Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Standard level
Paper 1

5 May 2023

Zone A morning | **Zone B** afternoon | **Zone C** afternoon

1 hour 30 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer all questions.
- The maximum mark for this examination paper is **[70 marks]**.

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5 pages

Section A

Answer **all** questions.

1. Outline the function of a web browser. [2]

2. State the purpose of the memory address register (MAR). [1]

3. Outline **one** reason for using Unicode to represent data in a computer system. [2]

4. (a) Identify **one** characteristic of random access memory (RAM). [1]

(b) Explain the use of cache memory. [3]

5. Construct a truth table for the logic expression [4]

A NAND (B NOR C)

6. Outline what is meant by a collection. [2]

7. Identify **two** layers in the Open Systems Interconnection (OSI) seven-layer model. [2]

8. Given the integer array `DATA`:

DATA	[0]	[1]	[2]	[3]	[4]	[5]
	7	21	5	19	6	2

and the following algorithm:

```
K = 5
A = 1
B = 0
while K >= 0
    if DATA[K] mod 2 < 1
        then
            A = A * DATA[K]
        else
            B = B + 1
    end if
    K = K - 1
end while
output(A)
output(B)
```

(a) construct a trace table for this algorithm; [4]

(b) deduce the purpose of this algorithm. [2]

9. Outline what is meant by the term “abstraction”. [2]

Section B

Answer **all** questions.

10. An organization needs to improve its current computer systems. The systems are legacy systems with a large number of end users.

(a) Identify **two** issues concerning the roles of end users that must be considered in relation to the new system. [2]

(b) Outline the meaning of the term "legacy system". [2]

(c) Identify **one** method of gathering requirements from end users. [1]

The organization needs to use existing data in the new system.

(d) Explain **one** problem that may occur during data migration. [3]

A decision needs to be made on whether to use parallel running or a direct changeover method of implementation.

(e) Explain **one** advantage of using parallel running instead of a direct changeover. [3]

(f) End users will require training in the use of the new system.

(i) Identify **one** method of training for end users. [1]

(ii) Evaluate the advantages and disadvantages for the end user of the method of training identified in (f)(i). [3]

11. Many organizations use a virtual private network (VPN) to enable employees working remotely to access files that are held on the organization's server.

(a) State **two** technologies that are required to provide a virtual private network (VPN). [2]

(b) Identify **two** factors that may affect the speed of data transmission. [2]

(c) Explain why data compression would be used when data is transmitted. [3]

A large amount of sensitive data is stored online and needs to be protected.

(d) Outline how encryption is used to protect data. [2]

(e) Describe the role of a firewall. [2]

Employees are increasingly working from home.

(f) Discuss the social impacts of this changed work pattern on employees. [4]

12. There are 1000 rooms where students can live on a college campus. The rooms are numbered from 1 to 1000. The bill for each room must be paid each month.

The room numbers of the students who have paid their bills for the month of May so far are stored in the `ROOMNUMS` array (see **Figure 1**).

Figure 1: Example data stored in the `ROOMNUMS` array

ROOMNUMS	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	2	216	15	109	156	120	93	18	21	56

For example, the bill for room number 93 has been paid. This can be seen in `ROOMNUMS[6]`.

(a) State **two** characteristics of a linear array. [2]

The campus administrator would like to check whether the student in room number `X` has paid the bill for the month of May or not.

The sub-program `check(ROOMNUMS)` accepts the array `ROOMNUMS`, allows room number `X` to be input, searches for `X` in the `ROOMNUMS` array, and outputs an appropriate message.

(b) Identify **two** types of searching algorithm. [2]

Figure 2 shows two examples of input and output for the data stored in the `ROOMNUMS` array as given in **Figure 1**.

Figure 2: Examples of input and output

Example 1	
Input:	216
Output:	"The student in room 216 has paid the bill"

Example 2	
Input:	444
Output:	"The student in room 444 has not paid the bill yet"

(c) Construct an algorithm in pseudocode for the sub-program `check()`. [5]

(d) Construct an algorithm in pseudocode to sort the `ROOMNUMS` array in **descending** order using the bubble sort algorithm. [6]