INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATIONS 2
in preparation for General Certificate of Education Advanced Level
Higher 2

CANDIDATE NAME			
CLASS		INDEX NUMBER	

COMPUTING 9754/01

Paper 1 **8 September 2008**

3 hours

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

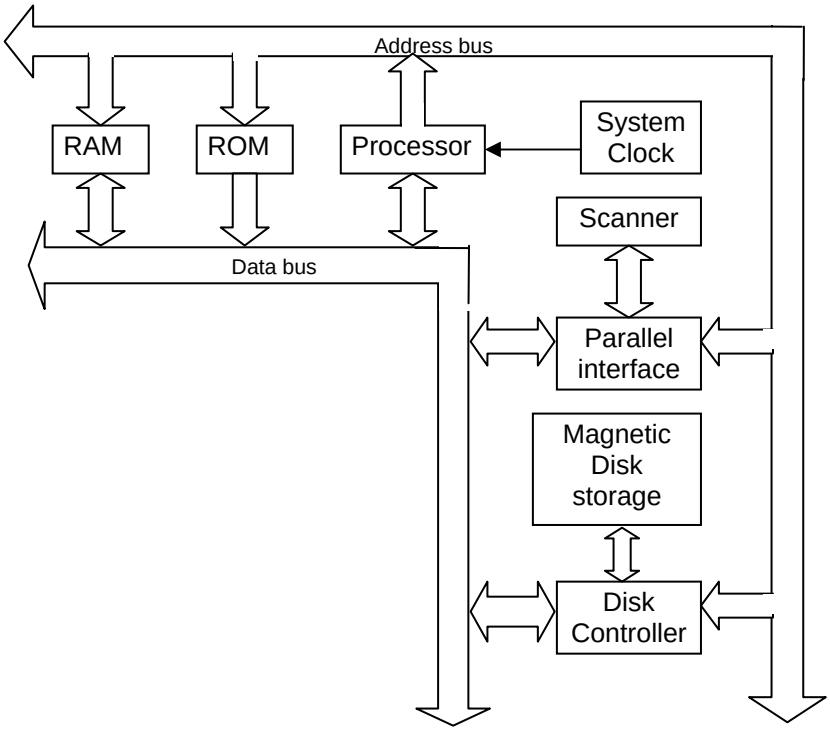
Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the 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) Figure below shows part of a typical computer system architecture.



i) Explain why the *data bus* is bi-directional but the *address bus* is one-way only. [2]

ii) A third kind of bus is not shown in Figure above.
Name this bus and give **two** examples of a signal carried by this bus. [3]

iii) Explain the differences between RAM and ROM. [2]

iv) Explain what is meant by *machine cycle time.* [1]

b) Describe an appropriate application for each of the following input/output devices. In each case, explain why the application is appropriate.

i) Portable data entry terminal.

ii) Optical-character reader. [6]

2 a) Describe what is meant by

i) batch processing;

ii) on-line processing;

iii) off-line processing;

iv) real-time processing. [4]

b) Give an example of a computer application which needs to use **both** batch processing and online processing. Explain which parts of the application use

i) batch processing;

ii) online processing. [4]

c) Give an example of a computer application which would need to be processed in real time. Justify your choice. [2]

d) i) Explain what is meant by an interrupt. [2]

ii) Describe the steps perform by the CPU when an interrupt occurs. [5]

3 a) Describe each of the following types of user interface and give an example of an application where it might be used.

i) Form based;

ii) Menu based;

iii) Command line. [6]

b) When a program is first written, the code will probably contain errors. Explain how you would use trace and dump facilities to help find the errors in such a program. [6]

c) Explain using examples, how programming language facilities can be used to make a program more readable and understandable. [4]

4 a) Define the term pointer. [1]

b) Describe, with the aid of a diagram, the data structure called a linked list. [3]

c) A firm holds the personal records of its employees as a linked list. The key which is used to order the records is the date of joining the firm, represented as the six-digit number yymmdd (for the year, month and day). The list is held with the newest employee first in the list.

i) Indicate by means of diagrams and notes what happens to the linked list

I) when a new employee joins the firm;
II) when an employee leaves the firm. [4]

ii) The firm wishes to reverse the order of the linked list, so that the longest serving employee will be the first in the list, and the newest employee will be the last. Write an algorithm which will carry out this task efficiently, by modifying the pointers and avoiding the need to copy the data about the employees. [7]

5 a) Explain the difference between a database and a database management system (DBMS). [2]

b) A hospital wishes to store details of its wards, patients and their medical condition in a way that will allow information about these details to be extracted.
The data requirements are defined as follows.

- Each ward has zero or more patients.
- Each patient may suffer from one or more medical conditions.
- A particular medical condition may be attributed to more than one patient.
- A patient can be assigned to only one ward at any one time.

A solution is to create a database with four tables :
Ward, Patient, MedicalCondition, PatientMedicalCondition.

i) For each table specify the attributes (fields) required and state the primary key for each table. [8]

ii) Draw an E-R diagram to show the relationships between the four tables. [4]

iii) Using the SQL commands SELECT, FROM, WHERE, write an SQL statement to query the database tables for the name and medical condition description of all patients in ward 05. [3]

6 Recursion is one of the most powerful features of high-level programming languages.

a) Explain what recursion is, and how it differs from repetition. [3]

b) The program MAIN, listed below, calls a recursive procedure, XO. The program is run, and the values 46 and 3 are input. Write down, in the correct order, all the values printed. Show your reasoning clearly. (Note that in this language, x DIV y gives the integral part of the quotient when x is divided by y, and x MOD y gives the remainder.)

```
program MAIN
   declare integers a, b
   input a, b
   XO (a, b)
   print a, b
end MAIN

procedure XO (x, y)
    declare integers a, b
    a = x DIV Y
     b= x MOD y
   if a > 0 then XO (a, y)
   print (b)
end XO
```

[8]

c) Given two positive integers M and N, the function GCD(M,N) is defined by

i. If M < N, swap M and N.

ii. Divide M by N and let R be the remainder. If R = 0, N is the answer.

iii. Set M = N, N = R and go back to step i.

Produce a recursive solution for GCD(M,N) using pseudocode. You may assume the availability of an operator MOD where a MOD *b* returns the remainder when a is divided by b. [5]

7 a) Explain the difference between **sorting** and **merging,** and describe when each technique would be used. [4]

b) Write an algorithm which will store in LARGE and SMALL the largest and smallest values among a set of integer values stored in elements one to MAX of an array named LIST. [4]

c) The array LIST is to be sorted using an insertion sort.
Using pseudocode, write a detailed algorithm for insertion sort. [6]

8 Syntax diagrams and Backus Naur Form(BNF) are methods of defining syntax. You can assume that the symbols <letter> and <digit> are already defined for parts a) and b) below and need not define anymore.

a) Given that an identifier must start with a letter or an underscore which may be followed by letters, digits and underscores. A single letter is a valid identifier. Typical valid identifiers are

K MARK2 X2Y2 _x1y1_ x_value

Draw a syntax diagram to define an identifier. [4]

b) An inventory file has thousands of records. Each record has fields for item code, description, and quantity in stock.

i) The item code is always two uppercase letters followed by two digits. The description can consist of uppercase and lower case letters and spaces. The quantity in stock can consist of up to three digits. Write down the definition for this record in Backus-Naur form. [4]

ii) It is decided to include the cost in this record. The cost will consist of one or more digits, followed by a decimal point, followed by two digits. Examples are 0.27, 23.40 and 150.00.
Write down the definition for this cost in Backus-Naur form. [3]