NANYANG JUNIOR COLLEGE
General Certificate of Education Advanced Level
Higher 2
JC2 Preliminary Examination

COMPUTING

9754/01

Paper 1

Sep 2009

3 hours

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number 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, tables 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.

Answer **all** questions.

1 **(a)** Database management systems are aimed at solving a number of problems associated with traditional file-based systems. Describe three such problems and explain how they are solved by database management systems. [6]

(b) A national car hire company uses a relational database. Cars are available for hire from a large number of depots around the country. Two entities (or records) are cars-for-hire & depots.

(i) Suggest four attributes (or fields) associated with the entity cars-for-hire. [4]

(ii) Draw a diagram showing the relationship between the entities cars-for-hire and depots. [1]

(iii) State one other entity which is related to either or both of the original entities. Describe the relationship(s). Suggest an attribute for this entity. [3]

2 A stack is to be implemented using an array of 20 elements.

(a) Describe an algorithm to remove an item from a stack and place it in the variable x. [4]

(b) With the aid of examples, explain what are nested functions or nested subroutines. [3]

(c) Explain with the aid of diagrams or otherwise, how a stack can be used by the operating system to process “nested functions” or “nested subroutines”. [6]

(d) Outline the data attributes and member functions for a class stack abstract data type. You need not go into details as to how they will be implemented. [6]

(e) What is the difference between a linear queue and a circular queue? [4]

(f) Using the circular queue Queue[1..max], write the procedure to

(i) AddQueue(x) to add a person x to the queue.

(ii) LeaveQueue(x) for a person x to leave the queue [6]

3 A software development team has been asked to develop a suite of technical programs for use by scientists in a laboratory. It is intended that the package will control scientific equipment and will record results directly. The package is required to have an interface which uses a mixture of GUI and text-based elements.

(a) Describe the benefits which a GUI would offer in this case and also the possible benefits of being able to change from a GUI to a text-based interface on occasions. [4]

(b) One method of input which was considered in this case but then rejected was a voice input system involving word recognition. Discuss the difficulties faced by those developing voice input systems. [7]

4 A team of programmers is writing a suite of real-time programs for a safety-critical air traffic control system.

(a) Explain why the speed of the programs is very important in this case. [1]

(b) The suite of programs could contain various types of error, including syntax errors and logical errors. Explain each of the following terms, giving an example in each case:

(i) Syntax error; [2]

(ii) Logical error; [2]

(iii) Run time error. [2]

(c) Explain why careful version control is important when developing computer programs. [1]

(d) The programming team is aiming to produce a very high quality suite of programs. One approach they adopt is to make extensive use of standard modules. They also take a number of other measures to try to achieve high quality. Describe how using standard modules will help to achieve their aim and describe other measures they can take. [9]

5 Below is a quotation from a computer sales person who is talking to a systems administrator.

"A modern computer system is nothing without its Operating System and you will love this new OS because of its improved Graphics User Interface."

(a) Give TWO reasons why the sales person believes that the improved graphics user interface will be attractive to the systems administrator. [2]

(b) Explain why the phrase: *"is nothing without its Operating System"* is not true. [2]

The sales person continues:

"Another great feature of this operating system is that it will automatically make all the adjustments if you insert an additional internal board."

(c) **(i)** Describe TWO circumstances when a systems administrator might want to add an internal board to a system. [4]

(ii) Describe what the systems administrator would have to do if the operating system did not support this automatic feature. [2]

(iii) Describe how ONE aspect of the systems administrator's responsibilities would be made easier due to this automatic feature. [2]

Annabel uses her computer system to store and retrieve many documents. Annabel is very disciplined about deleting unwanted files from the hard disk. Annabel is unhappy to find that file access has become slower.

(d) **(i)** Explain why Annabel's system has become slower. [2]

(ii) Describe what Annabel should do to improve the speed of file access. [2]

(iii) Explain how the Operating System would carry out the process that you have suggested in your answer to (d)(ii). [3]

[Turn over

6 **(a)** The following are examples of acceptable signed real numbers.

53.33, -23.66E17, 23E-7, 88.66E+5, +100.0

Provide the BNF grammar rules for signed real number. [7]

(b) In a certain language, an identifier may consist of any number of letters and digits, the first of which is a letter. A print statement can consist of the word PRINT alone, or PRINT followed by any number of identifiers, separated from each other by commas.

Draw the syntax diagram for

(i) the syntax of an identifier,

(ii) the syntax of a print statement. [6]

(c) Consider the following production rules for a sentence <S> in BNF.

<S> ::= <A>a<B>b
<A> ::= <A> b | b
<B> ::= a<B> | a

For each of the following, indicate whether or not it is a valid sentence. For those which are not valid, explain why.

(i) baab

(ii) bbbab

(iii) bbaaaaa

(iv) bbaab [4]

(d) Write the BNF grammar for an object which is a symmetric sequence of binary digits and with odd number of digits, e.g 00100, 1, 101, etc. [3]

7 The following are the inorder and postorder traversal of a single binary tree whose nodes are labeled 0, 1, 2 … 9.

inorder: 4 1 5 6 2 0 8 3 9 7

postorder: 4 6 5 2 1 8 9 7 3 0

(a) Draw the corresponding tree T with the nodes labelled. [5]

(b) Write pseudocode for printing out the postorder traversal of a binary tree T. [5]

~ End of Paper 1 ~