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

COMPUTER SCIENCE
STANDARD LEVEL
PAPER 1

Tuesday 19 November 2002 (afternoon)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

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

SECTION A

*Answer **all** questions.*

1.   (a)   Define the term *syntax error*.   *[1 mark]*

   (b)   Outline **one** difference between the way an interpreter reacts to a *syntax error*, as opposed to the way a compiler reacts to the same error.   *[2 marks]*

2.   A floppy disk drive is a secondary storage device, providing *direct access* to data. State **one** secondary storage device which uses only *serial access*.   *[1 mark]*

3.   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 minimum number of bits that are needed to represent this data.   *[1 mark]*

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

6.   Calculate the binary representation of the decimal number 123.   *[1 mark]*

7.   Discuss **one** advantage and **one** disadvantage of using *speech* or *voice recognition* rather than a keyboard when inputting a long list (several hundred items) of numerical data.   *[4 marks]*

8. The array NAMES holds data as shown below:

[1]	[2]	[3]	[4]	[5]	[6]
ANT	FLY	FREE			

The following algorithm is intended to add to the array (but may contain one or more logical errors).

```
procedure ADD(val THISNAME string)
   declare POS integer
   POS <-- 1
   repeat
      POS <-- POS + 1
   until (NAMES[POS] = "FREE") or (NAMES[POS] = THISNAME)
   if NAMES[POS] = "FREE" then
      NAMES[POS] <-- THISNAME
      NAMES[POS + 1] <-- "FREE"
   endif
endprocedure ADD
```

By tracing the algorithm, or otherwise, copy and complete the following table to show the contents of the array after the following successive calls to the procedure: ADD("BEE"), ADD("ANT") and ADD("FLY").

	[1]	[2]	[3]	[4]	[5]
ADD("BEE")					
ADD("ANT")					
ADD("FLY")					

[4 marks]

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

10. 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]*

SECTION B

*Answer **three** questions.*

11. 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.

In the following data, each line contains the competitor's name, score for the required elements, score for the presentation and total score.

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) Identify the competitor who lost the tie-breaker.   *[1 mark]*

(b) Describe a suitable data structure to hold data about one skater.   *[3 marks]*

The data is to be stored so that it can be searched by name or by total score.

(c) Discuss the different data structures and search methods that could be used.   *[6 marks]*

12. A school has a LAN which connects secretaries' PCs and teachers' PCs to a set of servers in a central location.

The servers also contain many documents (one document in each file), including letters to parents, course descriptions, newsletters, budgets, *etc*.

(a) (i) State **one** possible network topology.   *[1 mark]*

     (ii) Draw and label a diagram of the topology you identified in (i).   *[3 marks]*

(b) Describe a reliable back up strategy for a secretary to back up documents
without using **removable** media.   *[2 marks]*

An email system for students and teachers is also included.

(c) Describe **two** appropriate security measures for the email system.   *[4 marks]*

13. Customers can buy books from a World-Wide-Web site: www.Books.com. The customers use a web-browser to access the web site and to read information until they find a book they want. Then they type their name, address, and credit card number into the web browser, which sends the data to the web server. Customers can place orders from anywhere in the world at any time of day.

At company headquarters in Paris, the server prints a report each morning at 8.00 am, showing all the orders from the past 24 hours. The printed report looks like this:

```
                    DAILY ORDER REPORT
ISBN                 Title                Customer
------------------------------------------------------------------
1-56592-392-8        Java Script by Example   Mrs Hildegard Johansen
                                              95 Rose Street
                                              Chicago, USA

0-8120-9811-0        Internet Terms Dictionary Mr Don Johnson
                                              Executive Plaza 1
                                              London, England

... more orders ...
```

This report lists several thousand orders each day. Employees pack the books and send them to customers by express mail.

(a) The server holds a list of customer orders. Describe **two** advantages of storing these records initially in a *transaction file*, rather than storing them immediately in a *master file*. *[4 marks]*

(b) Outline **one** feature of the World-Wide-Web which makes it particularly suitable in this application. *[2 marks]*

Books.com hold personal data on customers including the books they have bought.

(c) Discuss **two** possible problems to customers if Books.com do not take adequate measures to protect this data. *[4 marks]*

14 . In a grocery store, the sales clerk uses a laser scanning device to read a bar code on each item (package). The scanner transmits the bar code to an attached cash register (point-of-sale terminal). The cash register converts the bar code to a string (the Product ID) and transmits this string to a central computer. The central computer searches for the Product ID in a data-file, retrieves the corresponding price for the scanned item, and transmits the price back to the cash register. The cash register prints the price on a paper receipt.

Example Data

Item	Bar Code	String (Product ID)	Price
Orange juice	0 40000 23331 2	"040000233312"	2.49

(a) Construct a system flowchart (input-process-output) for this system. The chart must show **four** devices: laser-scanner, cash register, central computer and printer. It must clearly identify the data transferred between devices. *[5 marks]*

(b) The cash register contains a keyboard. Describe a situation when the clerk must enter the Product ID through the keyboard, even though the laser-scanner is functioning correctly. *[1 mark]*

(c) State **two** reasons why optical bar codes are preferable to a Magnetic Ink Character Recognition system. *[2 marks]*

(d) Outline **one** advantage of using this system rather than putting price labels directly on the items. *[2 marks]*