INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

COMPUTER SCIENCE
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PAPER 1

Wednesday 2 May 2001 (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. Describe **one** reason why MICR might be used rather than OCR to input data.   *[2 marks]*

2. Determine how many bits per second a device transmits if it sends 16kB of data per second (where 1 byte = 8 bits).   *[2 marks]*

3. Identify the **three** types of programming error, and give an example of **each**.   *[6 marks]*

4. Define the term *controller*.   *[1 mark]*

5. Outline the difference between *batch processing* and *on-line processing*, stating an example of when **each** would be used.   *[4 marks]*

6. Two types of error-checking during data entry are verification and validation.

    (a)   Describe verification and identify the type of error that it tries to prevent.   *[3 marks]*

    (b)   Describe **one** validation technique and identify **one** situation in which it might be used.   *[3 marks]*

7. Compare **two** aspects of the storage of numbers using integer and floating-point representations.   *[4 marks]*

8. Describe how a hashing algorithm is used to access a record in a direct access file and identify **one** advantage and **one** disadvantage of this file organisation.   *[6 marks]*

9. Outline **two** uses of a stack in a computer system.   *[4 marks]*

10. Outline **two** features of object-oriented programming (OOP) and identify **one** disadvantage of OOP.   *[5 marks]*

SECTION B

*Answer **four** questions.*

11. The following algorithm carries out an error-checking routine:

```
function CHECK(val DATA integer array [1..8])
   result boolean
   declare POS, COUNT integer

   COUNT <-- 0
   for POS <-- 1 upto 8 do
      if DATA[POS] = 1 then
         COUNT <-- COUNT+1
      endif
   endfor

   return (COUNT mod 2)=0
endfunction CHECK
```

(a) State the result of CHECK for DATA

0	1	1	1	0	1	1	0
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]

by copying and completing the following trace table:

POS	DATA [POS] = 1	COUNT	CHECK
		0	
1	false	0	
2	true	1	

[4 marks]

(b) Deduce the result of CHECK for:

1	1	0	0	1	0	1	0	DATA
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	

[1 mark]

(c) Identify the error-checking method that the function CHECK is performing.   [2 marks]

(d) State a situation when this type of error-checking would be used.   [1 mark]

(e) Describe **one** problem with this error-checking method.   [2 marks]

12. The standard length of a byte to store one character is 8 bits, which can represent up to 256 different characters. Writing in the Chinese language requires over 400 characters. These can be represented in a computer by increasing the number of bits used to store a character (that is, to change the size of a byte).

(a) State the minimum number of bits required in a byte to store 400 of the Chinese characters. *[1 mark]*

(b) Explain the implications of a change in the number of bits used in a byte on a computer system with respect to:

(i) hardware. *[3 marks]*

(ii) software. *[3 marks]*

(iii) communication. *[3 marks]*

13. Part of an algorithm used in a drawing package is given below:

```
if DATA[1] = 0 then
    LINE(DATA[2],DATA[3],DATA[4],DATA[5])
elsif DATA[1] = 1 then
      CIRCLE (DATA[2], DATA[3], DATA[4])
elsif DATA[1] = 2 then
      MOVE (DATA[2], DATA[3])
endif
```

Where DATA is a one-dimensional integer array of order 5, and LINE, CIRCLE and MOVE are procedures that control drawing routines.

LINE(X1,Y1,X2,Y2) outputs a straight line from the co-ordinates (X1,Y1) to (X2,Y2).
CIRCLE(X,Y,R) outputs a circle with its centre at co-ordinates (X,Y) and radius length R.
MOVE(X,Y) moves the cursor position to co-ordinates (X,Y).

(a) State the effect of using the above algorithm with the following data in DATA:

(i) DATA

0	3	6	2	0
[1]	[2]	[3]	[4]	[5]

[1 mark]

(ii) DATA

2	12	45	2	0
[1]	[2]	[3]	[4]	[5]

[1 mark]

(b) State why DATA would need to be redefined to order 31 if a new module was written to process a shape with 15 sides.

[1 mark]

(c) (i) Explain why the use of a static data structure (an array) is inefficient.

[2 marks]

(ii) Suggest a better data structure to store the required data within the program. As part of your answer, draw a sketch of the data structure and explain why it is better than an array.

[5 marks]

14. A programmer implements an object (using Object-Oriented Programming, OOP) called QUEUE, with the usual properties associated with such a structure, for example: initialise and add a data item to the rear.

(a) State **one** further property associated with a queue.   *[1 mark]*

(b) Describe **one** use of a queue in a computer system.   *[2 marks]*

(c) Explain the OOP term *encapsulation* with reference to the example above.   *[3 marks]*

(d) The queue could be implemented using either an array or a dynamic structure with pointers. Explain the advantage of using OOP in this situation.   *[4 marks]*

15. The user interface of a computer system is very important and includes the display of data (such as menus), as well as any specialised input/output hardware.

(a) Identify four factors that would be considered when selecting suitable hardware. *[4 marks]*

(b) Suggest three ways in which the design of the layout of data to be displayed could be decided. *[3 marks]*

(c) Explain how the interface will be tested before the final implementation. *[3 marks]*