Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 1

30 April 2026

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

2 hours 10 minutes

Instructions to students

- 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]**.

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Section A

Answer **all** questions.

1. Identify **three** characteristics to consider when comparing different types of computers. [3]

2. Identify **two** resources that can be shared on a local area network (LAN). [2]

3. State the purpose of the stack access method `pop()`. [1]

4. State the purpose of the stack access method `isEmpty()`. [1]

5. Describe how colours are represented in a computer. [3]

6. A truth table with three inputs (A, B and C) and one output (OUT) needs to be constructed.

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A combination of the three inputs (A, B and C) represents a binary number.

For example:

A = 1, B = 0 and C = 1 represent the binary number $101_{(2)}$.

The decimal equivalent of $101_{(2)}$ is $5_{(10)}$.

The output, OUT, should be 1 if either of the following occur:

- The binary number, represented by the combination of three inputs, has an odd number of 1s.
- The decimal equivalent of the binary number, represented by the combination of three inputs, is odd.

Otherwise, the output, OUT, is 0.

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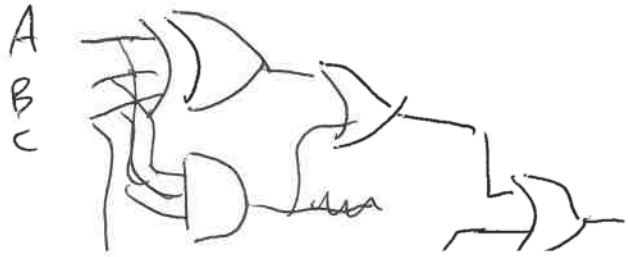
Construct the truth table as described. Note that zero (0) is an even number. [4]

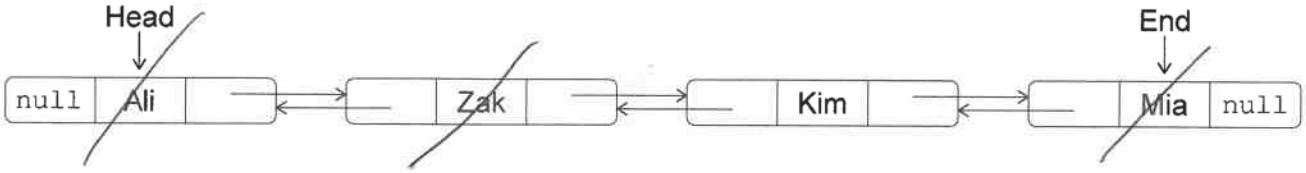
A B C
0 0 1
0 1 0
1 0 0
1 1 1

A
B
C

Application
Presentation
Session
Transport
Network
Data link
Physical



7. Consider the following doubly linked list:



Four operations are performed on this doubly linked list in the following order:

- The node containing the name Zak is deleted from the doubly linked list.
- The first node is deleted from the doubly linked list.
- The last node is deleted from the doubly linked list.
- A new node containing the name Ben is inserted at the beginning of the doubly linked list.

Sketch the resulting doubly linked list. [4]

8. (a) Define the term *protocol*. [1]

(b) List **three** reasons why protocols are necessary in computer networks. [3]

9. State **one** computer program that translates code written in a high-level language into machine-readable code. [1]

10. Outline what is meant by debugging. [2]

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Section B

Answer **all** questions.

11. A prototype for a company's new computer system has been developed.

(a) State **two** reasons why the company might not proceed with the new system after evaluating the prototype. [2]

After the prototype is evaluated and revised, the company decides to implement the new system, which is run in parallel with the old system.

(b) Evaluate parallel running as part of a system installation process. [4]

The company wants to promote its services on the World Wide Web and using email to communicate with customers. To target its promotion effectively, the company has asked every customer to provide their name, email address, home address and date of birth.

(c) (i) List **three** threats to the security of the data collected by the company. [3]

(ii) State the purpose of an email server. [1]

(iii) State **two** benefits of using email for communication among employees. [2]

(iv) Explain the need for encryption in email communication. [3]

12. (a) (i) Distinguish between primary memory and secondary memory. [3]

(ii) Outline **two** functions of an operating system (OS) in managing primary memory. [4]

(b) A control unit (CU), an arithmetic logic unit (ALU), registers, cache memory and buses are some components of a central processing unit (CPU) that work together to execute the machine instructions.

(i) State the role of the memory data register (MDR). [1]

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

(iii) Explain the role of buses in CPU operations. [4]

13. (a) A taxi meter calculates fares based on distance and time.

During a trip, the taxi meter displays the fare in real time for the passengers. A preset rate for the fare is applied, and the driver inputs extra charges for luggage, trips on national holidays, or tolls.

(i) Identify **two** input devices that could be used to collect the data needed to calculate the fare. [2]

(ii) Describe the use of a microprocessor in a taxi meter. [3]

(b) Taxi companies use global positioning system (GPS)-enabled taxi apps on drivers' and passengers' smartphones to measure the distance of a trip and calculate the fare.

(i) Explain how GPS works. [6]

(ii) State **two** benefits of a GPS-enabled taxi app for passengers. [2]

(iii) State **two** benefits of a GPS-enabled taxi app for taxi drivers. [2]

14. A program has been developed for an embedded system with limited data storage capacity.

Program execution time and memory usage should be planned precisely.

(a) Outline **two** disadvantages of using a dynamic data structure in this program. [4]

The static integer array, `A`, containing eight elements, has been initialized (see **Figure 1**).

Figure 1: Example data held in the static integer array `A`

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]
9	8	7	4	1	2	1	3

The following recursive sub-program has been constructed:

```
rec (M, A)
    if M >= 3
        then return A[M] * rec(M-1, A)
        else return 1
    end if
end rec
```

(b) Determine the value of `rec(7, A)`. Show all your working. [5]

The sub-program `isThere(X, ARR)` needs to be written. It accepts an integer, `X`, and the array of integers `ARR` sorted in ascending order.

An iterative binary search must be used in the sub-program to check whether `X` is contained in the array `ARR` or not. The sub-program `isThere(X, ARR)` should return `TRUE` if `X` is contained in the array `ARR`; otherwise, it should return `FALSE`.

For example, if the array `ARR` holds the following data:

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

then:

- `isThere(7, ARR)` should return `TRUE`.
- `isThere(1, ARR)` should return `FALSE`.

(c) Construct an algorithm in pseudocode for the sub-program `isThere(X, ARR)` as described. [6]

15. A music college holds a range of concerts.

There are three types of tickets for these music events, and each type has its own price (see **Figure 2**).

Figure 2: Types and prices of music event tickets

Ticket type	Description	Price
A	General admission	15
B	Faculty, staff, alumni, senior citizens	10
C	Students	5

The college has a 200-seat concert hall. There are 20 rows, each with 10 seats.

The static two-dimensional char array `CONCERT` stores data about the types of tickets sold for one concert (see **Figure 3**).

929 The characters A, B and C represent the type of ticket sold for each seat.

The character X shows that a ticket has not been sold for that seat.

Figure 3: An excerpt from the two-dimensional char array `CONCERT`

	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[0]	A	A	A	C	B	B	A	C	C	A
[1]	X	X	A	A	C	C	A	A	A	B
[2]	A	C	C	C	C	C	A	A	B	X
...	...									
[19]	C	X	X	X	B	B	B	X	A	X

A000 For example:

- `CONCERT[19][0] = 'C'` shows that a student ticket has been sold for the first seat in the last row of the concert hall.
- `CONCERT[2][9] = 'X'` shows that no ticket has been sold for the last seat in the third row of the concert hall.

(a) Outline **two** reasons why a static two-dimensional char array is a suitable data structure to hold this data. [4]

(This question continues on the following page)

(Question 15 continued)

A program that analyses the ticket sales data has many sub-programs.

The sub-program `student(CONCERT, ROW)` accepts the two-dimensional char array `CONCERT` and an integer, `ROW`, which represents the row index value. It outputs the number of student tickets sold in that row.

For example, from **Figure 3**:

- `student(CONCERT, 0)` outputs `3`.
- `student(CONCERT, 1)` outputs `2`.

(b) Construct an algorithm in pseudocode for the sub-program `student(CONCERT, ROW)` as described. [4]

The sub-program `revenue(CONCERT)` accepts the two-dimensional char array `CONCERT` and outputs the total amount of money from the sale of tickets for a concert.

(c) Construct an algorithm in pseudocode for the sub-program `revenue(CONCERT)` as described. [7]