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International Baccalaureate®
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**COMPUTER SCIENCE
HIGHER LEVEL
PAPER 1**

Thursday 8 November 2012 (afternoon)

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Section A: answer all the questions.
- Section B: answer all the questions.
- The maximum mark for this examination paper is *[100 marks]*.

SECTION A

Answer **all** the questions.

1. State **two** characteristics that should be considered when comparing different computers. [2 marks]

2. Describe how increasing the size of *cache memory* improves the performance of a computer. [2 marks]

3. Outline the need for an *A–D converter* in a voice recognition system. [2 marks]

4. Outline **one** advantage to computer system designers of using the prototyping approach. [2 marks]

5. Describe how a *parity check* is used to ensure data integrity in the transmission of data. [3 marks]

6. An international organization has offices in five different world regions. Compare the use of e-mail with video conferencing for communication between the staff. [4 marks]

7. Define the term *latency*, in terms of hard disk operation. [1 mark]

8. Numbers are represented in *floating point* format that uses 8 bits for the mantissa and 4 bits for the exponent.
 - (a) Describe how the binary number 1110.011 would be represented in this format. [3 marks]

 - (b) Define the term *overflow*. [1 mark]

9. Convert the following *infix* expression into a *postfix* expression.

$A + B * C + D$

[1 mark]

10. Calculate the value of the following *prefix* expression.

$- + * 5 2 3 7$

[1 mark]

11. State **two** resources that could be shared on a LAN. [2 marks]
12. State **two** possible communication links that could be used to connect the LAN to a WAN. [2 marks]
13. A two-dimensional array `int[][] x = new int[3][3]` currently holds the following data.

1	1	1
2	2	1
1	1	1

After tracing the code given below redraw the grid and show the new contents of `x`. [3 marks]

```
for (int i = 0; i < 3; i = i + 1)
{
    for (int j = 0; j < 3; j = j + 1)
    {
        if (i == j)
        { X[i][j] = X[i][j]; }
        else if (i > j)
        { X[i][j] = 1; }
        else
        { X[i][j] = 0; }
    }
}
```

14. A *processor* is executing a program.
- (a) State where all instructions and data are stored. [1 mark]
- (b) State the name of the register that holds the address of the next instruction to be executed. [1 mark]
- (c) Outline the purpose of an *accumulator*. [2 marks]
15. Outline the purpose of *buses* in the execution of the statement `x = a + b;`. [3 marks]
16. Describe **one** advantage and **one** disadvantage of the growing use of computers in society. [4 marks]

SECTION B

Answer **all** the questions.

17. A system analyst has been asked to oversee the computerization of a new department of a large firm and uses *interviews* and *questionnaires* to collect data.

(a) Outline **one** advantage of using:

(i) interviews rather than questionnaires; [2 marks]

(ii) questionnaires rather than interviews. [2 marks]

At the end of the analysis stage a *feasibility report* is produced which contains several possible solutions.

(b) Explain why more than one possible solution is proposed. [2 marks]

The hardware and software have now been installed.

(c) Explain **two** tasks that should be carried out before the new computer system can be fully implemented. [4 marks]

18. At the end of each school year up to 200 students take an examination. Exams are marked by the teacher and results input using a keyboard. Sample data about two students is shown below.

Student Code: 9902-008	Score: 28	Passed: No
Student Code: 9902-028	Score: 82	Passed: Yes

(a) (i) State appropriate data types for the **three** data items listed above. [3 marks]

(ii) Describe a data structure that could be used to hold data about all students in the school. [3 marks]

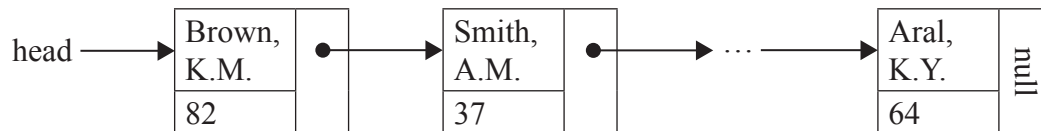
A multiple choice examination will be used the following year in order to capture and process the data automatically.

(b) Suggest suitable input devices and data preparation requirements so that this can be carried out. [4 marks]

19. An IB student is constructing a Java program while a set of documents such as essays, lab reports and other homework is being printed out.

- (a) Identify the mode of operation that allows this concurrent performance. [1 mark]
- (b) (i) Define the term *queue* as a data structure. [1 mark]
 - (ii) Identify **two** different queues that are used in this example. [2 marks]
- (c) Outline the meaning of the term *double buffering* with respect to printing. [2 marks]
- (d) Explain how *interrupts* are used to fill the printer buffer. [4 marks]

20. The logical representation of a list that holds students' names and scores is as follows.



- (a) Describe the difference between logical and physical representation of data. [2 marks]
- (b) (i) Identify the type of search that could be used to find a given student in the list. [1 mark]
 - (ii) State the *BigO efficiency* of the search algorithm. [1 mark]

To speed up the search for a particular student a *binary tree* can be used to hold data.

- (c) (i) Describe how a binary tree holding student names and scores would be structured. [4 marks]
 - (ii) Explain how the score for a particular student can be found. [2 marks]

21. Consider the following recursive method.

```
public int calculate(int n)
{
    if ((n == 0) || (n == 1))
    { return 1; }
    else
    { return n + calculate(n - 1); }
}
```

(a) Identify the terminating condition for this method. [1 mark]

(b) Determine the value of variable *y*, showing all of your working.

`int y = calculate(calculate(2));` [5 marks]

(c) (i) State the range of integer values for which the formal parameter *n* is correct. [1 mark]

(ii) Identify the error that will occur if `calculate()` is called with an incorrect argument. [1 mark]

(iii) State the modification to `calculate()` that will prevent the error occurring. [1 mark]

(iv) Identify the data structure which holds the parameter values and returns addresses during execution of the method. [1 mark]

22. (a) Express the logical **xor** operation using a truth table. [2 marks]

(b) (i) Construct the Boolean expression for output *X* in terms of inputs *A*, *B* and *C* for the following truth table. [2 marks]

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

(ii) Simplify the expression. [3 marks]

(c) Draw the logic circuit for the following expression.

$$H = W + Y \cdot Z + \overline{W \cdot Y}$$
[3 marks]