IBO

IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

COMPUTER SCIENCE
HIGHER LEVEL
PAPER 1

Tuesday 19 November 2002 (afternoon)

2 hours

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all of Section A.
- Answer four questions from Section B.

SECTION A

*Answer **all** questions.*

1. Outline the principal characteristics of *batch* and *on-line processing*. *[4 marks]*

2. Explain how *speech* or *voice recognition* can be used to capture and execute spoken commands from a given set of commands. *[4 marks]*

3. (a) Define the term *megahertz* (MHz). *[1 mark]*

    (b) Outline the steps of the machine instruction cycle. *[4 marks]*

4. A program must input a user's name and age.

    (a) Describe a method for *validating* the user's age. *[2 marks]*

    (b) Describe a method for *verifying* the user's age. *[2 marks]*

5. Outline the function of an *interpreter*. *[2 marks]*

6. State **two** benefits that object oriented programming (OOP) techniques provide to the software developer. *[2 marks]*

7. A graphics file can be stored using 8-bit colour or using 24-bit colour.

    (a) State the number of different colours that can be represented using the 8-bit format. *[1 mark]*

    (b) Outline an application in which 8-bit images would be an advantage over 24-bit images. *[2 marks]*

    (c) Pictures are to be converted to black and white to be put into a school newspaper using 16 shades of grey. State the number of bits that are needed to represent this data. *[1 mark]*

8. A programmer has the job of writing a program for a small business. The first step is to define and document the problem. Explain what is meant by defining the problem. *[3 marks]*

9. (a) Define the term *computer virus*. *[3 marks]*

(b) State **two** measures that can be taken to protect a computer system from *viruses*. *[2 marks]*

10. Explain why a kilometre is exactly 1000 metres, but a kilobyte is **not** exactly 1000 bytes. *[2 marks]*

11. Given the following algorithm

```
P <-- 1
K <-- 1
I <-- 1
repeat
  K <-- K * 2
  P <-- P + 1/K
  I <-- I + 1
until I >= 4
output(P)
```

By tracing the algorithm, copy and complete the following trace table.

line	P	K	I	I >= 4	output
1	1				
2		1			
3					

[5 marks]

Turn over

SECTION B

*Answer **four** questions.*

12. A competition in figure skating consists of two parts: required elements and presentation. A competitor's score is the sum of the two parts. Whenever there is a tie, a competitor with the higher required elements score ranks higher.

Name	Required Elements	Presentation Score	Score
Lana	4.3	4.1	8.4
Ana	4.7	4.3	9.0
Sara	4.2	4.7	8.9
Vera	4.1	4.3	8.4
Jenny	4.4	4.1	8.5
Debbie	4.2	4.0	8.2

(a) Suggest an appropriate data type to hold data about each competitor (name, score for the required elements, score for presentation and competitor's score).   *[3 marks]*

(b) Draw a diagram to show how the data given above could be stored in a binary search tree in order of rank. Data should be inserted into the tree in the order given in the table, *i.e.* Lana is inserted first.   *[4 marks]*

(c) The same data could be inserted into a singly linked list in rank order. Compare this method with the method of part (b).   *[3 marks]*

13. The average speed with which a computer locates instructions or data and loads a copy into RAM is called the *access time*.

The *access time* for a device such as a magnetic disk is measured in three stages:

- seek time
- rotational delay (latency)
- data transfer time

(a) Explain what is meant by each of the underlined terms.   *[6 marks]*

(b) Computer systems use both *primary* and *secondary* storage components.

    (i) Identify an application for each.   *[2 marks]*

    (ii) Explain the suitability of the storage component for each application.   *[2 marks]*

14. A company uses internally produced software for processing payroll data. At the end of each week, time sheets are collected and sent to the computer centre. All data is entered via the keyboard. Invalid data is printed, corrected and entered into the next batch of transactions; a new file of valid transactions on disk is produced. The transaction file is used to update the employee master file; cheques, payslips and a payroll summary are printed.

(a)   (i)   Describe **two** types of documentation that should be provided in the payroll software package. *[4 marks]*

      (ii)   Errors may arise from "bugs" in the software. Explain **two** methods of avoiding these errors. *[2 marks]*

(b)   Construct a system flowchart of the system described above. *[4 marks]*

15. Given the following declaration:

```
NODE    record

              DATA string
              NEXT pointer

        endrecord
```
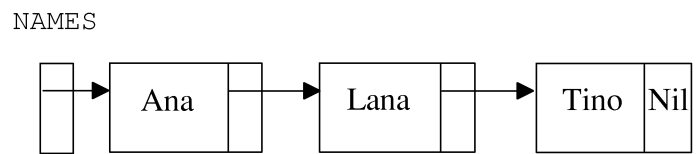
and the following recursive algorithm:

```
procedure MYSTERY (val LIST pointer-> NODE)
      if LIST # NIL
         then MYSTERY (LIST-> NEXT)
                            output (LIST-> DATA)
         endif
endprocedure MYSTERY
```


(a) Identify

    (i) under what circumstances the procedure will terminate;   *[1 mark]*

    (ii) under what circumstances the procedure will continue.   *[1 mark]*

(b) Given the list pointed to by NAMES.

       NAMES

    Trace the algorithm for the call MYSTERY(NAMES), showing clearly your
working at each call to the procedure.   *[5 marks]*

(c) Deduce the purpose of the algorithm MYSTERY.   *[2 marks]*

(d) Identify a different data structure that would most likely be used in a non
recursive implementation of MYSTERY.   *[1 mark]*

16. (a) (i) Simplify the following Boolean expression.

$$B = \overline{\overline{X+Y}} \quad + \quad \overline{\overline{Y.X+X+Y}}$$

[4 marks]

(ii) Draw the logic circuit that corresponds to your answer to part (a) and identify all ordered pairs (X,Y) that make the circuit output true. *[3 marks]*

(b) The contents of the following eight bit register are to be interpreted as a two's complement integer.

1	1	0	0	1	1	0	0

(i) State the value represented by the MSB (most significant bit). *[1 mark]*

(ii) Calculate the decimal value of the register. *[1 mark]*

(iii) State **one** advantage of using two's complement. *[1 mark]*