Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 1

12 November 2025

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

2 hours 10 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 **[100 marks]**.

8825 – 6404

9 pages

Section A

Answer **all** questions.

1. State **two** features of a computer language. [2]

2. State the purpose of the memory data register (MDR) within a central processing unit (CPU). [1]

3. Identify **two** characteristics of fibre-optic cables. [2]

4. Assume that integers are represented using 8 bits.

(a) The hexadecimal representation of a particular integer is 7A.

State the binary representation of this integer. [1]

(b) The binary representation of a particular integer is 00011100.

State the hexadecimal representation of this integer. [1]

5. A list of strings should be inputted in the following order:

Freesia, Clarkia, Hibiscus, Gardenia, Bergenia, Erica

and inserted in a binary tree in such a way that an inorder traversal of the binary tree visits the nodes in alphabetical order.

(a) Sketch the resulting binary tree. [3]

(b) State the number of parent nodes in this binary tree. [1]

6. Data stored on a disk can be lost due to human error.

Identify **two** causes of data loss **other than** human error. [2]

7. Outline **one** purpose of paging as an OS resource management technique. [2]

8. Construct a truth table for the following expression:

X = NOT A OR NOT B AND C [4]

9. Many homes have microprocessor-controlled alarm systems.

Describe the role of the microprocessor in a home alarm system. [3]

10. (a) State what is meant by recursion. [1]

(b) Consider the following recursive sub-program:

```
recur(N)
    output (N)
    if N > 0 then
        recur (N-1)
        output (N)
    end if
end recur
```

and the following sub-program call:

```
recur(NUMBER)
```

where `NUMBER` is an integer.

(i) State the number of times the output statement will be executed if `NUMBER` is smaller than or equal to zero. [1]

(ii) State the number of times the output statement will be executed if `NUMBER` is greater than zero. [1]

Section B

Answer **all** questions.

11. An organization replaced its local area network (LAN) with a wireless local area network (WLAN).

(a) Identify **three** hardware components of a WLAN. [3]

(b) Outline **two** advantages of a WLAN for the organization. [4]

A WLAN will introduce many cybersecurity risks.

(c) Describe **two** ways in which the organization can avoid unauthorized interception issues. [4]

The organization allows employees to connect to the network from their homes.

(d) Explain how a virtual private network (VPN) allows employees full functionality as well as secure access to the organization's network. [4]

12. A company's new computer system is being developed.

(a) The system analyst decided to use direct observation as a method of gathering data about processes that are carried out.

(i) Identify **two** advantages for the system analyst of using direct observation to gather this data. [2]

(ii) State **one** method of gathering data from end-users **other than** direct observation. [1]

(iii) Identify **two** advantages for the system analyst of using the method stated in part (a)(ii). [2]

A prototyping approach is being used to develop the new computer system.

(b) (i) Outline **one** advantage of prototyping. [2]

(ii) Outline **one** disadvantage of prototyping. [2]

The company's management is considering whether all its data will be stored locally or remotely using a cloud service.

(c) Compare and contrast local storage and cloud storage in terms of data security, cost, and accessibility. [6]

13. A student uses graphic processing software.

(a) List **three** examples of the use of graphic processing software. [3]

The student uses the secondary memory on their desktop computer to store compressed graphic files.

(b) State **one** feature of secondary memory. [1]

(c) Outline **two** limitations of using compression. [4]

The graphics card in the student's computer uses 16 bits to represent each pixel on the colour monitor.

(d) Describe how this graphics card could affect the quality of colour images that are displayed on the monitor. [3]

Over time, the student's desktop computer will become less capable of running the latest games and streaming. The student replaced the graphics card but is still not satisfied with the capabilities of the computer.

(e) Suggest **two other** hardware upgrades to improve the performance of the student's desktop computer. [4]

14. (a) List **three** features of a dynamic data structure. [3]

(b) (i) Describe the structure of a circular linked list. [3]

(ii) State **two** applications of circular linked lists in computing. [2]

(c) Stacks and queues are linear data structures.

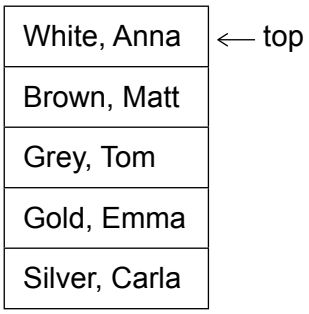
(i) Identify **two** differences between stack data structures and queue data structures. [2]

The stack `CUSTOMERS` holds the names of customers.

An algorithm is needed to remove names from the stack `CUSTOMERS` and store them in two queues.

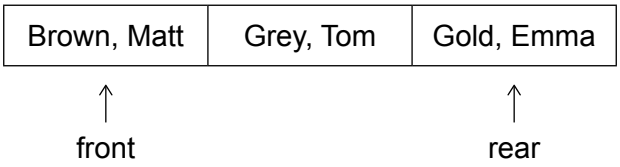
Customers' names beginning with the letters A to M (inclusive) should be stored in queue `ONE`, and customers' names beginning with the letters N to Z (inclusive) should be stored in queue `TWO`.

For example, the stack `CUSTOMERS` holds the following names:

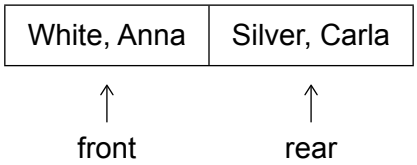


After execution of the algorithm:

- the stack `CUSTOMERS` should be empty
- queue `ONE` should be:



- queue `TWO` should be:



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(Question 14 continued)

You may assume that:

- the subprogram `firstletter(S)` is available. It accepts the string `S` and returns the first character in the string `S`. For example, `firstletter("Gold Emma")` returns the character `'G'`
- the stack `CUSTOMERS` already contains names, and queue `ONE` and queue `TWO` have been initialized.

(ii) Construct an algorithm in pseudocode to remove names from the stack `CUSTOMERS` and store them in two queues, as described.

You must use stack access methods **and** queue access methods in your response. [5]

15. A two-dimensional array is also known as a matrix.

A square matrix is a matrix with the same number of rows and columns.

Figure 1: Example data stored in four square matrices: AMAT, BMAT, CMAT, and DMAT

AMAT

	[0]	[1]	[2]	[3]	[4]
[0]	2	4	1	4	5
[1]	0	5	7	0	6
[2]	0	0	3	2	2
[3]	0	0	0	2	3
[4]	0	0	0	0	9

BMAT

	[0]	[1]	[2]	[3]
[0]	1	0	0	0
[1]	3	6	0	0
[2]	4	0	7	0
[3]	0	3	2	0

CMAT

	[0]	[1]	[2]
[0]	2	0	0
[1]	0	5	0
[2]	0	0	3

DMAT

	[0]	[1]	[2]	[3]
[0]	1	5	0	0
[1]	3	6	9	0
[2]	4	0	7	1
[3]	0	3	2	0

The main diagonal is the set of elements that run from the upper left-hand corner of the matrix to the lower right-hand corner of the matrix.

(a) State all the main diagonal elements in the matrix `DMAT` in **Figure 1**. [1]

(b) Describe the process to check whether an element of a matrix is a main diagonal element. [2]

In an upper triangular matrix, all entries below the main diagonal are 0.

The sub-program `isUpper(MAT,N)` accepts a square matrix `MAT` and an integer `N` that represents the number of rows and columns.

It returns `TRUE` if `MAT` is an upper triangular matrix; otherwise it returns `FALSE`.

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(Question 15 continued)

For example, from **Figure 1**:

`isUpper(AMAT,5)` returns `TRUE`
`isUpper(CMAT,3)` returns `TRUE`
`isUpper(DMAT,4)` returns `FALSE`
`isUpper(BMAT,4)` returns `FALSE`

(c) Construct an algorithm in pseudocode for the sub-program `isUpper(MAT,N)` as described. [7]

In a lower triangular matrix, all entries above the main diagonal are 0.

The sub-program `isLower(MAT,N)` accepts a square matrix `MAT` and an integer `N` that represents the number of rows and columns.

It returns `TRUE` if `MAT` is a lower triangular matrix; otherwise it returns `FALSE`.

For example, from **Figure 1**:

`isLower(AMAT,5)` returns `FALSE`
`isLower(CMAT,3)` returns `TRUE`

The sub-program `identify(MAT,N)` calls sub-programs `isLower(MAT,N)` and `isUpper(MAT,N)` to determine and output whether the square matrix `MAT` is:

- upper triangular
- lower triangular
- both upper and lower triangular
- none of the above.

For example, from **Figure 1**:

`identify(AMAT,5)` should output ' UPPER '
`identify(BMAT,4)` should output ' LOWER '
`identify(CMAT,3)` should output ' BOTH '
`identify(DMAT,4)` should output ' NONE '

(d) Construct an algorithm in pseudocode for the sub-program `identify(MAT,N)` as described. [5]