CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9618/33**

Paper 3 Advanced Theory **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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 **16** pages. Any blank pages are indicated.

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[Turn over

1 **(a)** User-defined data types may be created by programmers when writing software.

Explain the reasons why user-defined data types are needed.

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..... [3]

(b) Write the pseudocode statement to declare a non-composite data type, `Fibonacci`, that holds the following numbers:

0, 1, 2, 3, 5, 8, 13, 21

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..... [2]

2 Complete the following paragraph using the most appropriate words from the given list.

Some words are **not** used.

adjacent	**Application**	**BitTorrent**	**corresponding**
Internet	**layer**	**Link**	**lower**
protocol	**route**	**Transport**	**upper**

The implementation of a ..... suite can be viewed as a stack. Each ..... of the stack has its own specific functionality and can only communicate with ..... layers of the stack. User interaction is associated with the highest level of the stack, which is the ..... layer. [4]

3 **(a)** State **one** example of where serial file organisation could be used.

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..... [1]

(b) Describe how records are organised in serial files.

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..... [2]

(c) Outline the process that is used to find a record in a serial file.

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..... [3]

4 **(a)** Describe the characteristics of massively parallel computers.

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..... [3]

(b) State **one** difference and **one** similarity between the SIMD and MISD computer architectures.

difference .....

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similarity .....

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[2]

5 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) Calculate the normalised binary floating-point representation of –18.5625 in this system.

Show your working.

mantissa												exponent			

working .....

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[4]

(b) Explain the problem that would occur if the two binary floating-point numbers representing the denary numbers 91.5 and 123.25 were added together and the result stored in the given system.

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..... [3]

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6 **(a)** The Karnaugh map (K-map) represents a logic circuit with four inputs.

CD \ AB	00	01	11	10
00	0	1	1	0
01	0	1	0	0
11	0	1	0	0
10	0	1	1	0

(i) Draw loop(s) around appropriate group(s) in the K-map to produce an optimal sum-of-products. [2]

(ii) Write the Boolean expression from your answer to **6(a)(i)** as a simplified sum-of-products. Do **not** carry out any further simplification.

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..... [2]

(iii) Write the Boolean expression from your answer to **6(a)(ii)** in its simplest form by using Boolean algebra to simplify it.

..... [1]

(b) Simplify the following expression using De Morgan's laws and Boolean algebra.

Show all the stages in your simplification.

$\mathbf{X = \overline{A + B + C} + \overline{B + C}}$

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..... [3]

7 **(a)** Outline the process of using a stack to evaluate an expression written using Reverse Polish Notation (RPN).

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..... [3]

(b) Write the following infix expression in RPN.

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((18 – 15 + 3) * 5) / 12
```

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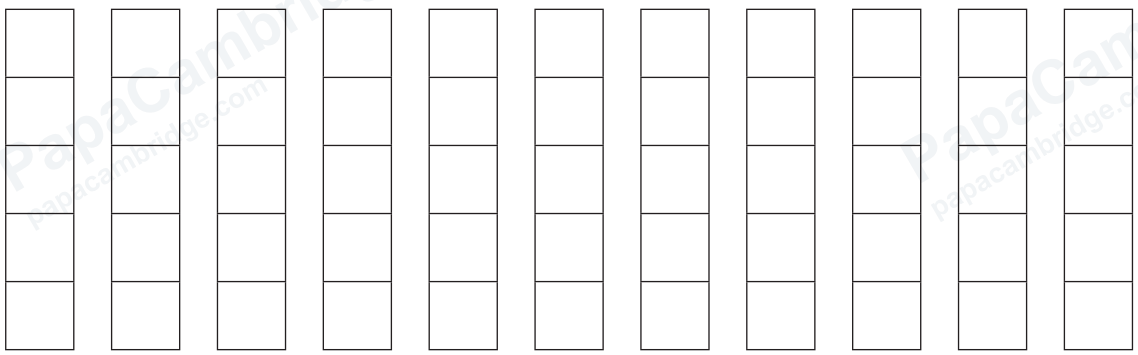
..... [2]

(c) The RPN expression

```
16  3 * 36  6 / 18  6 – * +
```

is to be evaluated.

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



[4]

8 **(a)** Describe the purpose of quantum cryptography.

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..... [2]

(b) Outline **two** benefits and **two** drawbacks of quantum cryptography.

benefit 1 .....

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benefit 2 .....

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drawback 1 .....

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drawback 2 .....

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..... [4]

9 **(a)** Explain what is meant by regression methods in relation to machine learning.

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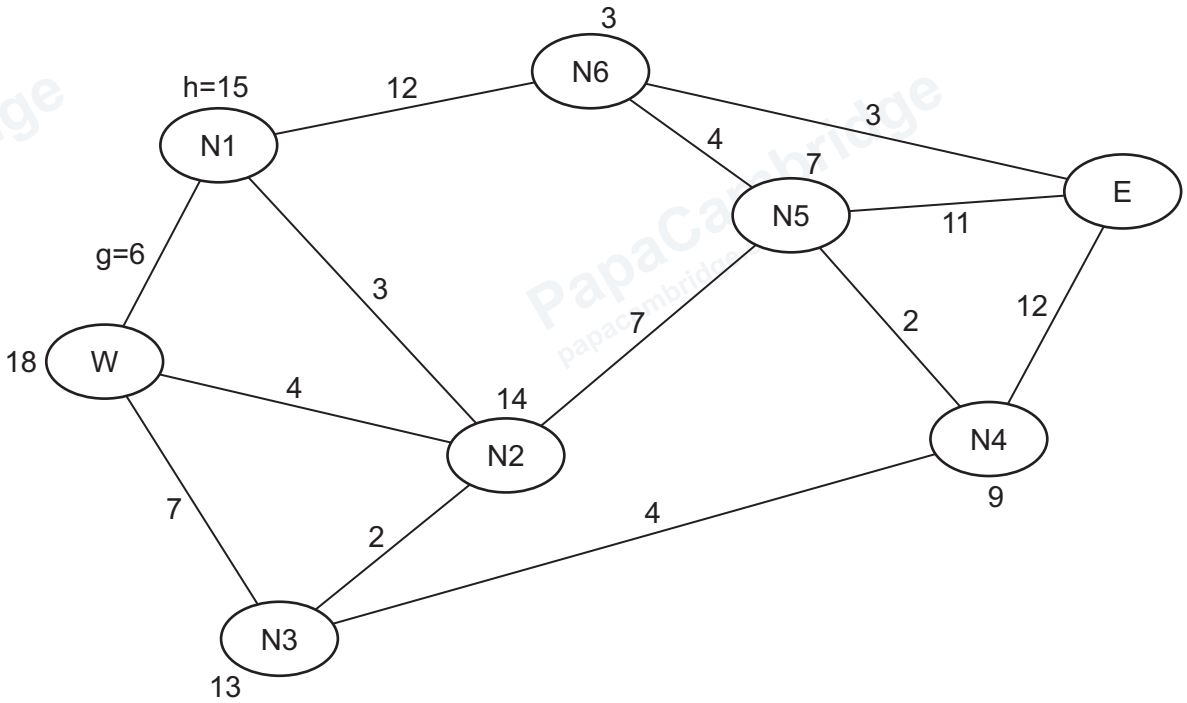
..... [3]

(b) The A* algorithm is used to perform searches on a graph.

Calculate the best path between the W and E nodes on the following diagram using the A* algorithm.

Show your working in the table provided.
The first two rows have been done for you.



current path	destination node	cost of current path (g)	heuristic (h)	total (f = g + h)
W	W	0	18	18
W	N1	6	15	21

final path	

[5]

10 (a) A program declares a 1D array globally as `PartName[1:1000000] OF STRING`, and sorts its contents in ascending alphabetical order. The function `PartSearch` performs a binary search on the array. The item to be found is passed as a parameter. If it is found, its location in the array is returned, otherwise, –1 is returned.

(i) Complete the following table to define the variables used in the function.

identifier	data type	description
`Left`		
`Right`		
`Mid`		
`Target`		

[2]

(ii) Complete the pseudocode for the function to perform a binary search on `PartName` using all the variables from the table in **10(a)(i)**.

Some lines may be left blank.

```
FUNCTION PartSearch(.....
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.....
ENDFUNCTION
```

[5]

(b) Describe how the time efficiency of a binary search changes as the number of items in the search list increases. Refer to Big O notation in your answer.

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..... [2]

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

The current contents of memory are:

address	data
232	120
580	26

(a) Use **only** the given instruction set to write assembly language code to:

- store the denary value `325` in labelled variable `A`
- store the value from location `232` in labelled variable `B`
- subtract the value `50` from the value stored in variable `B`
- store the current value in the accumulator in location `875`
- add the value stored in location `580` to the value stored in variable `A`
- subtract the value stored in location `875` from the current value in the accumulator
- store the result in variable `Final`.

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..... [5]

(b) Show the values of the variables `A`, `B` and `Final` from **11(a)** in the following table, after the code has been run:

label	data
A:	
B:	
Final:	

[3]

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