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

COMPUTING

9754/01

Paper 1

Sep 2008

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)** Three types of system which are commonly used in many organisations are batch-processing systems, single-user on-line systems and multi-user on-line systems. For each type of system, give an example, with reasons, of situations in which its use is most appropriate. [6]

(b) A teacher of Advanced level Computing has the choice of using any one of these three types of system with classes of about twenty students. Discuss the arguments which would influence the teacher in making an appropriate choice. [4]

(c) The teacher would like to automate the task of taking class attendance. Suggest suitable hardware that will be needed in such a system. [4]

(d) Two teachers are developing their own versions of a software system for maintaining records of the grades of pupils in their classes. It is expected that, in subsequent years, these records will be passed to other teachers responsible for the pupils. One of the teachers writes a program from first principles. The other selects a package, based on a spreadsheet but including word processing and database features, and uses this to implement the system.

What points would you expect the second teacher to make when describing to the first the merits of the package-based approach to solving the problem? Are there any advantages in the first teacher's approach? [6]

2 Many business offices and educational institutions use networks of personal computers, while others use stand-alone systems.

(a) Discuss, using examples of activities from each type of environment, the relative benefits of networks and stand-alone systems. [5]

(b) Where a network is used, there is a need for central management of the system. Describe what is necessary and how it is typically done, making clear the role of a network operating system as well as the functions carried out by the person whose job it is to manage the network. [7]

(c) Data is transmitted on a network in blocks of 16 words, each word consisting of eight data bits with a ninth bit to provide an even-parity check.

When a certain block was transmitted, the data block was received as follows.

Word no.	*Data bits*	*Parity bit*
0	01000011	1
1	10101111	0
2	10101111	0
3	01111011	0
4	00100101	1
5	01011010	1
6	11110000	0
7	10001101	0
8	11101100	1
9	00010011	1
10	10111111	1
11	00111010	0
12	10110101	1
13	11101110	0
14	11101001	1
15	11011101	0

(i) Which of the 16 words is incorrect? [2]

(ii) Explain how it is possible for a block to be retrieved incorrectly in such a way that the parity check does not detect that an error has occurred. [2]

(iii) A 17th word is added to each block to act as a check sum. Explain how this can be used to provide an additional check when a block is transmitted. [2]

(iv) Explain what happens in a typical network system when a data block is received which contains a transmission error. [6]

3 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]

4 The details about chefs, customers, dishes and tables in a restaurant are as follows:

- Customers may order a number of dishes
- Each dish has only one chef cooking that dish
- A chef can cook more than one dish
- Each chef has their own table which is not used by any other chef to serve their dishes
- The date that a customer orders a dish is recorded

Four relational tables in a database can be identified: Customer, Dish, Dish-Orders and Chef.

(a) Specify the attributes (fields) required and state the primary key for each table. [10]

(b) Explain how the tables are linked. [3]

(c) Explain how the details of all the customers served by a named chef can be found. [4]

(d) Draw the ER diagram of this database. [3]

(e) The identifying field for each dish is either a letter followed by two digits or a letter followed by a digit followed by a letter.

Given that
<LETTER> ::= A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z
<DIGIT> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

(i) Using Backus-Naur Form (BNF), define <IDENTIFYING FIELD>. [3]
(ii) The rule for an <IDENTIFYING FIELD> has changed. It is now defined as

- A letter followed by a one or two digit number that must not start with a zero, OR
- An unlimited string of letters

Using BNF define the new rules for <IDENTIFYING FIELD>. [6]
(Note: <LETTER> and <DIGIT> are given in the question and do not need to be defined again.)

5 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. [4]

(c) Explain two advantages of using linked lists over arrays in implementing abstract data types. [4]

(d) State two applications of a Queue ADT. [2]

6 (a) A dictionary consists of a set of records with a key field (KF) and a key value (KV) associated with it. A dictionary can be implemented by using a linked list. Explain with the aid of diagrams, how the following set of data items consisting of [Member Id, Member Name] can be added to the head of a link list. Assume that the list is initially empty.

[1234, “AH BENG”]
[2133, “MUTHU”]
[1266, “AHMAD”] [6]

(b) The dictionary has the following functions associated with it.

(i) ADD(KF, KV): add a record to the link list;
(ii) REASSIGN(KF, KV): updates a record in the link list;
(iii) DELETE(KF): deletes a record in the link list.

Describe the algorithm to implement the above functions. [9]