



# Cambridge International AS & A Level

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## COMPUTER SCIENCE

9618/23

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 2025

2 hours

You must answer on the question paper.

You will need: Insert (enclosed)

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

### INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.
- The insert contains all the resources referred to in the questions.

This document has **20** pages. Any blank pages are indicated.



Refer to the **insert** for the list of pseudocode functions and operators.

1 A program is being developed for the management of a sports centre.

(a) The programmer developing the software decides to use modules (procedures or functions) and local variables. They also decide not to use global variables.

(i) State **two** reasons why the programmer decides to use modules.

1 .....

.....

2 .....

.....

[2]

(ii) State **one** difference between local and global variables.

.....

..... [1]

(iii) State **two** benefits of using local variables.

1 .....

.....

2 .....

.....

[2]

(b) The pseudocode design contains a number of expressions.

Complete each pseudocode expression so that it evaluates to the value shown.

Refer to the **insert** for the list of pseudocode functions and operators.

| Expression                                      | Evaluates to |
|-------------------------------------------------|--------------|
| ..... (68)                                      | 'D'          |
| ..... (04/02/2025)                              | 2            |
| .....TRUE                                       | FALSE        |
| ..... (..... ("Court1.4Upper" , ..... , .....)) | 1.4          |

[5]





- (c) The table lists some of the variables used in the program.

Complete the table by writing the most appropriate data type for each variable.

| Variable         | Use of variable                                                                                            | Data type |
|------------------|------------------------------------------------------------------------------------------------------------|-----------|
| MemberCount      | stores how many members have used the sports centre each day                                               |           |
| TotalTakings     | stores the total amount of money taken each day                                                            |           |
| BookingConfirmed | stores the state of a booking for an exercise class; a booking is either confirmed or <b>not</b> confirmed |           |
| MemberDOB        | to calculate when to send an email with a birthday message to a member                                     |           |

[4]



- 2 A programmer uses a number of Abstract Data Types (ADT) in the programs that she is developing.

- (a) A stack using memory locations 400 to 409 is used in one program.

The diagram represents the current state of the stack.

A variable `TopOfStack` pointer indicates the last value added to the stack.

**Stack**

| Memory location | Value                         |
|-----------------|-------------------------------|
| 409             |                               |
| 408             |                               |
| 407             |                               |
| 406             |                               |
| 405             |                               |
| 404             |                               |
| 403             | 'P' ← <code>TopOfStack</code> |
| 402             | 'X'                           |
| 401             | 'D'                           |
| 400             | 'B'                           |

- (i) Complete the answer column in the following table:

|                                                                                                                          | Answer |
|--------------------------------------------------------------------------------------------------------------------------|--------|
| the memory location of the value that has been on the stack for the longest time                                         |        |
| the number of consecutive <b>push</b> operations that will result in the <code>TopOfStack</code> variable containing 409 |        |

[2]





(ii) The diagram shows the current state of the stack.

| Stack           |                  |
|-----------------|------------------|
| Memory location | Value            |
| 409             |                  |
| 408             |                  |
| 407             | 'A' ← TopOfStack |
| 406             | 'C'              |
| 405             | 'F'              |
| 404             | 'K'              |
| 403             | 'B'              |
| 402             | 'S'              |
| 401             | 'R'              |
| 400             | 'D'              |

The following sequence of operations are performed:

PUSH 'T'  
 POP  
 POP  
 PUSH 'Z'  
 PUSH 'X'  
 POP  
 PUSH 'Y'

Complete the following diagram to show the state of the stack after the operations have been performed.

| Stack           |       |
|-----------------|-------|
| Memory location | Value |
| 409             |       |
| 408             |       |
| 407             |       |
| 406             |       |
| 405             |       |
| 404             |       |
| 403             |       |
| 402             |       |
| 401             |       |
| 400             |       |





- (b) In a different program, the programmer decides to implement a linked list using an array of records.

- (i) The array is represented in the diagram.

A pointer value of  $-1$  indicates the end of the linked list.

Complete the pointer field to produce a linked list that is in alphabetical order.

| Index | Data      | Pointer |
|-------|-----------|---------|
| 0     | "Neptune" |         |
| 1     | "Jupiter" |         |
| 2     | "Saturn"  |         |
| 3     | "Earth"   |         |
| 4     | "Mercury" |         |
| 5     | "Uranus"  |         |

[3]

- (ii) The variable `StartPointer` contains the index of the first item in the linked list.

State the value of the variable `StartPointer`

..... [1]

- (c) A third program is also being created to manage a queue.

Describe **two** features of a queue.

Feature one .....

.....

Feature two .....

.....

[2]





The module will:

step 2 – simulate **one** roll of the dice by generating a random integer between 1 and 6 inclusive

step 4 – repeat, as required from **step 2**

step 6 – return the average value.

..... [7]

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| File line number | File data |
|------------------|-----------|
| 1                | "350"     |
| 2                | "502"     |
| 3                | "434"     |
| ...              | ...       |
| 49               | "492"     |
| 50               | "872"     |
| 51               | "772"     |
| 52               | "201"     |

The owner requires a module to output all week numbers where the number of items sold is greater than 500.

Do **not** include pseudocode statements in your answer.

[5]



(b) Once the program has been completed, it is tested using the walkthrough method.

Describe the walkthrough method and explain how it can be used to identify errors.

.....

.....

.....

.....

.....

.....

.....

..... [3]



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| Parameter    | String returned        | Explanation                                                                                                                                |
|--------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| "0010010110" | "0010010110 <b>0</b> " | there are an even number of 1s in the string passed to <code>Parity()</code> so a '0' is concatenated to the end of <code>BitString</code> |
| "101010"     | "101010 <b>1</b> "     | there are an odd number of 1s in the string passed to <code>Parity()</code> so a '1' is concatenated to the end of <code>BitString</code>  |

Assume the parameter `BitString` can only contain the characters '0' and '1'

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page, providing a template for handwriting practice or general writing. There are no margins, text, or other markings on the page.



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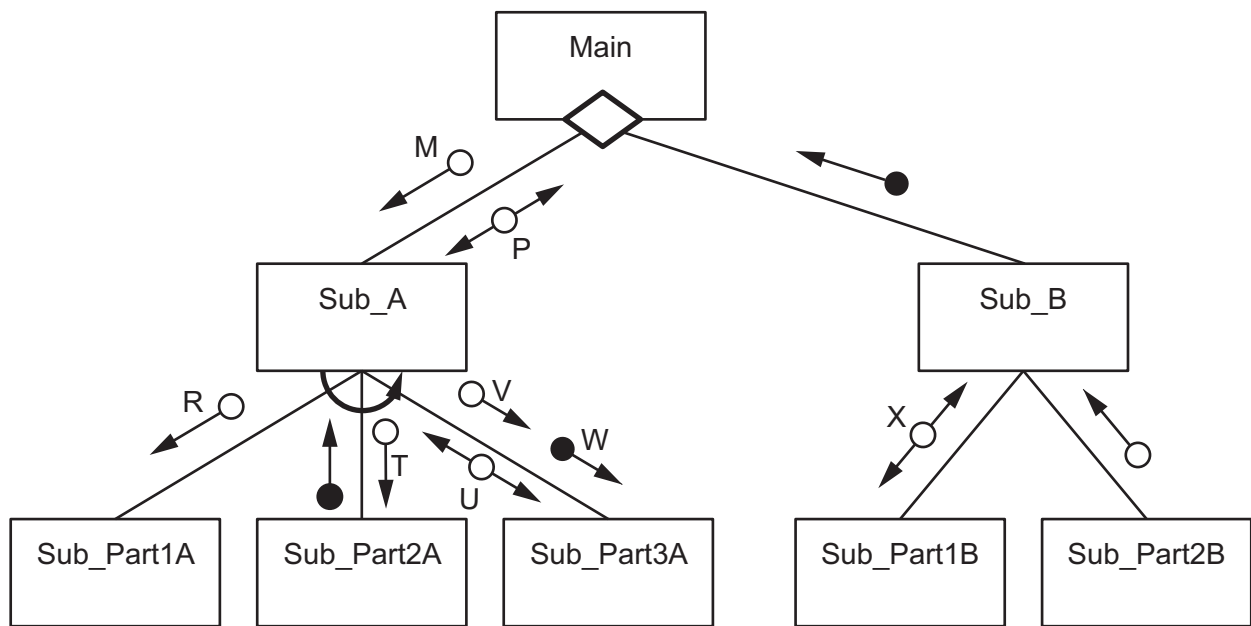
.....

..... [8]





6 Study the structure chart:



Some of the parameter data types are:

- R and V are of type `INTEGER`
- T is of type `REAL`
- U is of type `STRING`
- W is of type `BOOLEAN`.

Some of the modules in the structure chart are functions, others are procedures.

(a) Explain **one** difference between functions and procedures.

.....  
 ..... [1]

(b) Write the pseudocode to define the module headers:

Sub\_Part1A

.....  
 .....

Sub\_Part2A

.....  
 .....

Sub\_Part3A

.....  
 .....





(c) The structure chart uses the two symbols shown.

Complete the table to explain what each symbol means and how the relevant modules in the structure chart are affected.

| Symbol                                                                            | Explanation                                  |
|-----------------------------------------------------------------------------------|----------------------------------------------|
|  | <div><div></div><div></div><div></div></div> |
|  | <div><div></div><div></div><div></div></div> |

[3]



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| Module        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UpdateVisit() | <ul style="list-style-type: none"> <li>called with two parameters:               <ol style="list-style-type: none"> <li>loyalty points of type <code>INTEGER</code></li> <li>last visit date of type <code>DATE</code></li> </ol> </li> <li>change the loyalty points:               <ul style="list-style-type: none"> <li>increase by <b>four</b> if the last visit date and the current date are in the same month</li> <li>otherwise increase by <b>one</b></li> </ul> </li> <li>change the last visit date to the current date</li> <li>the changed values must be available to the code that follows the call to <code>UpdateVisit()</code></li> </ul> |

Assume the customer has made at least **one** previous visit.

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

[5]



- (ii) The programmer decides to amend the `UpdateVisit()` module so that loyalty points are further increased if the customer visits the coffee shop the same day of the week as their last visit.

Write the pseudocode for this condition.

.....

..... [1]





(b) A text file `Loyalty.txt` will be used to store the data items for the loyalty scheme.

The text file `Loyalty.txt` contains only one line of data for each customer.

Each data item is separated by a comma:

`<CustomerID>,<LoyaltyPointsString>,<LastVisitDateString>`

`LastVisitDateString` is always eight characters in length in the format: DDMMYYYY.

An example of how a line of data will be stored in the text file `Loyalty.txt` is:

`"100123,132,05032025"`

This example shows that the customer with an ID of 100123 had 132 loyalty points following their last visit to the coffee shop on 05/03/2025.

If a customer visits the coffee shop on a Monday, the value of their loyalty points is increased by 10.

The programmer has defined **two** more program modules:

| Module                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>FindCustomer()</code><br>(is already written) | <ul style="list-style-type: none"><li>called with a parameter of type <code>STRING</code> that represents a customer ID</li><li>returns the line of data read from the text file <code>Loyalty.txt</code> containing the data items for that customer</li></ul>                                                                                                                                                                                             |
| <code>MondayCheck()</code>                          | <ul style="list-style-type: none"><li>called with a parameter of type <code>STRING</code> that represents the customer ID of a customer</li><li>calls <code>FindCustomer()</code></li><li>extracts the loyalty points from the string returned by <code>FindCustomer()</code></li><li>increases the loyalty points for the current customer by 10 if the day visited is a Monday</li><li>returns an integer value representing the loyalty points</li></ul> |





The module `FindCustomer()` must be used and assume it returns a valid string for the current customer.

[8]



(ii) A date is stored in `LastVisitDateString` in the format:

DDMMYYYY

DD is a 2-digit string

MM is a 2-digit string

YYYY is a 4-digit string.

For example, the date 03/09/2024 is stored as "03092024"

An algorithm is needed to convert the string stored in `LastVisitDateString` to data type `DATE` which is then stored in the variable `LastVisitDate`.

Complete the pseudocode for this algorithm:

Assume that `LastVisitDateString` has been declared and contains valid data.

```
DECLARE DayInt, MonthInt, YearInt : INTEGER
```

```
DECLARE LastVisitDate : DATE
```

.....

.....

.....

.....

.....

.....

.....

.....

[4]





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