Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9618/31**

Paper 3 Advanced Theory **October/November 2025**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

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.

This document has **12** pages. Any blank pages are indicated.

[Turn over

1 The composite record data type, `ClubMember`, is defined in pseudocode as:

```
TYPE ClubMember
  DECLARE Code : INTEGER
  DECLARE LastName : STRING
  DECLARE FirstName : STRING
  DECLARE Telephone : STRING
  DECLARE JoinDate : DATE
  DECLARE Fees : REAL
  DECLARE FeesPaid : BOOLEAN
ENDTYPE
```

(a) (i) Write the **pseudocode** statement to set up a variable for one record of the composite data type, `ClubMember`.

.....

..... [1]

(ii) Write the **pseudocode** statements to assign the following values to the variable set up in part **(a)(i)**:

- `984632` to `Code`
- `TRUE` to `FeesPaid`

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..... [2]

(b) An enumerated data type, `Activity`, is required, so that a new field, `Choice`, can be added to the composite data type, `ClubMember`, to allow members to choose an activity.

(i) Write the **pseudocode** statement for the type declaration of `Activity` to hold the names of the available activities:

Badminton, Football, Golf, Snooker, Swimming, Tennis.

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..... [2]

(ii) Write the **new pseudocode** statement required to update the declaration of `Choice` in the definition of `ClubMember`.

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..... [1]

2 Numbers are stored in a computer system using binary floating-point representation with:

- 12 bits for the mantissa
- 4 bits for the exponent
- two's complement form for both the mantissa and the exponent.

(a) Write the normalised floating-point representation of the following positive binary number using this system.

0.00000001110101101

Mantissa **Exponent**

[2]

(b) Calculate the normalised binary floating-point representation of –76.1875 in this system. Show your working.

Mantissa **Exponent**

Working .....

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[4]

3 **(a)** Explain why protocols are essential for communication between computer systems.

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..... [2]

(b) POP3 is an email communication protocol.

Identify and describe **two** other communication protocols that are used when sending or receiving emails.

Protocol 1 .....

Description .....

.....

.....

Protocol 2 .....

Description .....

.....

.....

[4]

(c) Describe **two** ways in which packet switching ensures a complete message is received when passing messages across a network.

1 .....

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2 .....

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[4]

4 **(a)** A scheduling routine determines how processes are managed by the operating system.

Identify **two** scheduling routines.

1 .....

2 .....

[2]

(b) Describe **two** ways in which the complexities of the computer hardware are hidden from the user.

1 .....

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2 .....

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[4]

5 **(a)** Identify **two** items commonly found within a digital certificate.

1 .....

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2 .....

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[2]

(b) Explain why a digital certificate is required to validate a digital signature.

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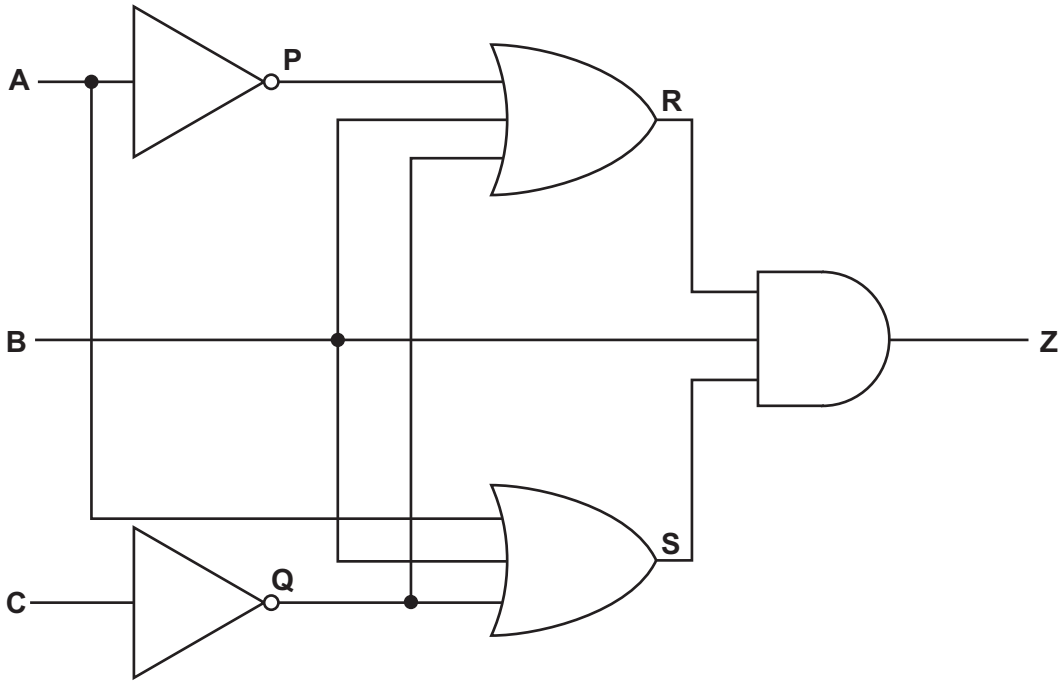
..... [3]

6 **(a)** The diagram shows a logic circuit.



Complete the truth table for the given logic circuit.
Show your working.

			Working space				
A	**B**	**C**	**P**	**Q**	**R**	**S**	**Z**
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

[3]

(b) **(i)** Complete the Karnaugh map (K-map) for the Boolean expression:

$\overline{A}.B.C + \overline{A}.B.\overline{C} + A.\overline{B}.C + A.B.\overline{C}$

A \ BC	00	01	11	10
0				
1				

[2]

(ii) Draw loop(s) around appropriate group(s) in the K-map to produce an optimal sum-of-products.

[2]

(iii) Write the Boolean expression from your answer to part **b(ii)** as a simplified sum-of-products. Do **not** carry out any further simplification.

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..... [2]

7 **(a)** Identify **one** Artificial Intelligence (AI) algorithm to find the shortest distance between two points on a graph.

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..... [1]

(b) Describe Deep Learning.

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..... [5]

8 **(a)** Outline the purpose of lexical analysis during the compilation of a program.

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..... [2]

(b) Write the Reverse Polish Notation (RPN) for the given infix expression:

```
(2 - 6) * (13 + 7) / 5
```

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..... [2]

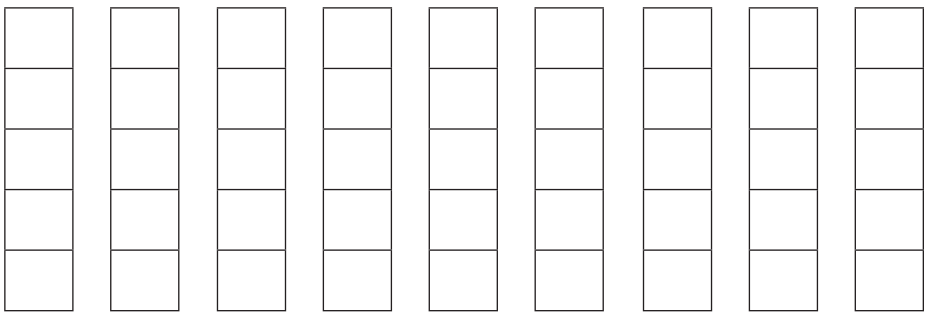
(c) The RPN expression:

```
d a b + * c a - /
```

is to be evaluated, where:

`a = 6`, `b = 12`, `c = 15` and `d = 5`.

Show the changing contents of the stack as the RPN expression is evaluated.



[4]

9 **(a)** A stack has been implemented using pseudocode to store a maximum of 100 string items using the global variables in the following table:

Identifier	Data type	Description	Initialisation value
`Base`	`INTEGER`	pointer for the bottom of the stack	`0`
`Top`	`INTEGER`	pointer for the top of the stack	`-1`
`StackArray`	`STRING`	1D array to implement the stack	`[0:99]`
`Max`	`INTEGER`	maximum number of items in the stack	`100`

The value of `Top` is incremented each time a data item is added to the stack and decremented every time a data item is removed.

(i) Complete the **pseudocode** for the function to remove a data item from the stack.

```
FUNCTION Pop() .....
   DECLARE DataItem : STRING
   DataItem ← ""

   IF ..... THEN

      DataItem ← .....

      Top ← .....
   ELSE
      DataItem ← "You cannot remove data; the stack is empty"
   ENDIF

   .....
ENDFUNCTION
```

[5]

(ii) Write the **pseudocode** to output the data item removed from the stack with an appropriate message.

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..... [1]

(b) A stack is used to implement recursion.

State the **three** essential features of recursion.

1 .....

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2 .....

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3 .....

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[3]

10 Explain what is meant by **exception handling**.
Include an example of a possible cause of an exception in your answer.

Explanation .....

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Example .....

[3]

11 The table shows assembly language instructions for a processor that has one register, the Accumulator (ACC).

Label	Instruction		Explanation
	Opcode	Operand	
	LDM	#n	Load the number n to ACC
	LDD	<address>	Load the contents of the location at the given address to the ACC
	LDI	<address>	The address to be used is at the given address. Load the contents of this second address to the ACC
	ADD	<address>	Add the contents of the given address to the ACC
	SUB	<address>	Subtract the contents of the given address from the ACC
	STO	<address>	Store the contents of the ACC at the given address
<label>:		<data>	Gives a symbolic address <label> to the memory location with contents <data>
# denotes a denary number, e.g. #123 <label> can be used in place of <address>			

(a) Write **assembly language** code, using **only** the given instruction set to:

- store the denary value `100` as a named constant
- subtract the constant from the value contained in address 632
- store the result in variable `Answer`.

Show the initialisation of the constant and `Answer` in the table provided.

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Label	Contents

[6]

(b) The address 632 contains the value `45`.

State the value of `Answer` after the code described in part **(a)** has executed.

..... [1]

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