



88137011



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.

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

- (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]*

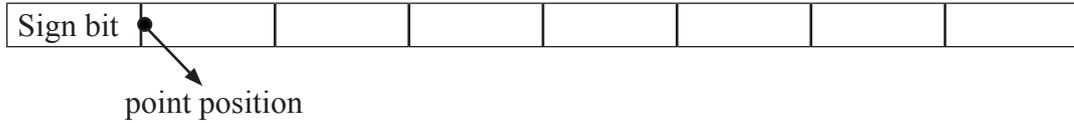
15. A list of names is input and inserted in a binary tree in such a way that an in-order traversal of the binary tree visits the nodes in alphabetical order of the names.

- (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.  

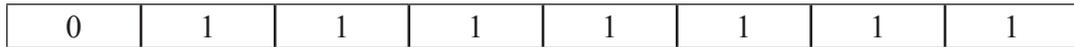
Chris, Colin, Lise, Richard

*[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



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

The binary representation of the least negative number is



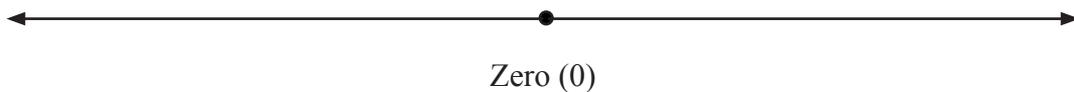
and its value in decimal is  $-2^{-7}$ .

**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

<b>3</b>	<b>10</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
[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=func (5, 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]*

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