

INNOVA JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 2

COMPUTING

9754/01

12 Sep 2011

3 hours

Additional Materials: Writing Paper

READ THESE INSTRUCTIONS FIRST

Write your name and class 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** 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.

This document consists of 7 printed pages.



Innova Junior College

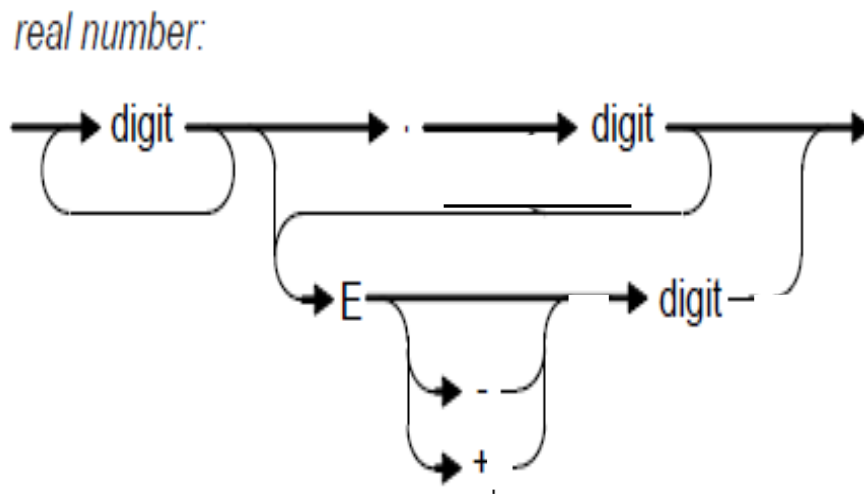
[Turn over

Answer **all** questions.

- 1 a) A processor is to carry out the instruction ADD 00011011 where the first two zeroes after ADD is the addressing mode.
This instruction means that the value 011011 will be added to the accumulator.
(Note: The 'ADD' operation would normally be stored as a binary code.)
- i) What is the binary value of 011011 in decimal? [1]
 - ii) Explain what is meant by a mnemonic and why it is used. [2]
 - iii) Describe the steps of the fetch-execute cycle, stating the effect on the registers in the processor, when carrying out this instruction. [6]
- b) Describe the following types of human computer interface and for each one give an example of an application for which it would be used.
- i) Graphical User Interface (GUI) , [3]
 - ii) Form-based interface. [3]
- c) State three utility programs associated with the use of a hard drive. Explain the purpose of each of the programs. [6]

- 2 a) A software manufacturer has been requested to produce an education package and the software manager insists on the use of top-down design in the production of the software. Explain the term *top-down design*. [2]
- b) When software is written, the code will probably contain errors. Describe each of the following types of program error, giving an example in each case.
- i) syntax error;
 - ii) logic error;
 - iii) arithmetic error;
 - iv) semantic error. [8]
- c) Most compilers include debugging tools. Describe how these may be used to find errors in a module. [3]
- d) Describe two methods of making the code of a piece of software more understandable to other programmers. [4]
- 3 A high-level programming language supports a variety of data types.
- a) Explain each of the following data types and give an example of its use.
- i) boolean;
 - ii) integer number;
 - iii) real number;
 - iv) character. [8]
- b) It is possible to represent integer values by the use of real. Why are integer types provided? [2]
- c) With the aid of an example from a high-level language, show how programmers may create their own data types. [3]
- d) Values can be passed to procedures and functions by using:
- i) pass-by-value;
 - ii) pass-by-reference.
- Explain the difference between these two methods. [4]

- 4 This syntax diagram attempts to define the syntax for a real number in a particular programming language.



where <digit> = any digit from 0 to 9.

- a) State whether each of the numbers listed below are valid real numbers. Give a reason for your answer in each case.
- i) -12.87; [2]
 - ii) 5.92; [2]
 - iii) 22E+12. [2]
- b) Redraw the syntax diagram for “real numbers” so that all the numbers in a) will be accepted. [3]
- c) Write the **new** syntax diagram in Backus Naur Form (BNF). You can assume <digit> is already defined and thus no definition for it is required. [5]

- 5 a) Explain what is meant by a *recursive routine*. [2]
- b) i) When a procedure is called by a program, describe the information which must be stored in order to return to the program at the end of the procedure.
- ii) Suggest a suitable data structure for storing this information. Justify your answer. [3]
- c) The Fibonacci numbers are defined as follows :
The first and second numbers are both 1.
Each successive number is the sum of the previous two numbers.
Write a recursive routine to find the N^{th} term of a Fibonacci series. [4]
- d) An algorithm is required to list all even numbers from 99 to 1 in reverse order and compute their sum.
- i) Write an algorithm that uses a **repeat** construct to do this.
- ii) Write an algorithm that uses a **while** construct to do this.
- Explain the difference between them. [7]

- 6 a) A Database Management System (DBMS) provides methods for accessing and using data through

- i) query languages;
- ii) report generators;
- iii) generators for input and output screens.

Describe each of these facilities [6]

- b) A book publishing company plans to create a computer system to store data on:

- books;
- customers;
- customer orders.

Each order can be for more than one book item. The details about one book item on the order form is called an order line.

A solution is to create a database with four tables: book, order, order-line and customer.

- 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]

The company uses a multi-user database stored on a server to allow staff to access the data.

- iii) Explain the concurrent update problem which could arise with this multi-user database and how a DBMS (Database Management System) overcomes the problem. [3]

- 7 IJC County is about to have its annual Big Pig Contest. As the sheriff's son Peter is majoring in computer science, the county hires him to computerize the Big Pig judging. Each pig's name (string) and weight (integer) is to be read in. The county expects large entries this year.

The output needed is a listing of pigs ordered from lightest to heaviest. Because Peter has just learned some sorting methods in school, he feels up to the task of writing this "pork-gram". He writes a program to read in all the entries into an array of records, then uses the insertion sort to put the whole array in order according to the PigWeight field. Unfortunately this sorting method is found to be too slow.

- a) Describe a sorting algorithm which would be suitable for carrying out this task much more quickly by using the following weights of ten pigs as an example.
99, 87, 91, 96, 105, 112, 97, 81, 100, 93 [6]
- b) Assume that the 10 pigs are stored in **ascending order** in an array. If the array is searched by means of a *binary search*, state which elements would be accessed, and in what order,
 - i) when searching for the number 99 (which is present), and
 - ii) when searching for 95 (which is *not* present)? [2]
- c) If the array contained 3000 integers (actual number of pigs) instead of ten, what is the greatest number of integers which would need to be accessed during a binary search? [1]
- d) Using pseudo-code, write an algorithm which performs a binary search on an array containing a set of integers arranged in ascending order. [5]