Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9618/33**

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 **(a)** An enumerated data type, `Spectrum`, is required to hold the names of colours.

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

Red, Orange, Yellow, Green, Blue, Indigo, Violet.

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..... [2]

(ii) Identify **two** characteristics of the list of values given in an enumerated data type declaration.

1 .....

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2 .....

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[2]

(b) `ColourData` is a composite data type to store definitions of colours.

Write **pseudocode** statements to declare `ColourData` to hold the following fields:

Field	Example data
ColourCode	`XYZ12345`
Colour	`Red`
Wavelength	`650`
Frequency	`4.62`
PrimaryColour	`Yes`

Use the most appropriate data type in each case, including the enumerated data type `Spectrum` from part **a(i)**.

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..... [4]

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
- 2 bytes in total.

(a) Outline the effect of changing the number of bits used to store the mantissa to 10 bits, in this system.

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(b) Describe **one** example of a situation that could cause an overflow to occur and the consequences of such an overflow.

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3 Describe how packet switching is used to pass messages across a network. Do **not** include checking for completeness and resending packets in your answer.

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4 Identify **and** describe **three** protocols that are used in the Application Layer of the TCP/IP protocol suite.

Protocol 1 .....

Description .....

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Protocol 2 .....

Description .....

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Protocol 3 .....

Description .....

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..... [6]

5 **(a)** State the purpose of multi-tasking.

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..... [1]

(b) Explain how an operating system ensures that multi-tasking operates efficiently.

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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	0	0	0
01	1	1	1	0
11	0	1	1	1
10	0	0	1	1

(i) Draw loop(s) around appropriate group(s) in the K-map to produce an optimal sum-of-products. [3]

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

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..... [2]

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

Show all the stages in your simplification.

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

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7 **(a)** Outline the process of optimisation during the compilation of a program.

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

((6 + 12) / (16 – 10)) * 18

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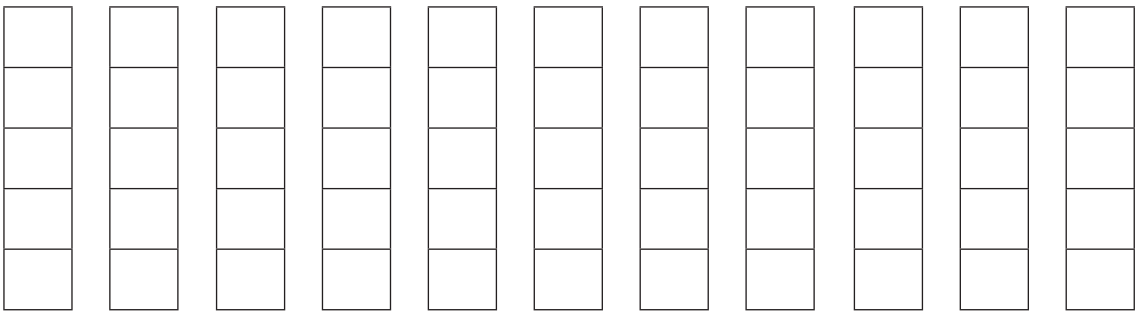
(c) The RPN expression

`c a – b d + * b c + /`

is to be evaluated, where:

`a = 4`, `b = 12`, `c = 24` and `d = 6`.

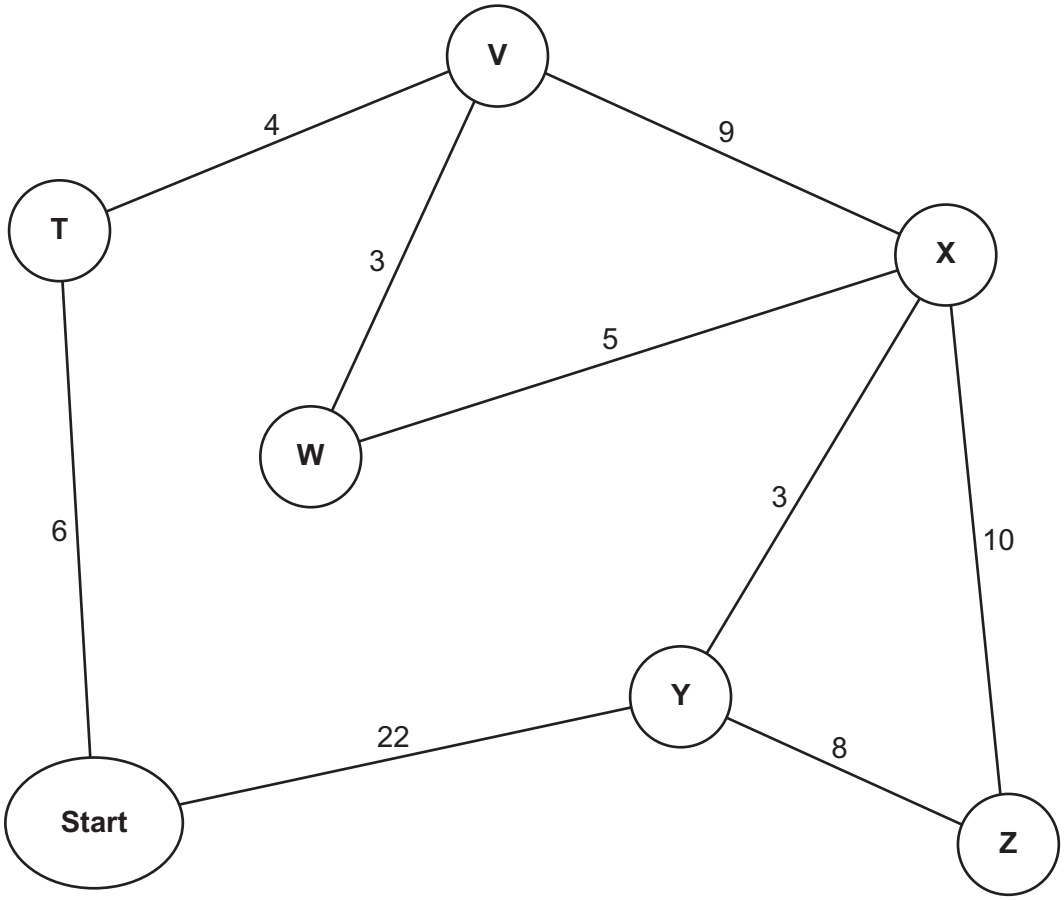
Show the changing contents of the stack as the RPN expression is evaluated.



[4]

8 Calculate the shortest distance between the **Start** node and each of the nodes in the graph using Dijkstra's algorithm.

Show your working on the graph **or** in the working space. Write your answers in the table provided.



Working .....

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Answers:

T	V	W	X	Y	Z

[5]

9 A company requires a digital certificate to ensure the authenticity of its online communications.

Outline the process followed to acquire a digital certificate.

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10 A stack, `StackArray`, is to be implemented using pseudocode, to store a maximum of 100 string items in an appropriate array. Declarations are required so that the stack has a beginning, an end and a maximum size. An array is also required to store the data.

(a) Write **pseudocode** to declare the variables, constant and array required to implement the stack.

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(b) Write **pseudocode** for a procedure to initialise the top and bottom pointers of the stack to appropriate values.

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11 Describe when the use of recursion would be beneficial **and** give an example.

Description .....

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Example .....

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[3]

12 An exception can occur when running a program.

(a) Explain what is meant by an exception.

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(b) Identify **one** example of an exception and give **one** reason why the exception may cause a problem.

Example .....

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Reason .....

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[2]

13 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 the 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
	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 the 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	Contents
563	125
899	63

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

- store the denary value `250` as labelled variable `X`
- store the value stored in location 563 as labelled variable `Y`
- add the value stored in variable `X` to the value stored in variable `Y`
- subtract the value stored in location 899 from the current value in the Accumulator
- store the result in variable `Total`.

Show the initialisation and values of the variables `X`, `Y` and `Total` in the table provided.

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Label	Content

[7]

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