



Cambridge International AS & A Level

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COMPUTER SCIENCE

9618/31

Paper 3 Advanced Theory

May/June 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 **16** pages. Any blank pages are indicated.

- 1 A programmer is writing a program to manage bookings for a small taxi company. The programmer requires some user-defined data types.

- (a) Write a **pseudocode** statement to declare the enumerated data type, `Vehicle`, to hold the identity code of each of the company's taxis:

M100, M230, T101, T102, T120, T150

.....
 [2]

- (b) Write **pseudocode** statements to declare the composite data type, `Booking`, to hold data about taxi bookings. The data required includes:

- booking number (any combination of letters and numbers)
- destination
- client name
- client telephone number
- date of departure
- address for pick-up
- the identity code of the taxi used.

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

.....

 [4]



* 0000800000003 *

3

2 Numbers are stored in a computer using binary floating-point representation with:

- 10 bits for the mantissa
- 6 bits for the exponent
- two's complement form for both the mantissa and the exponent.

(a) Write the normalised floating-point representation of the following binary number using this system.

0.00000011010111

Mantissa

--	--	--	--	--	--	--	--	--	--

Exponent

--	--	--	--	--	--

[2]

(b) Calculate the normalised binary floating-point representation of -25.3125 in this system. Show your working.

Mantissa

--	--	--	--	--	--	--	--	--	--

Exponent

--	--	--	--	--	--

Working

.....

.....

.....

.....

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.....

[4]



- 3 (a) The Application Layer and Transport Layer are two layers of the TCP/IP protocol suite.

Describe the purpose of the Application Layer **and** the purpose of the Transport Layer.

Purpose of Application Layer

.....

.....

.....

.....

Purpose of Transport Layer

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[5]

- (b) Describe packet switching as a method of transmitting messages across the internet.

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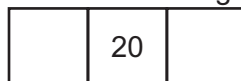
.....

[4]



- 4 (a) A linked list of nodes is used to store an ordered list of integers. Each node consists of the data, a left pointer and a right pointer, for example:

Left pointer Data Right pointer

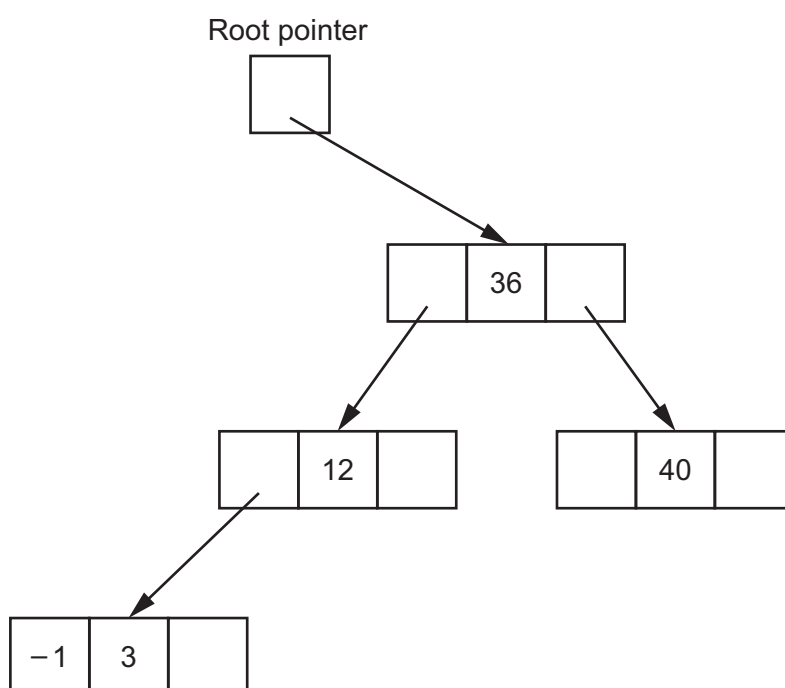


The linked list will be organised as a binary tree.

–1 is used to represent a null pointer.

Complete the binary tree, including null pointers, to show how the data will be organised after the following integers have been added:

6, 15, 41, 66



[4]

- (b) Describe what is meant by recursion.

.....

.....

.....

..... [2]



- (c) A binary tree is a suitable Abstract Data Type (ADT) that a designer can implement using recursive algorithms.

Identify **one other** ADT that a designer can implement using recursive algorithms.

..... [1]

- 5 This truth table represents a logic circuit.

INPUT				OUTPUT
A	B	C	D	Z
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

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

Z =

..... [2]





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

		AB			
		00	01	11	10
CD	00				
	01				
	11				
	10				

[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 logic expression from your answer to part (b)(ii) as the simplified sum-of-products.

Z = [2]

6 Describe the process of executing a program using an interpreter.

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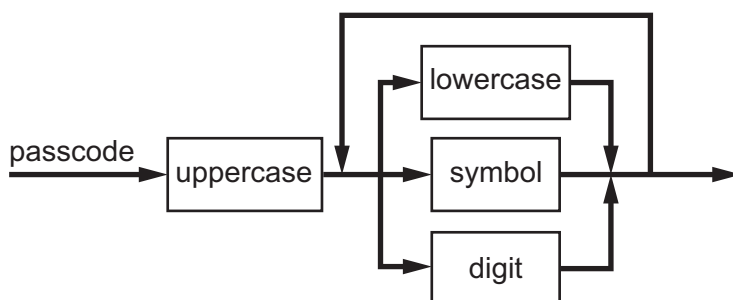
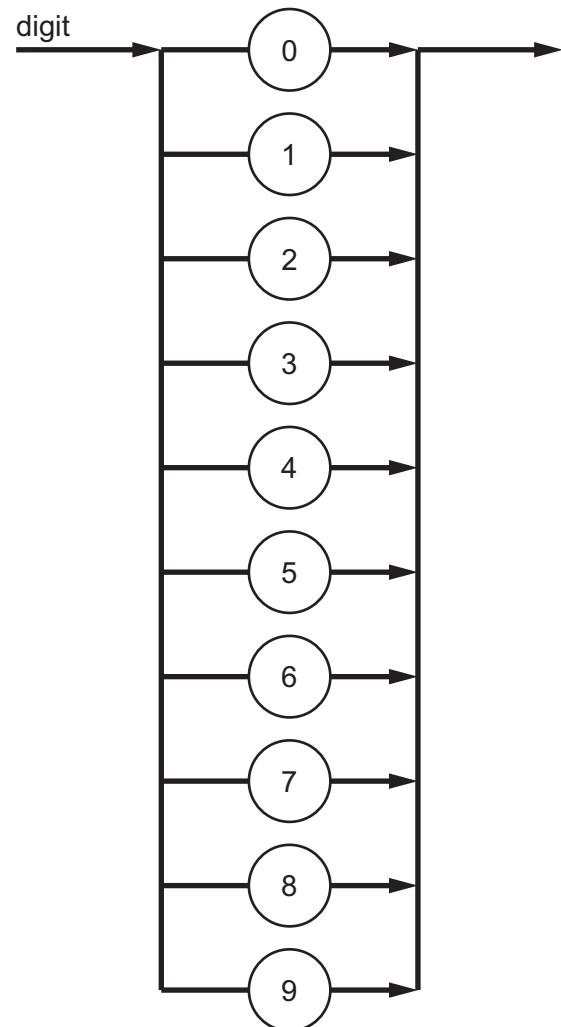
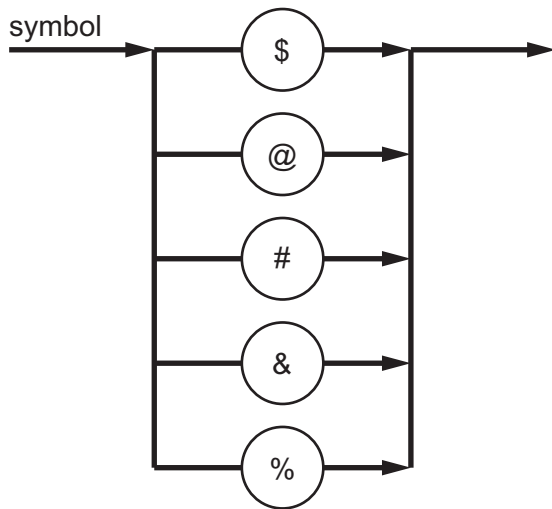
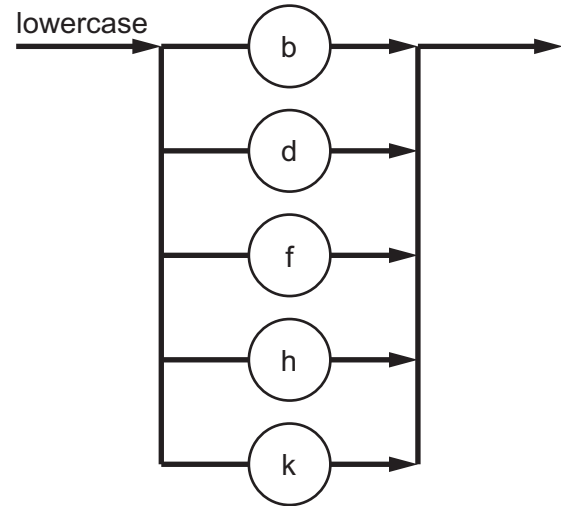
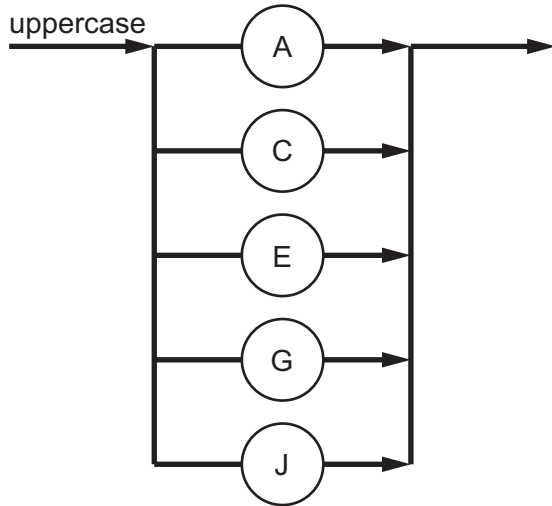
.....

..... [4]





7 Several syntax diagrams are shown.





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

#Jd7

Reason

.....

C%6A

Reason

.....

[2]

(b) Complete the Backus-Naur Form (BNF) for **<uppercase>** and **<passcode>**.

<uppercase> ::=

.....

<passcode> ::=

.....

.....

.....

.....

.....

[4]





- 8 (a) Describe what is meant by **multi-tasking** and how it benefits process management.

.....

.....

.....

.....

..... [2]

- (b) Explain the function of the shortest remaining time scheduling routine **and** give a benefit of this routine.

Function

.....

.....

.....

.....

.....

.....

Benefit

.....

[4]

- 9 Secure Socket Layer (SSL) and Transport Layer Security (TLS) are two protocols.

- (a) State **two** functions of SSL/TLS.

1

.....

2

.....

[2]

- (b) Give **two** examples of situations where the use of SSL/TLS would be appropriate.

1

.....

2

.....

[2]



10 (a) Describe the purpose of a graph when used in an Artificial Intelligence (AI) system.

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..... [2]

(b) Explain the use of artificial neural networks in Deep Learning.

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..... [4]





- 11 (a) A medical centre uses objects of the class `Appointment` to record treatments given and medication prescribed during each doctor's appointment. Some of the attributes required in the class are listed in the table.

Attribute	Data type	Description
DateSeen	DATE	date of treatment
Treatments	STRING	treatments given
Medications	STRING	medications prescribed

Patients are identified by a unique 8-digit number, beginning with the patient's year of birth, for example, 20108989.

Doctors are identified by their name, for example, A N Other.

Complete the class diagram for Appointment, to include:

- attribute and data type for the identification of the patient
- attribute and data type for the identification of the doctor
- methods to assign date seen, treatments given and medications prescribed
- method to return the date seen and the attributes for the patient and the doctor.

Appointment	
DateSeen	: DATE
.....	:
.....	:
Treatments	: STRING
Medications	: STRING
	
SetPatientID(PatientNumber : INTEGER)	
SetDoctor(DoctorID : STRING)	
.....	
.....	
.....	
.....	
.....	
GetTreatments()	
GetMedications()	



- (b) (i) Identify the object-oriented programming (OOP) feature whose function includes restricting external access to the data.

..... [1]

- (ii) Describe what is meant by the OOP feature **inheritance**.

.....

 [2]

- 12 The pseudocode algorithm checks whether a location in a stock file `StockList.dat` is empty or not. The location is given by the user. If the location is empty, a suitable message is displayed, otherwise the item stored at that location is displayed.

Complete this file-handling pseudocode algorithm.

```
DECLARE Location : INTEGER
DECLARE Item : STRING
DECLARE Continue : BOOLEAN
DECLARE Answer : CHAR
Continue ← TRUE
```

```
OPENFILE .....
WHILE Continue
  OUTPUT "Enter a location between 1 and 500: "
  INPUT Location
```

```
  .....
  GETRECORD .....
  IF Item = "" THEN
    OUTPUT "This record is missing."
  ELSE
    OUTPUT "The item in stock is ", .....
  ENDIF
  OUTPUT "Another location (Y or N)?"
  INPUT Answer
  IF Answer <> 'Y' THEN
    Continue ← FALSE
  ENDIF
ENDWHILE
```

```
  .....
  OUTPUT "End of program"
```

[5]



* 0000800000014 *



14

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* 0000800000015 *



15

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