SERANGOON JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION 2009

COMPUTING   **9754/01**

Higher 2

Paper 1

Thursday
20 August 2009

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 6 printed pages (including this page).

1   A bank uses computers to store financial details of its customers.

a) State **four** measures contained in data protection legislation that protect personal customer data.   [4]

b) The administration staff at the bank are concerned about data privacy. Describe methods that can be used to reduce these concerns.   [4]

c) The management of the bank are concerned about the accuracy of data contained on the computer system. Explain how verification can be used to reduce errors.   [4]

2   An automatic teller machine (ATM) deals with customer requests by using both batch and real-time modes of computer system use.

a) Describe what is meant by a batch mode of use and give an example of its use with an ATM.   [3]

b) Describe what is meant by a real-time mode of use and give an example of its use with an ATM.   [3]

3   a) Describe how the memory address register (MAR) and the memory data register (MDR) are used when an instruction is processed.   [4]

b) Describe **two** more registers that are used when an instruction is processed.
                                                                          [4]

c) Describe the meaning of **pipelining**.   [3]

4   A restaurant offers a large selection of food for each course (Starters, Main Course, and Desserts) and a selection of drinks, both alcoholic and non-alcoholic. You have been asked to help in the design of the user interface on this PDA to enable the waiters and waitresses to identify a table and take orders. One requirement is the facility to select the table number on the first screen.

a) Give **three** more requirements.   [3]

b) How should the details of the order be transmitted from the PDA to the computer in the kitchen so that the staff know what dishes to prepare?   [1]

5   In a high-level programming language, a variable of type integer is defined
    as :

    intVariable ::= <intLetter> <%> | <intLetter> <string> <%>

    intLetter ::= I | J | K | L | M |N

    string ::= <letter> | <string><letter>

    letter ::= A | B | C | D |…| Z

    a) State whether or not the following are valid integer variables. In each case
        give a reason for your answer.

        i)   %IN

        ii) I2N%

        iii) in%

        iv) INTO   [8]

    b) A real variable consists of an uppercase letter other than I to N followed by
        any number of uppercase letters A to Z and digits 0 to 9, including none.

        For example, B, WEIGHT and VELY42C are valid real variables but MASS is
        not.

        Define a real variable. You may use any of the definitions in a) without re-
        writing them.   [5]

6   a) Explain how local variables differ from global variables and state the reasons
        why local variables are used. Use examples to illustrate your answer.   [4]

    b) Use examples to explain what is meant by a parameter to a subprogram. Your
        examples should illustrate the use of parameters passed
        i)   by value,

        ii) by reference   [5]

    c) Outline how the mechanism of parameter passing can be implemented.   [3]

7 Table 1 shows an array of integers with some initial values.

1	2	3	4	5	6	7	8
0	13	-33	4	17	17	14	17

Table 1

Study the following algorithm and trace its execution by completing the trace Table 2. ASCII code for a <space> (' ') is 32 and the ASCII code for 'A' is 65, 'B' is 66 and so on. **Chr( )** takes a single integer value as its parameter. The function returns the ASCII character represented by the parameter. Example: **Chr(65)** will return value 'A'. [6]

```
Start
        Final String = ' '
        For Position 1 To 8 Do
                NextNumber = 65 + Index[Position]
                NextChar = Chr(NextNumber)
                FinalString = ConCat(FinalString, NextChar)
        End For
        Print FinalString
End
```

Position	NextNumber	NextChar	FinalString
			' '
1	65	'A'	'A'
2			

Table 2

8 A snack dispensing machine is being designed which will give change when a customer inserts more money than the cost of the snack chosen.

The machine only accepts $2, $1, 50 cents, 20 cents, 10 cents and 5 cents coins. All snacks cost a multiple of 5 cents. The machine should give the change in as few coins as possible.

A programmer is asked to write a routine **CalculateCoinage (Change)**. The routine will take, as a parameter, the amount of change to be returned. The routine will then calculate how many of each coin are required.

Choose **three** suitable sets of test data for the parameter **Change**, which adequately test the functionality of this routine. Justify your choice in each case. [6]

9   Give an example of each of the following data structures and state a feature of
    each.   [4]

    a) LIFO

    b) FIFO

10 Two sequential files A and B contain records of a fixed length with key field
    values in ascending order. The two files are to be merged to form a single
    sequential file C containing the same records with the key field values in
    ascending order. Each of the files A and B is terminated by a dummy record with
    a huge key field value, represented by *hugekey*. File C is to be terminated
    similarly. Apart from the dummy records, all the key field values are supposed to
    be different from each other; it is therefore an error if any record in file A has the
    same key field value as any record in file B. Describe in detail an algorithm for a
    program to carry out the merge.   [8]

11 In this part you are required to draw some binary search trees that hold the data
    {2, 3, 6, 9, 12, 14, 15, 16, 20}, ordered numerically. Each of these trees must be
    balanced and have no single-child nodes.

    a) Draw a binary search tree for the data.   [2]

    b) Draw a binary search tree with preorder traversal
            14, 9, 3, 2, 6, 12, 16, 15, 20.   [2]

    c) Draw a binary search tree with postorder traversal
            2, 6, 3, 12, 15, 20, 16, 14, 9.   [2]

    d) Write a recursive method to preorder traverse a binary search tree and print
       each node.   [3]

    e) Describe the algorithm used to delete a node from a binary search tree.   [9]

12 A school of 600 pupils keeps details about its students in a file of records stored on magnetic disc. Each student is allocated an arbitrary unique number in the range 1000-9999 which acts as the key field of the file. Each record occupies one disc block. The file is to be created as a random file.

   a) It has been suggested that a suitable way of organizing the file is to subtract 999 from the key field and to store the record in the block with that number.

      i) Explain why this may not be a good way of organizing the file.

      ii) Suggest a more suitable hashing function which could be used, and explain why it has been chosen.   [5]

   b) During a creation of a random file, a record may hash to a block which already contains a record. Suggest how this record may be added to the file.   [3]

13 A simulation of the design of a lift is modelled on a computer.

   a) State an input, the processing and an output that should be used in the simulation.   [3]

   b) Explain how inputs and outputs can be simulated on a computer.   [3]

   c) Explain why simulation would be appropriate in this case.   [2]

   d) State **two** difficulties of simulating a lift for a 40 storey office block. [2]

   e) Explain why the programmers would use a dynamic data structure for the simulation.   [2]

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