Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9618/32**

Paper 3 Advanced Theory **October/November 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 **16** pages. Any blank pages are indicated.

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1 **(a)** Describe how packet switching is used to transmit messages across a network.

.....

.....

.....

.....

.....

..... [3]

(b) State **two** benefits and **two** drawbacks of packet switching as a method of transmitting messages across a network.

Benefit 1 .....

.....

Benefit 2 .....

.....

Drawback 1 .....

.....

Drawback 2 .....

.....

[4]

2 **(a)** Describe **serial file organisation** as a method of storing data records in a file.

.....

.....

.....

..... [2]

(b) State **one** example of a use for serial file organisation.

.....

..... [1]

3 **(a)** Describe the user-defined data type **record**.

.....

.....

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.....

.....

..... [3]

(b) A programmer defines a record, `Order`, to store the following data:

- account number
- order number
- order price
- order date.

Write **pseudocode** statements to define this record.

.....

.....

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.....

.....

.....

.....

..... [4]

4 Numbers are stored in a computer 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 denary value of the given normalised binary floating-point number.

Show your working.

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

Working .....

.....

.....

Answer .....

[2]

(b) Calculate the normalised binary floating-point representation of –49.1875 in this system.

Show your working.

Mantissa												Exponent			

Working .....

.....

.....

.....

.....

.....

.....

.....

[4]

5 **(a)** Name and describe **two** protocols used by the Application Layer of the TCP/IP protocol suite.

Protocol 1 .....

Description .....

.....

.....

Protocol 2 .....

Description .....

.....

..... [4]

(b) Explain the purpose and function of the Application Layer in the TCP/IP protocol suite.

.....

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.....

.....

..... [3]

6 The truth table for a logic circuit is shown.

INPUT				OUTPUT
A	**B**	**C**	**D**	**X**
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

(a) Write the Boolean logic expression that corresponds to the given truth table as the sum-of-products.

X = ...

..... [3]

(b) Complete the Karnaugh map (K-map) for the given truth table.

CD \ AB	00	01	11	10
00				
01				
11				
10				

[2]

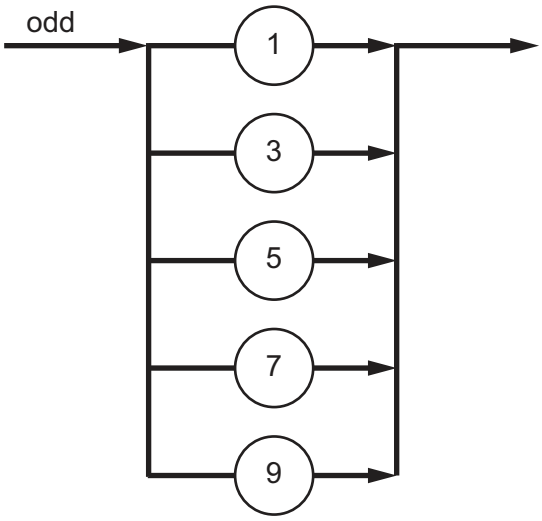
(c) Draw loop(s) around appropriate group(s) in the K-map to produce an optimal sum-of-products. [2]

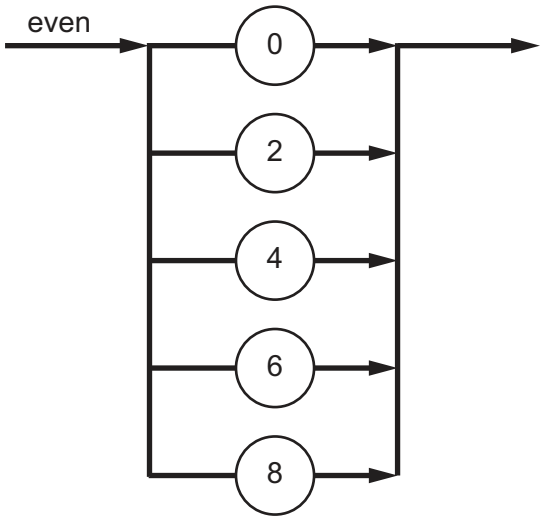
(d) Write the Boolean logic expression from your answer to part **(c)** as the simplified sum-of-products.

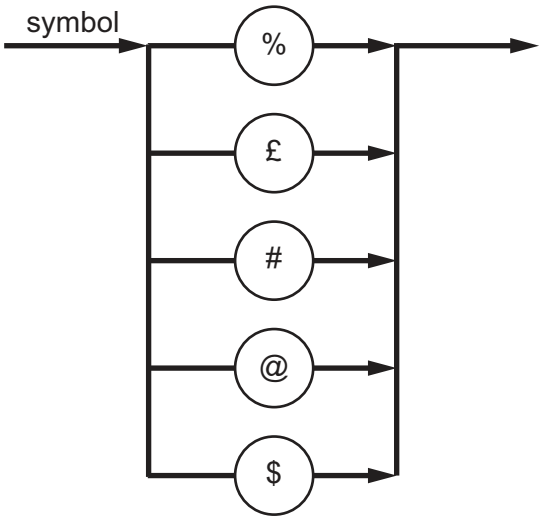
X = ...

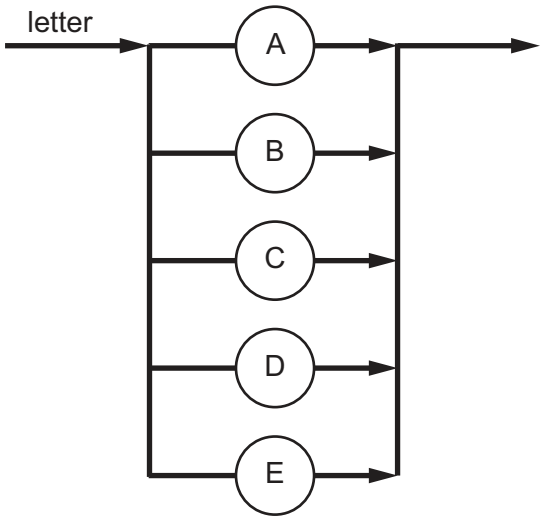
..... [2]

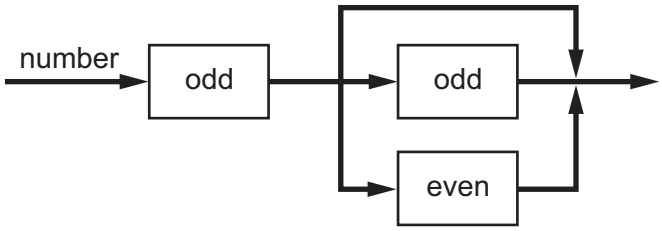
7 Several syntax diagrams are shown.











(a) State why each number is invalid for the given syntax diagrams.

21

Reason .....

.....

123

Reason .....

.....

[2]

(b) Complete the Backus-Naur Form (BNF) for the given syntax diagrams.

<symbol> ::= .....

.....

<number> ::= .....

.....

[2]

(c) A new syntax rule, **code**, is required. It must begin with a letter, followed by one or two numbers, and end with a symbol.

(i) Draw a syntax diagram for **code**.

[3]

(ii) Write the BNF for **code**.

.....

.....

.....

..... [2]

8 Complex Instruction Set Computer (CISC) is a type of processor.

Identify **four** features of a CISC processor.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

..... [4]

9 **(a)** The kernel is the central component of an Operating System (OS).

Outline how the kernel of an OS acts as an interrupt handler.

.....

.....

.....

..... [2]

(b) **(i)** State what is meant by the term **multi-tasking** in an Operating System.

.....

..... [1]

(ii) Describe how multi-tasking is implemented in an Operating System.

.....

.....

.....

..... [2]

10 Objects and classes form the basic structure of Object-Oriented Programming (OOP).

(a) Outline the structure of a class.

.....

.....

.....

.....

.....

..... [3]

(b) Give **three** differences between an object and a class.

1 .....

.....

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2 .....

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.....

3 .....

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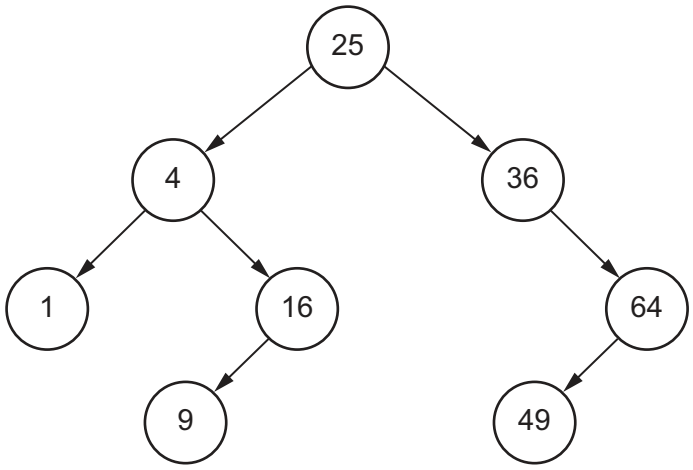
[3]

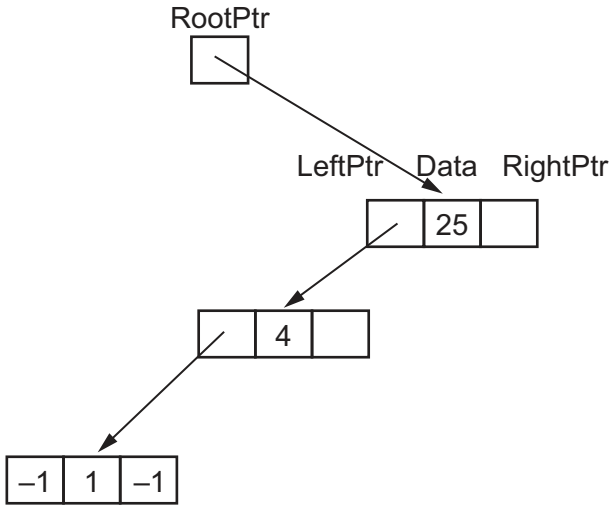
11 This binary tree shows an ordered list of integers.



(a) A linked list of nodes is used to store the data. Each node consists of a left pointer, the data and a right pointer.

−1 is used to represent a null pointer.

Complete this linked list to represent the given binary tree organisation.



[4]

(b) A 2D array is used to store the nodes of the linked list in part **(a)**.

Complete the diagram using your answer for part **(a)**.

RootPtr

0

FreePtr

Index	LeftPtr	Data	RightPtr
0		25	
1		4	
2		36	
3		1	
4		16	
5		64	
6		9	
7		49	
8			

[4]

(c) The linked list in part **(a)** is implemented using a 1D array of records. Each record contains a left pointer, data and a right pointer.

The following pseudocode represents a function that searches for an element in the array of records `LinkList`. It returns the index of the record if the element is found, or it returns a null pointer if the element is not found.

Complete the pseudocode for the function.

```
FUNCTION SearchList(Item : INTEGER).....
   NullPtr ← -1

   ..... ← RootPtr
   WHILE NowPtr <> NullPtr
      IF LinkList[NowPtr].Data < Item THEN
         NowPtr ← LinkList[NowPtr].RightPtr
      ELSE

         IF ..... THEN

            NowPtr ← .....
         ELSE
            RETURN NowPtr
         ENDIF
      ENDIF
   ENDWHILE
   RETURN NullPtr
ENDFUNCTION
```

[4]

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