Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9740267570

COMPUTER SCIENCE **9618/32**

Paper 3 Advanced Theory **October/November 2022**

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.

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1 Normalised floating-point numbers are stored in a computer system using two's complement for both the mantissa and the exponent with:

- 11 bits for the mantissa
- 5 bits for the exponent.

(a) Write the largest positive two's complement binary number that can be stored in this system.

Mantissa											Exponent				

[1]

(b) Calculate the denary value of the given binary floating-point number.
Show your working.

Mantissa											Exponent				
1	0	1	1	0	0	1	0	0	1	1	0	1	0	0	1

Working .....

.....

.....

.....

.....

Answer .....

[3]

(c) State when underflow occurs in a binary floating-point system.

.....

.....

.....

..... [2]

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2 Lexical analysis and syntax analysis are stages in the compilation of a program.

(a) Identify **two other** stages that take place during the compilation of a program.

1 .....

.....

2 .....

.....

[2]

(b) Outline the purpose of syntax analysis.

.....

.....

.....

..... [2]

3 **(a)** Explain why a protocol is used in communication between computers.

.....

.....

.....

..... [2]

(b) The TCP/IP protocol implementation can be viewed as a stack.

Complete the diagram for the TCP/IP protocol stack.

Transport
Link

[2]

(c) Describe the purpose of the IMAP protocol.

.....

.....

.....

..... [2]

4 A program to manage regular flight details at an airport requires some user-defined data types.

(a) Write **pseudocode** statements to declare the enumerated data type `Aircraft` to hold data about the types of aircraft used for a flight.

These types of aircraft are: C300, C350, D242, E757, X380.

.....

.....

.....

..... [2]

(b) Write **pseudocode** statements to declare the composite data type `Flight` to hold data about flights to a specific destination. These include:

- flight number, which could be any combination of letters and numbers
- destination
- date of departure
- type of aircraft used.

Use the enumerated data type you created in **part (a)**.

.....

.....

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..... [4]

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

.....

..... [1]

(ii) Write **pseudocode** to store the details of the following flight in the variable you set up in **part (c)(i)**.

Field	Data
flight number	XA782
destination	Cambridge
date of departure	12/12/2022
type of aircraft used	C350

Use the field names you created in **part (b)**.

.....

.....

.....

.....

.....

..... [3]

5 Describe what is meant by a **virtual machine**.
Include in your answer **two** benefits and **two** drawbacks of using a virtual machine.

Description .....

.....

.....

.....

Benefit 1 .....

.....

Benefit 2 .....

.....

Drawback 1 .....

.....

Drawback 2 .....

.....

[6]

6 **(a)** State **two** differences between symmetric and asymmetric encryption.

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..... [2]

(b) Explain the process by which an organisation may acquire its digital certificate.

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..... [4]

7 Supervised and unsupervised learning are two categories of machine learning.

Describe supervised learning and unsupervised learning.

Supervised learning .....

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.....

.....

Unsupervised learning .....

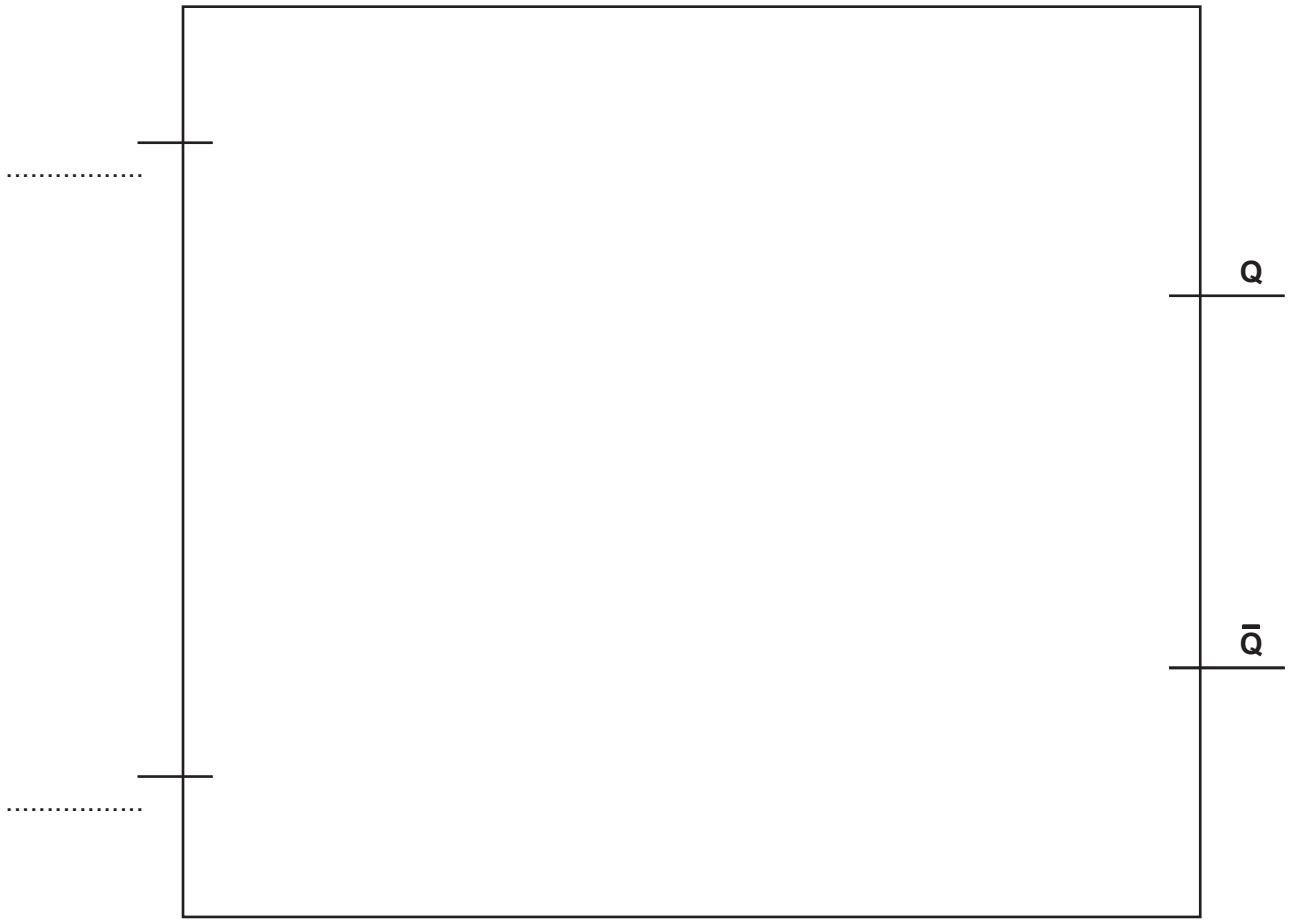
.....

.....

.....

[4]

8 **(a)** Draw a logic circuit for an SR flip-flop **and** label the inputs.



[4]

(b) State the purpose of a flip-flop.

.....

..... [1]

(c) Simplify the following expression using Boolean algebra, including De Morgan's laws. Show your working.

$$\overline{\overline{(A.B)}.\overline{(A.C)}.\overline{(B.D)}}$$

Working .....

.....

.....

.....

.....

Answer .....

[3]

9 **(a)** Explain the need for scheduling in process management.

.....

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.....

.....

..... [3]

(b) Describe these scheduling routines **and** identify a benefit for each one.

Shortest job first .....

.....

.....

.....

Round robin .....

.....

.....

.....

First come first served .....

.....

.....

.....

[6]

10 (a) Define these Object-Oriented Programming (OOP) terms:

Encapsulation .....

.....

Getter .....

.....

Setter .....

.....

[3]

(b) A school has a program written using OOP to maintain its staff and student records.

The object `SubstituteTeacher` allows the details of the school's substitute teachers to be stored. This includes their full name, telephone number and whether or not they are in school today. For example:

SubName	Sarah Jones
Telephone	01223658721
InSchool	TRUE

Complete the diagram for the object `SubstituteTeacher`, including appropriate properties and their getters and setters.

SubstituteTeacher
SubName : STRING ..... InSchool : BOOLEAN
..... SetTelephone(Tel : STRING) ..... GetSubName() ....

[3]

11 A simplified linked list is used to store the names of flowers in alphabetical order. It is implemented using two 1D arrays:

- `Flower` stores the names of the flowers.
- `NextPointer` stores the pointer to the next flower name in the list.

`HeadPointer` indicates the index of the first flower name in the linked list.

HeadPointer	6

When the end of the linked list is reached, the next pointer has the value of 0.

The following table shows the initial content of the arrays.

Index	Flower	NextPointer
1	Rose	7
2	Marigold	1
3	Foxglove	10
4	Iris	9
5	Daisy	3
6	Dahlia	5
7	Saxifrage	0
8	Lupin	2
9	Lily	8
10	Hydrangea	4

(a) Several flower names have been deleted from the linked list. These are crossed out in the following table.

Complete the table to show the new values of `HeadPointer` and `NextPointer` to keep the remaining flower names in alphabetical order.

HeadPointer	

Index	Flower	NextPointer
1	Rose	
2	~~Marigold~~	
3	Foxglove	
4	Iris	
5	Daisy	
6	~~Dahlia~~	
7	~~Saxifrage~~	
8	Lupin	
9	Lily	
10	~~Hydrangea~~	

[3]

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(b) Complete the pseudocode algorithm so that it achieves the following when applied to the arrays:

- The flower name is input.
- The linked list is searched, in order, for the flower name.
- If the flower name is found, an appropriate message is output to indicate it has been found.
- If the flower name is not found, an appropriate message is output to indicate it has not been found.
- The algorithm terminates when the next pointer value is 0.

```
Pointer ← HeadPointer
Found ← 0
OUTPUT "Enter a flower name "

.....

.....
   IF Flower[Pointer] = FlowerName THEN
      Found ← Pointer
      Pointer ← 0
   ELSE

      .....
   ENDIF
ENDWHILE

.....
   OUTPUT Flower[Found], " is found"
ELSE

   .....
ENDIF
```

[5]

(c) Explain how you could improve the simplified linked list structure.

.....

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..... [2]

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