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International Baccalaureate®
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COMPUTER SCIENCE
HIGHER LEVEL
PAPER 1

Tuesday 16 November 2010 (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.

SECTION A

*Answer **all** the questions.*

1. (a) Outline the purpose of the *systems life cycle* model. *[2 marks]*

(b) Identify the stage of the systems life cycle in which a feasibility report is prepared. *[1 mark]*

2. Draw a labelled diagram representing the basic structure of the *central processing unit* (CPU). *[4 marks]*

3. Customer orders are collected on paper, keyed in, and stored in the *customer orders file*. A stock *master file* is searched to determine whether sufficient stock is available and an appropriate report is produced.

Construct a *systems flowchart* representing the process described above. *[5 marks]*

4. Outline **one** example of *online processing*. *[2 marks]*

5. State **two** features to be considered when comparing the **speed** of different processors. *[2 marks]*

6. (a) Convert the decimal number 20.5 into binary. *[2 marks]*

(b) Convert the binary number 1010 1001 into hexadecimal. *[1 mark]*

7. Numbers can be stored in a computer in either *integer* or *floating-point representation*.

(a) State **one** reason for using floating-point representation. *[1 mark]*

(b) State **one** reason for using integer representation. *[1 mark]*

8. (a) State the register in which the results of all arithmetic operations are stored. *[1 mark]*

(b) Define the term *overflow error*. *[2 marks]*

9. State **two** types of *utility software*. *[2 marks]*

10. (a) State the BigO efficiency of a *binary search* algorithm. *[1 mark]*

(b) State the BigO efficiency of a *bubble sort* algorithm. *[1 mark]*

11. Data is collected by groups of students, on a field trip, and later transferred to a central computer.

(a) Identify **one** method of *data capture*. *[1 mark]*

(b) Identify **one** method of transferring data from the field to the central computer. *[1 mark]*

(c) There have been concerns about the accuracy of the data. Outline how *verification* and *validation* can be used to ensure it is as accurate as possible. *[4 marks]*

12. Define the term *encapsulation*. *[2 marks]*

13. (a) State **one** type of *interrupt*. *[1 mark]*

(b) Outline the steps in the *machine instruction cycle*. *[3 marks]*

SECTION B

*Answer **all** the questions.*

14. When a computer program is being developed errors may occur.

(a) Outline **two** types of possible errors, each with a suitable example. *[4 marks]*

(b) Describe **three** examples of software that assist in the development of computer programs. *[6 marks]*

15. (a) Draw the resultant binary search tree after the items in the following list have been inserted.

6, 4, 8, 3, 5, 7, 9 *[3 marks]*

(b) State the order in which items will be listed using pre-order traversal. *[2 marks]*

(c) State the tree traversal that will list the items in ascending order. *[1 mark]*

(d) Discuss, using diagrams, how the original order of the data will affect the efficiency of searching the tree. *[4 marks]*

16. A hospital has a large networked computer system. Data in the computer system is confidential.

(a) Identify **two** ways in which the security of the network within the hospital can be ensured. *[2 marks]*

(b) Describe how data could be recovered in a case of corruption. *[4 marks]*

Doctors, administrative staff and patients are permitted to access different parts of the data.

(c) Outline how the network administrator can reduce the risk that sensitive patient data is seen by someone other than a doctor. *[4 marks]*

17. (a) (i) Define the term *recursion*. *[1 mark]*

(ii) Describe **one** advantage and **one** disadvantage of recursion. *[4 marks]*

Examine the following recursive method.

```
public int mystery(int x, int y)
{
  if (x < y)
  { return 0; }
  else
  { return 1 + mystery(x - y, y); }
}
```

(b) State the value of variable `w` after

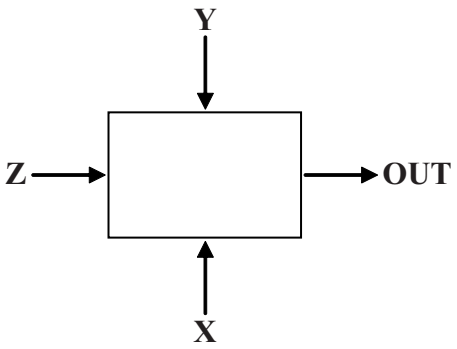
(i) `int w = mystery(2, 3);` *[1 mark]*

(ii) `int w = mystery(2, 2);` *[1 mark]*

(iii) `int w = mystery(7, 3).` *[1 mark]*

(c) Assuming that both arguments are positive, determine the purpose of the method `mystery`. *[2 marks]*

18. Consider the simplified logic circuit shown below. It has three inputs (**X**, **Y** and **Z**) and one output (**OUT**).



The output at **OUT** is the same as the input signal at **X** when the input signal at **Z** is 0.
The output at **OUT** is the same as the input signal at **Y** when the input signal at **Z** is 1.

(a) Construct a *truth table* that summarizes this behaviour. *[3 marks]*

(b) (i) From the truth table, construct the Boolean expression for output **OUT** in terms of inputs **X**, **Y** and **Z**. *[2 marks]*

(ii) Show that the expression can be simplified to $\mathbf{YZ} + \mathbf{X}\overline{\mathbf{Z}}$. *[2 marks]*

(c) Draw the logic circuit corresponding to the expression $\mathbf{YZ} + \mathbf{X}\overline{\mathbf{Z}}$. *[3 marks]*

19. Consider the following program fragment.

```
int n = 8;
int p = 1;
int s = 0;
for (int c = 1; c < n; c = c + 1)
{
  if (c % 2 == 0)
  { s = s + c; }
  else
  { p = p * c; }
}
output("s = " + s);
output("p = " + p);
```

(a) Construct the trace table, started below, for the program fragment. *[3 marks]*

c	c % 2 == 0	c < 8	p	s	output

(b) Determine the purpose of the program fragment. *[2 marks]*

(c) Rewrite the program fragment, converting the **`for`** loop into an equivalent **`while`** loop. *[2 marks]*

(d) Analyse the efficiency of the program fragment. *[3 marks]*