



GCE A LEVEL

1500U30-1



S25-1500U30-1

WEDNESDAY, 11 JUNE 2025 – MORNING

COMPUTER SCIENCE – A2 unit 3
Programming and System Development

2 hours

1500U301
01

ADDITIONAL MATERIALS

A WJEC pink 16-page answer booklet.

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

Write your answers in the separate answer booklet provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question; you are advised to divide your time accordingly.

The total number of marks available is 100.

Assessment will take into account the quality of written communication used in your answers.

Answer **all** questions.

1. (a) Describe a queue data structure. Give an example of where a queue data structure might be used. [3]

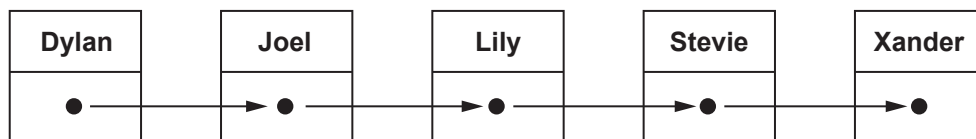
- (b) A stack is another type of data structure.

- (i) Draw a diagram to show how a stack would store the following names in the order they are received, where Jamie is received first.

Jamie, Elena, Arjun, Piotr, Julia, Morgan [1]

- (ii) Redraw the diagram to show the stack after two names are popped, and **David** and then **Eleri** are pushed. [2]

2. This is a diagram of a linked list of names in alphabetical order.



- (a) Redraw the linked list after **Joel** has been deleted. [2]

- (b) Redraw the linked list from part (a) after **Wiktor** has been added. [2]

3. (a) Draw a truth table to show the value of Q for all possible values of A, B and C for the following Boolean expression: [4]

$$Q = A. (\bar{B} + C)$$

- (b) Simplify the following Boolean expressions, clearly showing each step. Use Boolean algebra, identities and De Morgan's law where appropriate.

(i) $A.(\bar{A} + B) + \bar{B}.(A + C) + A.B$ [5]

(ii) $Z.(\overline{Z + Y}) + X.Y.(\bar{Z} + Z)$ [5]

4. (a) Determine the logical operation described by this truth table. [1]

Input		Output
0	0	1
0	1	1
1	0	1
1	1	0

- (b) (i) Using the key 11011010_2 show how the XOR operation can be used to encrypt 10110101_2 . [1]

- (ii) Show how the encrypted value can be decrypted. [2]

5. Discuss how Computer Aided Software Engineering (CASE) tools can assist with the design and development of a system. [8]

6. (a) Describe the benefits of creating detailed documentation at each stage of the Waterfall approach to system analysis and design. [2]

- (b) Describe the documentation required for the maintenance stage of the Waterfall approach. [6]

7. (a) Describe a situation where an insertion sort would be more suitable than other sorting algorithms. [2]

- (b) Write an insertion sort algorithm for integer values, using pseudo-code, to sort an array of unknown length into ascending order. [7]

8. This algorithm initialises two arrays.

```
for i = 0 to N - 1
    arrayA(i) = itemA
next i
for j = 0 to N - 1
    arrayB(j) = itemB
next j
```

- (a) (i) Evaluate the efficiency of the algorithm using Big O notation. [3]
- (ii) Determine the growth rate for time performance. [1]
- (b) Draw a graph of the algorithm to illustrate and identify its order of time performance. Graph paper is not required. [2]

9. A company called Parkwood Vale Cosmetics has a specific structure for email addresses for company employees depending on whether they work in sales or admin.

The email addresses are made up of:

- surname with an uppercase letter to start
- an uppercase letter to represent a first name initial
- an integer
- @ sign
- followed by either 'salespvc.co.uk' or 'adminpvc.co.uk'.

Example: DaviesL12@salespvc.co.uk

Produce a Backus-Naur form (BNF) definition for an email address used by the company. [5]

10. (a) State the difference between the two data compression types. [2]
- (b) A source image file in its original state has a size of 64,000 bytes and is compressed into a file size of 16,000 bytes. This compression algorithm takes 0.03 seconds per 1000 bytes to compress.
- (i) Calculate the compression ratio. [1]
- (ii) Calculate the saving percentage. [1]
- (iii) Calculate the compression time. [1]
11. (a) Other than privacy and monitoring, describe the contents typically found within a code of conduct. [8]
- (b) Describe the methods that can be used to monitor an employee's use of computer systems and compliance with the code of conduct. [6]
12. A binary tree needs to be created by inserting the following fruits in sequence: Pineapple, Strawberry, Lemon, Melon, Pomegranate and Apple.
- (a) Construct a binary tree using the following rules:
- The left pointer indicates the condition “earlier or at the same position in the alphabet”.
 - The right pointer indicates the condition “later in the alphabet”.
- You can abbreviate the fruit names if you wish. [2]
- (b) Carry out an in-order traversal of the tree. [1]
- (c) Carry out a pre-order traversal of the tree. [1]
- (d) Carry out a post-order traversal of the tree. [1]
13. Describe the features of the following programming paradigms and identify possible situations in which they might be used. [12]
- Procedural languages
 - Object-oriented languages
 - Specific purpose languages

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