Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4971703617

COMPUTER SCIENCE **9618/32**

Paper 3 Advanced Theory **May/June 2024**

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.

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1 **(a)** Describe the effect of changing the allocation of bits used for the mantissa and for the exponent in a floating-point number with a fixed total number of bits.

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..... [2]

(b) Real numbers are stored in a computer, using floating-point representation with:

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

Calculate the normalised floating-point representation of +54.8125 in this system.

Show your working.

Mantissa												Exponent			

Working .....

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..... [3]

2 **(a)** Outline why protocols are essential for communication between computers.

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..... [2]

(b) State the names of **two** different protocols associated with the sending and receiving of emails between computers.

Sending .....

Receiving .....
[2]

(c) Explain the meaning of the phrase:

BitTorrent protocol provides peer-to-peer file sharing.

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..... [3]

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[Turn over

3 **(a)** Explain what is meant by the term **non-composite data type** and give an example of a non-composite data type.

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Example .....
[3]

(b) Write **pseudocode** statements to declare the set data type `EvenNumbers` to hold this set of even numbers between 2 and 12:

2, 4, 6, 8, 10, 12

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..... [4]

4 Sheila has a customer called Fred. Fred wants to send Sheila a confidential document as part of a transaction.

Explain how Fred uses asymmetric encryption to send his document securely.

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..... [4]

5 **(a)** Write this infix expression in Reverse Polish Notation (RPN):

```
(7 - 2 + 8) / (9 - 5)
```

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..... [2]

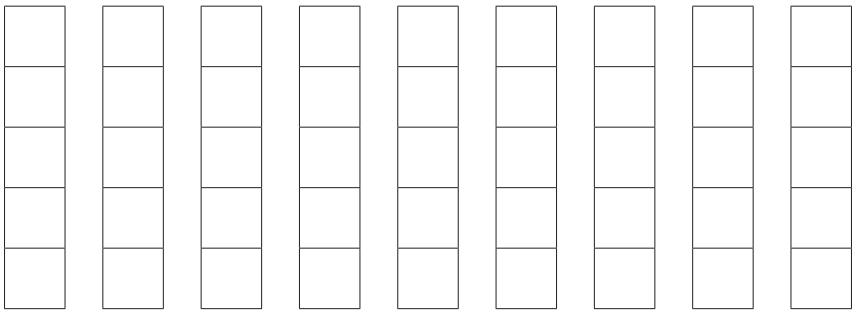
(b) Evaluate this RPN expression:

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

when

`a = 6`, `b = 3`, `c = 7` and `d = 9`

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



[4]

(c) Write this RPN expression in infix form:

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

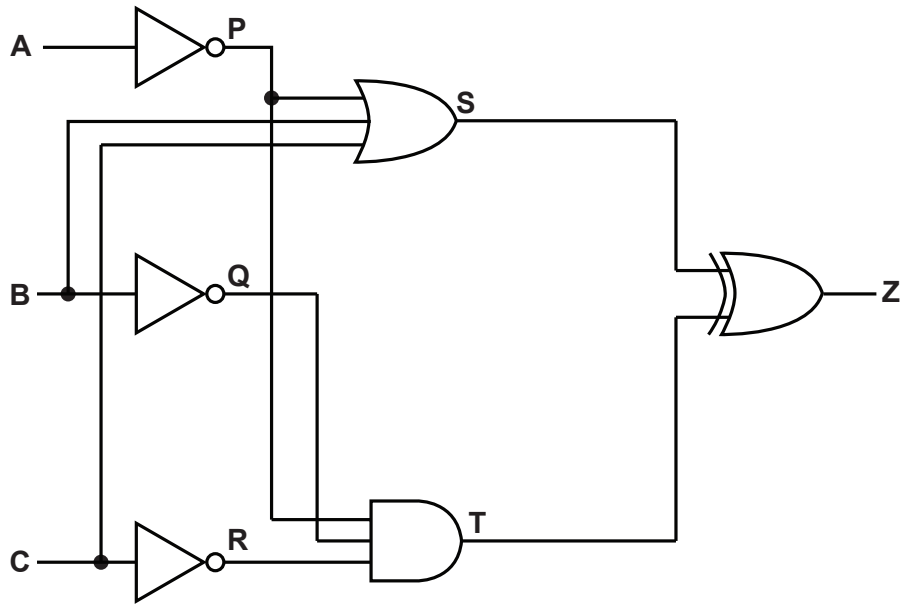
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..... [3]

6 The diagram shows a logic circuit.



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

			Working space					
A	**B**	**C**	**P**	**Q**	**R**	**S**	**T**	**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) Write the Boolean expression that corresponds to the logic circuit as a sum-of-products.

Z = ...

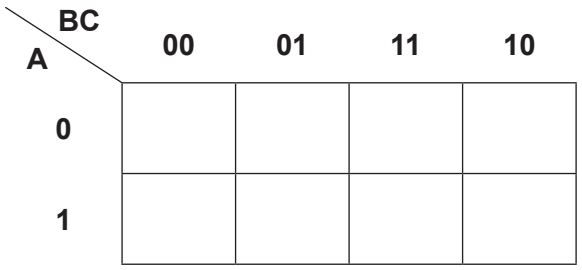
.....

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..... [2]

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

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



[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 **c(ii)** as a simplified sum-of-products.

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..... [1]

7 **(a)** Outline what is meant by **direct access** as a method of file access.

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..... [2]

(b) Explain how direct access is used to locate a specific record in sequential files and random files.

(i) Sequential files .....

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.....

..... [2]

(ii) Random files .....

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..... [2]

8 **(a)** Complete the pseudocode to find an item in a 1D array `Widgets` of type `STRING`, using a **linear** search.

```
DECLARE Widgets : ARRAY[1:50000] OF STRING
DECLARE TopOfList : INTEGER
DECLARE EndOfList : INTEGER
DECLARE Count : INTEGER
DECLARE ToFind : STRING
DECLARE Found : BOOLEAN
DECLARE NotInList : BOOLEAN
TopOfList ← 1
EndOfList ← 50000
OUTPUT "Enter the name of the item you wish to find "
INPUT ToFind

……
NotInList ← FALSE
Count ← TopOfList

WHILE …… AND ……

   IF …… THEN
      Found ← TRUE
   ENDIF
   Count ← Count + 1

   IF …… THEN
      NotInList ← TRUE
   ENDIF
ENDWHILE
IF Found = TRUE THEN
   OUTPUT "Item found at position ", Count - 1, " in array"
ELSE
   OUTPUT "Item not in array"
ENDIF
```

[4]

(b) Compare the methods used by the linear and binary search algorithms to find an item in an array. Refer to Big O notation in your answer.

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…… [4]

9 **(a)** Outline **two** benefits and **two** limitations of a virtual machine.

Benefit 1 .....

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.....

Benefit 2 .....

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.....

Limitation 1 .....

.....

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Limitation 2 .....

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[4]

(b) Explain the roles of the host operating system and the guest operating system as used in a computer system running a virtual machine.

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..... [3]

10 A **declarative** programming language is used to allow clients to choose daily activities at the beach.

```
01 activity(paddleboarding).
02 activity(sailing).
03 activity(rowing).
04 activity(kayaking).
05 activity(jetskiing).
06 client(stevie).
07 client(antonio).
08 client(henry).
09 client(eliza).
10 client(rebeka).
11 client(danny).
12 client(erik).
13 client(simone).
14 client(petra).
15 client(frankie).
16 choice(petra, rowing).
17 choice(frankie, sailing).
18 choice(erik, sailing).
19 choice(eliza, rowing).
20 choice(stevie, jetskiing).
21 choice(henry, sailing).
22 done(henry, jetskiing).
23 done(rebeka, jetskiing).
24 done(antonio, kayaking).
```

These clauses have the meanings:

Clause	Meaning
01	Paddle boarding is an activity.
06	Stevie is a client.
16	Petra has chosen rowing.
22	Henry has already done jet skiing.

(a) Jane is a client who would like to choose the activity surfing and she has already done sailing.

Write additional clauses to represent this information.

25 .....

26 .....

27 .....

28 .....

[4]

(b) Using the variable `List`, the goal:

```
choice(List, rowing)
```

returns

```
List = petra, eliza
```

Write the result returned by the goal:

```
choice(List, sailing)
```

`List =` ..... [1]

(c) `C` is a client who would like to choose `A` if `A` is an activity and `C` has **not** already done `A`.

Write this as a rule:

```
may_choose_activity(C, A)
```

`IF` .....

.....

.....

..... [4]

11 Explain what is meant by **Reinforcement Learning** in relation to Artificial Intelligence.

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..... [3]

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