



CANDIDATE  
NAME

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CENTRE  
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## 9618/32

October/November 2022

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- 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.

- 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.

- 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                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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[1]

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

| Mantissa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Exponent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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Working .....

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Answer .....

[3]

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

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..... [2]

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 .....

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2 .....

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[2]

(b) Outline the purpose of syntax analysis.

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[2]

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

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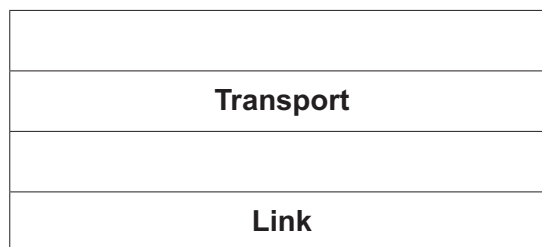
.....

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[2]

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

Complete the diagram for the TCP/IP protocol stack.



[2]

(c) Describe the purpose of the IMAP protocol.

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[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.

.....

.....

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..... [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)**.

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..... [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 .....

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.....

.....

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.

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

Working .....

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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 .....

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.....

.....

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:

|                  |             |
|------------------|-------------|
| <b>SubName</b>   | Sarah Jones |
| <b>Telephone</b> | 01223658721 |
| <b>InSchool</b>  | TRUE        |

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

| <b>SubstituteTeacher</b>   |
|----------------------------|
| 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     | <del>Marigold</del>  |             |
| 3     | Foxglove             |             |
| 4     | Iris                 |             |
| 5     | Daisy                |             |
| 6     | <del>Dahlia</del>    |             |
| 7     | <del>Saxifrage</del> |             |
| 8     | Lupin                |             |
| 9     | Lily                 |             |
| 10    | <del>Hydrangea</del> |             |

(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  $\leftarrow$  HeadPointer

Found  $\leftarrow$  0

OUTPUT "Enter a flower name "

.....

.....

IF Flower[Pointer] = FlowerName THEN

Found  $\leftarrow$  Pointer

Pointer  $\leftarrow$  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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