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

Thursday 14 November 2013 (afternoon)

2 hours 15 minutes

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**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** items of documentation that are usually included for the user in a software package. [2 marks]
2. Outline the need for an operating system to perform defragmentation. [2 marks]
3. Assume that, when written, the first bit is an even parity bit.
  - (a) Identify with reasons whether the following data stream was transmitted correctly.

10110100

 [2 marks]
  - (b) Compare parity bit checks and check sums in ensuring data integrity. [3 marks]
4. State **two** features of HTML that make it a good choice for creating and updating a website. [2 marks]
5. A school network is connected to the Internet.
  - (a) Outline **one** threat to the security of the school's data that may arise from the use of the Internet. [2 marks]
  - (b) Outline **two** implications of a school administrator being able to monitor students' use of the Internet. [4 marks]
6. State **two** functions of operating systems. [2 marks]
7.
  - (a) Define *stack*. [1 mark]
  - (b) State **two** applications of stacks in computing. [2 marks]

8. Consider the following Boolean expression.

$$A + \overline{B} \cdot C$$

- (a) Construct a truth table for the expression. *[3 marks]*
- (b) Draw the logic circuit for the expression. *[2 marks]*

9. (a) State the role of the following CPU components.

(i) accumulator *[1 mark]*

(ii) RAM *[1 mark]*

- (b) (i) Explain why interrupts are used in communication between the CPU and peripheral devices. *[2 marks]*

(ii) Identify **one** method of communication between the CPU and peripheral devices other than interrupts. *[1 mark]*

10. Determine the value of  $X_{(2)}$  in the following expression, where the 2, in brackets, is the base in which  $X$  is expressed. Show all your working.

$$X_{(2)} = A5_{(16)} + 5E_{(16)} \quad \text{[3 marks]}$$

11. Construct a systems flowchart for the process described below.

- A transaction file held on disk is validated.
  - An error report which gives details of invalid transactions is printed out.
  - All valid transactions are stored on a disk file, which is then sorted.
- [5 marks]*

## SECTION B

Answer **all** the questions.

- 12.** A fashion designer works from home to create a new clothing range for a company.
- (a) Outline **two** advantages of using a graphic tablet to create a design. *[4 marks]*
  - (b) Describe a communication system that would allow a fast transmission of data files from the designer to the company. *[2 marks]*
  - (c) Outline the benefits of data compression in storing and sending the designer’s work to the company. *[2 marks]*
  - (d) Explain the need for encryption when sending the designer’s work to the company. *[2 marks]*
- 13.** A company plans to build an off-site “Data Centre” to house its servers and associated devices. A system analyst is employed by the company to design and implement a computer system for the new Data Centre.
- (a) State **two** methods of data collection which could be used in the analysis stage. *[2 marks]*
  - (b) Explain why it may be useful to produce more than one prototype of the new computer system. *[2 marks]*
- There are two possible locations for the Data Centre:
- A central location in a major city
  - A town in an area where previously the main industry had been coal mining.
- (c) Discuss the social implications of the company’s choice of location for the Data Centre. *[6 marks]*

14. Weather data at 20 different locations in the mountains are measured by sensors and sent to a weather station's computer where they are stored.

Twice a day the data files holding the weather data are transferred from the weather station to the central server in a nearby city for processing.

- (a) State the type of processing. *[1 mark]*
- (b) Outline how the weather data could be transferred
  - (i) from the sensors to the weather station's computer. *[1 mark]*
  - (ii) from the weather station's computer to the central server. *[1 mark]*
- (c) Explain the need for analog-to-digital conversion in this system. *[3 marks]*
- (d) Explain **two** backup strategies that could be used in the event of a failure of the weather station's computer or the central server. *[4 marks]*

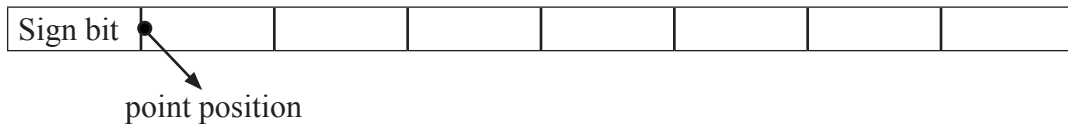
15. A list of names is input and inserted in a binary tree in such a way that an in-order traversal of the binary tree visits the nodes in alphabetical order of the names.

- (a) Outline the steps required to insert a given name at the correct position in the binary tree. *[5 marks]*
- (b) Draw a sketch of the resulting binary tree for the list of names inserted in the following order.
 

Chris, Colin, Lise, Richard

*[2 marks]*
- (c) Explain the efficiency of access to a binary tree with particular reference to the binary tree created in part (b). *[3 marks]*

16. An 8-bit register is used to hold fixed point real numbers in two's complement representation as follows.



The binary representation of the most positive number is

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

and its value in decimal is  $1 - 2^{-7}$ .

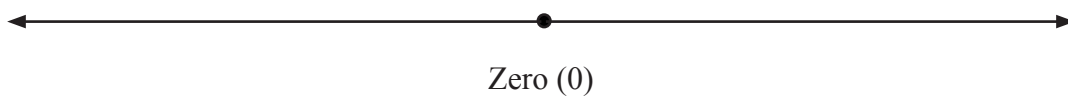
The binary representation of the least negative number is

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

and its value in decimal is  $-2^{-7}$ .

**Note:** The **most** negative number < the **least** negative number.

- (a) State the binary representation of the least positive number and determine its value in decimal. *[2 marks]*
- (b) State the binary representation of the most negative number and determine its value in decimal. *[2 marks]*
- (c) Copy the real number line below



and label

- (i) the range of positive and negative numbers; *[2 marks]*
- (ii) underflow; *[1 mark]*
- (iii) overflow. *[1 mark]*
- (d) Compare fixed point and floating point representation. *[2 marks]*

17. Consider the following recursive method.

```
int func (int k, int[] X)
{ if (k<0)
    { return 1;}
  else
    {return X[k] * func(k-1, X);}
}
```

(a) (i) Identify the terminating case in this method. *[1 mark]*

(ii) Identify the recursive case in this method. *[1 mark]*

(b) The integer array Data is given as follows

Data

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3   | 10  | 4   | 2   | 1   | 1   | 0   | 0   | 0   | 0   |
| [0] | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |

Determine the value of variable  $z$  after the following call. Show all your working.

$z = \text{func}(5, \text{Data})$  *[4 marks]*

(c) State the purpose of the method `func()`. *[2 marks]*

(d) Suggest **one** other way of solving the same problem. *[2 marks]*