



22137011



**COMPUTER SCIENCE
HIGHER LEVEL
PAPER 1**

Tuesday 14 May 2013 (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** forms of direct data entry. *[2 marks]*

2. Outline **one** advantage and **one** disadvantage to protest groups of communicating by social networks. *[4 marks]*

3. Identify **two** uses of CASE development tools in the development of a computer-controlled manufacturing process. *[2 marks]*

4. With reference to the CPU,
 - (a) outline the function of the control unit. *[2 marks]*
 - (b) describe how the size of the registers is related to the size of primary memory. *[2 marks]*

5. Describe a disadvantage of the use of virtual memory. *[2 marks]*

6. Outline the function of virus-checker software. *[2 marks]*

7. Outline **one** difference between ASCII and UNICODE representation. *[2 marks]*

8.
 - (a) Express the decimal number 189 as hexadecimal. You must show your working. *[2 marks]*
 - (b) Calculate the result of $EB_{(16)} + ACF_{(16)}$ giving your answer in hexadecimal. You must show your working. *[2 marks]*
 - (c) Explain how the use of floating-point representation extends the range of numbers that can be used. *[3 marks]*

9. Consider the following method.

```
public int GCD (int x, int y) // x,y not both 0
{
    if (y==0) return x;
    return GCD(y, x%y);
}
```

Trace the method to compute $GCD(15, 20)$, by copying and completing the table below. *[3 marks]*

| x | y | return |
|----|----|--------|
| 15 | 20 | ... |
| | | |

10. Describe the purpose of the interrupt register. *[2 marks]*

11. Compare the use of a dynamic data structure with a static data structure in storing **and** accessing data. *[4 marks]*

12. Outline the importance of key fields. *[2 marks]*

13. Describe **two** different types of errors, in number representation, that could occur when mathematical operations are processed on a computer. *[4 marks]*

SECTION B

Answer *all* the questions.

14. A LAN in a health centre allows two receptionists and four doctors to share three PCs and a printer which are connected to a server. The LAN has a star topology, and uses cables.

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

(ii) Define the term *client*. [1 mark]

(b) Outline the role of a hub in a star topology. [2 marks]

The doctors can access only the medical records of the patients; the receptionists cannot access the medical records of the patients and deal only with registering new patients and booking appointments.

(c) (i) Describe how the access of the doctors and the receptionists can be restricted to the appropriate parts of the file system. [2 marks]

It is proposed to allow patients partial access to the health centre's system over the Internet.

(ii) Explain the type and level of access that should be granted to the patients and how this would be achieved. [4 marks]

15. A PC is connected to a telephone line with an external modem via a serial port. An application running on the PC allows it to send files by fax. To transmit the document, the application dials the receiver's number, in order to establish a communication channel which is regulated by handshaking.

(a) Define the term *port*. [1 mark]

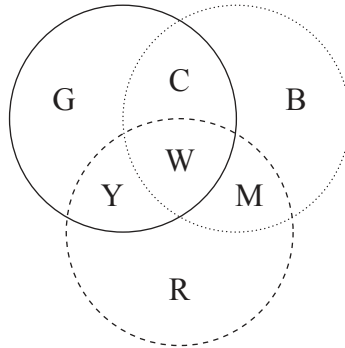
(b) Explain how the process of handshaking leads to successful communication. [3 marks]

The application uses a temporary buffer to store the document to be faxed.

(c) Describe how the use of a buffer contributes to a better use of the CPU. [3 marks]

(d) Explain how direct memory access allows a peripheral to access data. [3 marks]

16. A theatre has three stage lights: red (R), green (G) and blue (B). When the beams from each light cross, they produce the colours illustrated below. For example, when red (R) and green (G) are together the colour yellow (Y) is shown. The other colours are cyan (C), magenta (M), white (W).



The beams can be switched on (1) or off (0), and a logical circuit is controlling them.

- (a) Construct the table that represents all the possibilities for colours generated as specified in the model. [2 marks]

| R | G | B | Output |
|-----|-----|-----|-----------|
| 0 | 0 | 0 | undefined |
| 0 | 0 | 1 | B |
| ... | ... | ... | ... |
| | | | |

- (b) Simplify the Boolean expression

$$\left(\overline{(R \cdot \bar{G} \cdot B)} + \overline{(R \cdot G \cdot \bar{B})} \right) + (R \cdot \bar{G} \cdot \bar{B})$$

[4 marks]

- (c) Let E be the expression $(\bar{R} \cdot \bar{G} \cdot \bar{B})$.

- (i) Draw the circuit corresponding to the E. [2 marks]

- (ii) Explain how to obtain a circuit which is equivalent (*i.e.* it represents an expression logically equivalent to E), but that uses less logical gates. [2 marks]

17. An IT solutions company will provide a system for a major customer. The system analysis has been carried out and a feasibility report has been presented to the customer.

- (a) State **two** pieces of information that the feasibility report may contain. *[2 marks]*

The company is considering using either commercial software or customized software.

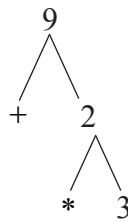
- (b) Discuss the factors that will affect their decision. *[4 marks]*

- (c) Explain why more than one cycle of analysis and design might be desirable. *[4 marks]*

18. Let E be the arithmetic expression $9 + 2 * 3$.

- (a) State the postfix representation of E. *[1 mark]*

The following tree is a possible representation of E.



- (b) Identify the traversal on the tree that would produce the expression E. *[1 mark]*

- (c) State the expression obtained by performing a post-order traversal of the tree. *[1 mark]*

- (d) Suggest an algorithm and a data structure to be used on the tree in order to produce the postfix representation of E. *[3 marks]*

- (e) Explain why binary tree traversal fits the requirements of the recursive method. *[4 marks]*

19. A network of analogue gas detectors and digital particle counters has been installed in a town. These detect the presence of different pollutants. The collected data are transmitted to a control centre, where they are processed overnight by a computer.
- (a) Define the term *analogue data*. *[1 mark]*

 - (b) Explain why it is necessary to convert the data from the gas detector from analogue to digital. *[2 marks]*

 - (c) Discuss the appropriateness of using polling for the communication of the data. *[4 marks]*

 - (d) Describe how the computer could sort the data without increasing the size of its primary memory. *[3 marks]*
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