

ST ANDREW'S JUNIOR COLLEGE

Preliminary Examination

H2 COMPUTING

9754/01

PAPER 1

16 SEP 2011

TIME: 1430 – 1730 hrs

3 hours

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.

Write your class and name on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a soft pencil for any diagrams, graphs, music or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

Total marks for this paper is **120** marks.

This question paper consists of 5 printed pages.



Answer **all** questions.

- 1
 - (a) What is the “fetch and execute” cycle in a processor? Describe the sequence of a fetch and execute cycle. [7]
 - (b) Describe the registers that are used in this cycle. [4]
 - (c) The most common mechanism for spreading a virus is through networks.
 - (i) What is a virus? [1]
 - (ii) What kind of damage can virus cause? [2]
 - (iii) Identify **TWO** precautions which can be taken to discourage them. [4]

- 2

An airport often needs to update flight codes on the arrival and departure screens. The flight codes are such that the first two characters is the code for a particular airline. The first two characters are either a digit followed by a letter of the alphabet or a letter followed by a digit or two letters. The letters can only be in upper-case. The airline code is then followed by a string of digits (at least a single digit) to form the flight code. Given the following BNF statement,

`<DIGIT> ::= 0|1|2|3|4|5|6|7|8|9`

 - (a) Write the additional BNF statements to specify the flight code described above. [4]
 - (b) If the string of digits following the two-character airline code cannot have preceding zeroes, e.g. BA01, SQ001 are not accepted, write the necessary BNF statements and/or modify the existing BNF statements to meet this new requirement. [2]

- 3
 - (a) In the context of object-oriented programming explain what is meant by:
 - (i) encapsulation;
 - (ii) object;
 - (iii) inheritance;
 - (iv) polymorphism. [8]
 - (b) Describe, with an example, a diagrammatic method of specifying a class. [4]
 - (c) Give two advantages of object-oriented programming. [2]

- 4 (a) Describe two differences between a binary search and a sequential search. [2]
- (b) Using pseudo code, write a recursive routine to implement a binary search. [4]
- (c) Explain how a quicksort and a bubble sort work in sorting the below list of numbers into ascending order.
- 6112 3218 2685 9164 7413 [8]
- (d) State two factors that can be used to decide whether the use of a bubble sort or a quick sort algorithm is more suitable. [2]
- 5 A large department store consists of a number of departments, for example food, clothes, furniture and many others. Each department has developed its own computer system. A system analyst is appointed to develop a new centralized computer system for the company. He refers to a typical model of a system development life cycle frequently.
- (a) Briefly describe, in logical order, the various stage of a typical system life cycle. [8]
- (b) A requirement specification is produced after the system analysis for the new system. Briefly describe its contents and explain the purposes of its use. [8]
- 6 (a) State **three** advantages of using a database management system over flat files. [3]
- (b) A Database Management System (DBMS) provides the following facilities for data access and data manipulation.
- (i) query language
 - (ii) report generator
 - (iii) generator for input and output screens
 - (iv) macros
- Describe each of these facilities. [8]
- (c) A DBMS links the application data model and the physical organization of the data. Explain the difference between the
- (i) application data model
 - (ii) physical organisation [4]

- 7 Given an Abstract Data Type (ADT) **OrderedList** which maintains a list of elements and has the following operations:

Init(): Creates an empty Ordered List
 Destroy(): Erases the whole list
 Insert(X): inserts element X into list in ascending order of X
 Delete(X): deletes element X from the list
 Size(): returns the total number of elements in the list
 Search(X): returns the position of element X in the list, returns zero if not found

- (a) Assuming an ADT **OrderedList**, **myList**, called the following operations in the sequence given,

```
myList.Insert("Tan")
myList.Insert("Lim")
myList.Insert("Ong")
```

draw appropriate diagrams to illustrate the status of **myList** after these operations have been called. Assume that a linked list data structure was used to store the elements and a free list is also maintained.

[3]

- (b) Write the algorithm that will implement the operation **Insert** specified for the ADT **OrderedList**.

[6]

- (c) Using existing operation(s), suggest how you would modify the algorithm in part (b) to ensure that no duplicate elements will be allowed in the **OrderedList**.

[1]

- (d) If the following operation was called following those in part (a),

```
myList.Delete("Lim")
```

and assuming that the ADT **OrderedList** was implemented using **arrays**, draw appropriate diagrams to illustrate the status of the **OrderedList myList** in the array after the additional operation has been executed. You should include the existence of a free list and other necessary information in the illustration.

[5]

- (e) If the upper-case letter of every letter of the alphabet is inserted into the **OrderedList**, **myList**, e.g.

```
myList.Insert("A")
myList.Insert("B")
...
myList.Insert("Y")
myList.Insert("Z")
```

Explain how you may use existing operations of the **OrderedList** to return the total number of entries in the list that begin with a particular letter of the alphabet (not including the single upper-case letters that were inserted).

[2]

- 8 A binary search tree (BST) is used to store words found within a given text file. Repeated words are not stored, i.e. only one copy of each unique word that occurs in the text file is stored.
- (a) Write the algorithm that will insert a given word string into this particular BST (assuming that the BST is implemented using pointers). [6]
 - (b) It was found that it was necessary to track the number of times each unique word occurs in the text file for statistic study. Using appropriate illustrations of the BST, explain how you would modify the node structure and the algorithm to accommodate this specification. [4]
 - (c) Some of the statistics required include the total number of words found in the text file and the top three words with the highest number of occurrences. Outline the algorithm to extract the statistics required from the BST. [4]
 - (d) Another requirement was to create an appendix of unique words that occur in the text file in alphabetically order. Write the algorithm that will generate this appendix. [4]

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