLY, comparing it with as few words as possible, and
 - how it would discover that the word BAT is not present in the list. [3]
- Describe in detail the algorithm illustrated by your answer to part (b), to search the tree for any given word or report its absence. [5]
- The words CAT and EEL are added to the list in that order. Draw the new tree and list the contents of the array after these changes have been made. [4]
- Describe an algorithm to convert the binary tree above from using a 3-dimensional array to a one-dimensional array. [6]

10 The following algorithm uses an array Values that contains the integers 4,7,9.

```
Last = 3
New = 6
Ptr = 1
WHILE(New > Values[Ptr])
    Ptr = Ptr + 1
ENDWHILE
WHILE (Last >= Ptr)
    Values[Last+1] = Values[Last]
    Last = Last - 1
ENDWHILE
Values[Ptr] = New
```

a) Draw a trace table for the above algorithm. [5]

b) What is the algorithm doing? [1]

11 a) The water level in a reservoir is controlled by a computer system. During normal operation the water level (**W**) is between the high water (**H**) and low water (**L**) marks. At these times the input value (**I**) and output valve (**O**) are both open.

If the level reaches **H** then the input value is shut off until the level falls below **H** again.

If the level falls below **L** then the output valve is shut off until the level rises above **L** again.

If the level falls below **L** for more than 1 hour, the system sends an alarm signal to the operator.

Using the variables **W,H,L,I,O** produce an algorithm to control the water level in the reservoir. [8]

b) Describe how the controller program can determine the water levels at any point of time. [2]

c) The alarm signal, together with all the other values from the system, is sent to a central control room. All the water supplies in the city are controlled from this central room by a single operator.

Explain the importance to the operator of good interface design, stating any features which should be considered. [5]

----- END OF PAPER -----