

The subroutine in **Figure 3** is used to authenticate a username and password combination.

- Array indexing starts at 0.
- Line numbers are included but are not part of the algorithm.

```

1  SUBROUTINE Authenticate(user, pass)
2      us ← ['dave', 'alice', 'bob']
3      ps ← ['abf32', 'woof2006', '!@34E$']
4      z ← 0
5      correct ← false
6      WHILE z < 3
7          IF user = us[z] THEN
8              IF pass = ps[z] THEN
9                  correct ← true
10             ENDIF
11         ENDIF
12         z ← z + 1
13     ENDWHILE
14     RETURN correct
15 ENDSUBROUTINE

```

Complete the trace table for the following subroutine call:

```
Authenticate('alice', 'woof2006')
```

[3 marks]

[illegible]

0	1
---	---

.

2

State the value that is returned by the following subroutine call:

```
Authenticate('bob', 'abf32')
```

[1 mark]

0	1
---	---

.

3

Lines 7 and 8 in **Figure 3** could be replaced with a single line. Shade **one** lozenge to show which of the following corresponds to the correct new line.

[1 mark]

A IF user = us[z] OR pass = ps[z] THEN☐**B** IF user = us[z] AND pass = ps[z] THEN☐**C** IF NOT (user = us[z] AND pass = ps[z]) THEN☐

0	1
---	---

.

4

A programmer implements the subroutine shown in **Figure 3**. He replaces line 9 with

```
RETURN true
```

He also replaces line 14 with

```
RETURN false
```

Explain how the programmer has made the subroutine more efficient.

[2 marks]

0 2

The algorithm shown in **Figure 3** is used to check if the start of an instruction for a particular assembly language is valid.

The string representation of the assembly language instruction is stored in the variable `instr`

Characters in the string are indexed starting at zero. For example `instr[2]` would access the third character of the string stored in the variable `instr`

Figure 3

```
code ← ''
i ← 0
WHILE instr[i] ≠ ':' AND i < 4
    code ← code + instr[i]
    i ← i + 1
ENDWHILE
valid ← False
IF code = 'ADD' OR code = 'SUB' OR code = 'HALT' THEN
    valid ← True
ENDIF
```

0 2 . 1

Shade **one** lozenge to show the most appropriate data type of the variable `i` in the algorithm in **Figure 3**.

[1 mark]

A Character

☐

B Integer

☐

C Real

☐

D String

☐**0 2 . 2**

State the data type of the variable `valid` in the algorithm in **Figure 3**.

[1 mark]

02.3

State the final value of the variable `valid` in the algorithm in **Figure 3** for the following different starting values of `instr`

[3 marks]

Value of <code>instr</code>	Final value of <code>valid</code>
ADD R0, R1	
ADD: R0, R1	
HALT	

02.4

State what an assembly language program must be translated into before it can be executed by a computer.

[1 mark]

02.5

State **two** reasons why a programmer, who can program in both high-level and low-level languages, would usually choose to develop in a high-level language rather than a low-level language.

[2 marks]

Reason 1

Reason 2

0	2	6
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Develop an algorithm, using either pseudo-code **or** a flowchart, that:

- initialises a variable called `regValid` to `False`
- sets a variable called `regValid` to `True` if the string contained in the variable `reg` is an uppercase `R` followed by the character representation of a single numeric digit.

Examples:

- if the value of `reg` is `R0` or `R9` then `regValid` should be `True`
- if the value of `reg` is `r6` or `Rh` then `regValid` should be `False`

You may wish to use the subroutine `isDigit(ch)` in your answer. The subroutine `isDigit` returns `True` if the character parameter `ch` is a string representation of a digit and `False` otherwise.

[3 marks]

0 3

Figure 3 shows an algorithm, represented using pseudo-code, that calculates the delivery cost for an order from a takeaway company.

Figure 3

```

orderTotal ← USERINPUT
deliveryDistance ← USERINPUT
deliveryCost ← 0.0
messageOne ← "Minimum spend not met"
messageTwo ← "Delivery not possible"
IF deliveryDistance ≤ 5 AND orderTotal > 0.0 THEN
    IF orderTotal > 50.0 THEN
        deliveryCost ← 1.5
        OUTPUT deliveryCost
    ELSE IF orderTotal > 25.0 THEN
        deliveryCost ← (orderTotal / 10) * 2
        OUTPUT deliveryCost
    ELSE
        OUTPUT messageOne
    ENDIF
ELSE
    OUTPUT messageTwo
ENDIF

```

0 3**1**

Using **Figure 3**, complete the table.

[2 marks]

Input value of orderTotal	Input value of deliveryDistance	Output
55.5	2	
35.0	5	

0 3**2**

State how many possible values the result of the comparison
 $\text{deliveryDistance} \leq 5$ could have in the algorithm shown in **Figure 3**.

[1 mark]

03.3 State the most suitable data type for the following variables used in **Figure 3**. **[2 marks]**

Variable identifier	Data type
deliveryCost	
messageOne	

03.4 State **one** other common data type that you have **not** given in your answer to Question **02.3**. **[1 mark]**

0	4
---	---

Figure 2 shows an algorithm, represented using pseudo-code.

- Line numbers are included but are not part of the algorithm.

Figure 2

```
1      num ← USERINPUT
2      IF NOT (num > 1) OR num > 20 THEN
3          OUTPUT "False"
4      ELSEIF num > 1 AND num < 15 THEN
5          OUTPUT "Almost"
6      ELSEIF num MOD 5 = 0 THEN
7          OUTPUT "True"
8      ELSE
9          OUTPUT "Unknown"
10     ENDIF
```

The modulus operator is used to calculate the remainder after dividing one integer by another.

For example:

- 14 MOD 3 evaluates to 2
- 24 MOD 5 evaluates to 4

0	4	.	1
---	---	---	---

Where is a relational operator **first** used in the algorithm in **Figure 2**?

Shade **one** lozenge.

[1 mark]

A Line number 1

☐

B Line number 2

☐

C Line number 3

☐

D Line number 6

☐

0 4 . 2 In the algorithm in **Figure 2**, what will be the output when the user input is 5?

Shade **one** lozenge.

[1 mark]

A Almost

☐

B False

☐

C True

☐

D Unknown

☐

0 4 . 3 Which value input by the user would result in `True` being output by the algorithm in **Figure 2**?

Shade **one** lozenge.

[1 mark]

A -1

☐

B 10

☐

C 20

☐

D 21

☐

0 4 . 4 Rewrite **line 2** from the algorithm in **Figure 2** **without** using the `NOT` operator.

The algorithm must still have the same functionality.

[1 mark]

0 4 . 5 A user inputs a value into the algorithm in **Figure 2**.

State **one** value that the user could input that would result in an output of `Unknown`

[1 mark]
