AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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Forename(s) _____

Candidate signature _____

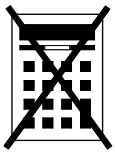
I declare this is my own work.

GCSE
COMPUTER SCIENCE

Paper 1 Computational thinking and programming skills – Python

Monday 12 May 2025 Afternoon Time allowed: 2 hours

Materials
- There are no additional materials required for this paper.
- You must **not** use a calculator.



Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Questions that require a coded solution must be answered in Python.
- You should assume that all indexing in code starts at 0 unless stated otherwise.

Information
The total number of marks available for this paper is 90.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8–9	
10	
11	
TOTAL	

Advice

For the multiple-choice questions, completely fill in the lozenge alongside the appropriate answer.

CORRECT METHOD  WRONG METHODS 

If you want to change your answer you must cross out your original answer as shown. 

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown. 

Answer **all** questions.

Do not write outside the box

0 1 **Figure 1** shows a program written in Python.

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

Figure 1

```
1    # Python program
2    a = 1
3    b = 1
4    c = 5
5    while b < c:
6        a = a + a
7        b = b + 1
8        print(a)
```

0 1 . 1 Where is an arithmetic operation **first** used in the program in **Figure 1**?

Shade **one** lozenge.

[1 mark]

A Line number **1** ⬭

B Line number **5** ⬭

C Line number **6** ⬭

D Line number **8** ⬭

0 1 . 2 Which of the following is a **false** statement about the program in **Figure 1**?

Shade **one** lozenge.

[1 mark]

A This program contains a comment. ⬭

B This program uses assignment. ⬭

C This program uses concatenation. ⬭

D This program uses iteration. ⬭

Do not write outside the box

0 1 . 3 State the relational operator used in the program in **Figure 1**.

[1 mark]

0 1 . 4 Complete the trace table for the program in **Figure 1**.

You may not need to use all the rows in the table.

[4 marks]

a	b	c	Output

7

Turn over for the next question

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0 2 A coffee shop has a loyalty scheme which rewards customers for buying drinks. The customer gets one stamp on their loyalty card for each individual drink they buy.

- Every 4th stamp on the card gets the customer a free biscuit.
- Every 5th stamp on the card gets the customer a free pastry.
- When the customer reaches 20 stamps, they get a free cake (but **no** biscuit or pastry).

The Python program shown in **Figure 2** should display whether the customer gets a free biscuit, pastry, cake or nothing free for their first 20 drinks.

For each drink purchased, the program **must** output either: `"Free biscuit"`, `"Free pastry"`, `"Free cake"` or `"Nothing free"`.

Some parts of the program have been replaced with the labels L1 to L3.

Figure 2

```
i = 1
while i <= 20:
    if i % 20 == 0:
        print("Free cake")
    elif L1:
        print("Free pastry")
    elif i % 4 == 0:
        L2
    else:
        L3
    i = i + 1
```

0 2 . 1 State the Python code that should be written in place of the labels in the program written in **Figure 2**.

[3 marks]

L1 _____

L2 _____

L3 _____

Do not write outside the box

0 2 . 2 The coffee shop wants to work out the total value of the free biscuits, pastries and cakes given out each day.

- Each free biscuit is worth £1
- Each free pastry is worth £2.50
- Each free cake is worth £3

Write a Python program to get the number of free biscuits, pastries and cakes, and calculate the total value for the day.

Your program must:
- get the user to enter the number of free biscuits and store it in a variable
- get the user to enter the number of free pastries and store it in a variable
- get the user to enter the number of free cakes and store it in a variable
- calculate the total value of the free items
- output the total value of the free items.

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code.

[4 marks]

7

Turn over ►

Do not write outside the box

0 3 Write a Python program that calculates the total cost of a netball coaching session for a group of students.

The total cost is calculated as follows:

- A booking fee of £20 plus:
  - £5 per student if there are 15 students or fewer
  - £3 per student if there are more than 15 students
- If there are more than 25 students, a booking fee of £100 and **no** other charges.

Your program should:

- get the user to enter the number of students
- output the total cost of the session.

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code.

[8 marks]

Do not write outside the box

8

Turn over ►

Do not write outside the box

0 4 A programmer is developing a system to register users for an app. The program needs to validate the first name of the user.

0 4 . 1 Identify the purpose of validation.

Shade **one** lozenge.

[1 mark]

A Checks that the user is human ⬭

B Checks that the user is who they say they are ⬭

C Checks that the input is a name ⬭

D Checks that the input is reasonable ⬭

0 4 . 2 Write a Python program to check the user's first name.

Your program should:
- get the user's first name
- check that the first name has more than one character and fewer than 15 characters:
  - if it has, output the message `Name accepted`
  - if it has not, output the message `Name not accepted`
- repeat until the name entered has a specified length.

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code.

[6 marks]

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Question 4 continues on the next page

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0 4 . 3 Which of the following statements best describes **boundary** test data?

Shade **one** lozenge.

[1 mark]

A Data that is not of the allowed data type ⬭

B Data that is at the limits of the allowed range ⬭

C Data that is expected by the program ⬭

D Data that will cause a syntax error ⬭

0 4 . 4 The programmer has started planning the tests that will be used to check the program is working correctly.

The program should:

- check that the first name has more than one character and fewer than 15 characters:
  - if it has, then output the message `Name accepted`
  - if it has not, then output the message `Name not accepted`

The start of the test plan is shown in **Figure 3**.

Figure 3

Test number	Test data	Type of test data	Expected result
1	`Thomas`	Normal	`Name accepted`
2		Boundary	`Name not accepted`

State the number of characters that a string used for test number 2 in **Figure 3** could contain.

[1 mark]

0 4 . 5 Normal and boundary are two types of test data.

State **one** type of test data that has **not** been used in **Figure 3**.

[1 mark]

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Question 4 continues on the next page

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ANSWER IN THE SPACES PROVIDED

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0 4 . 6 A programmer is designing an algorithm to generate usernames for users.

The algorithm should:

- ask the user to input their first name and their last name
- create a username:
  - if their first name has more than three characters, their username will consist of the first three characters of their first name followed by their last name
  - if their first name has three or fewer characters, their username will consist of their full first name followed by their last name
- output the username.

Figure 4 contains the statements required to implement a version of this algorithm.

Figure 4

L1 `firstName ← USERINPUT`

L2 `LEN(firstName) > 3`

L3 `username ← firstName + lastName`

L4 `OUTPUT username`

L5 `username ← SUBSTRING(0, 2, firstName) + lastName`

L6 `lastName ← USERINPUT`

Using the labels (L1 to L6) shown in **Figure 4**, complete the flowchart to implement the algorithm.

[3 marks]

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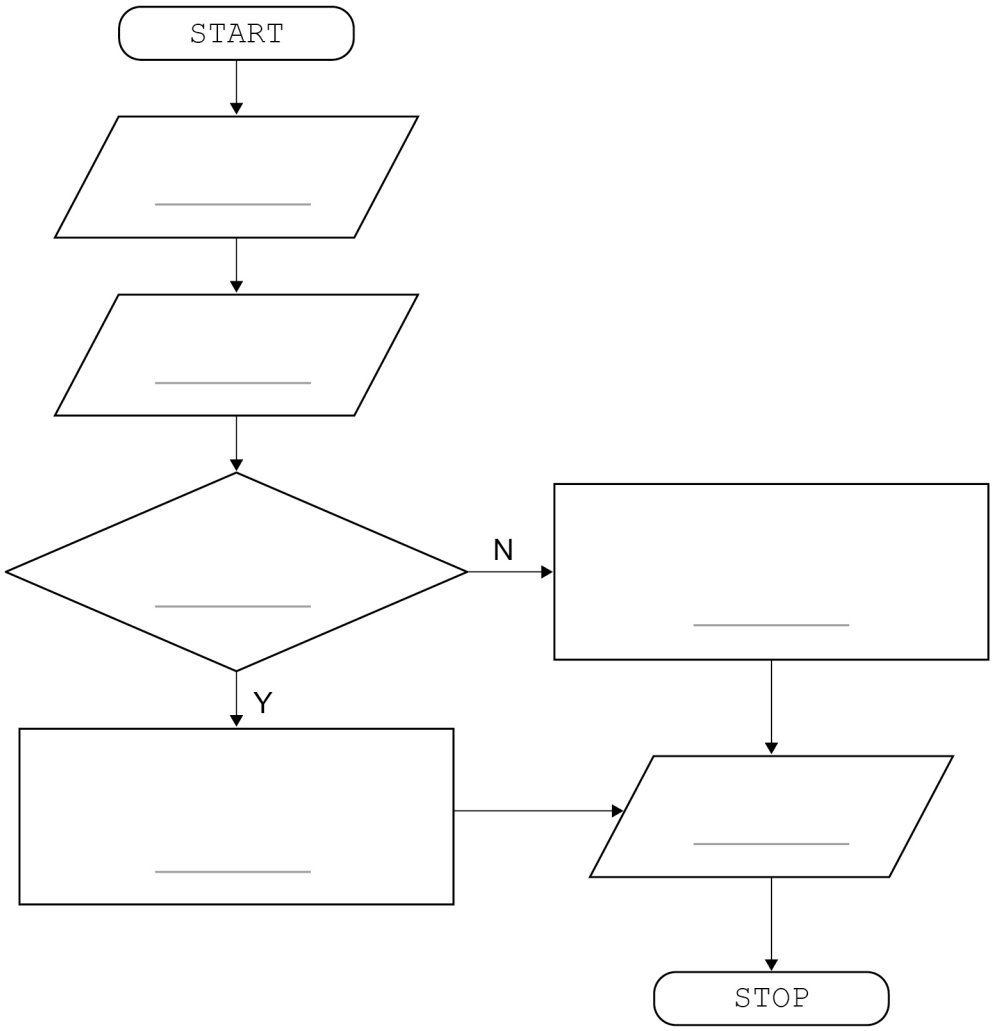

13

Turn over for the next question

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0 5 The Python program in **Figure 5** gets five numbers and outputs the sum of those numbers.

Figure 5

```
num1 = int(input())
num2 = int(input())
num3 = int(input())
num4 = int(input())
num5 = int(input())
total = num1 + num2 + num3 + num4 + num5
print(total)
```

0 5 . 1 An integer data type is used in the program in **Figure 5**.

Describe what is meant by a **data type**.

[1 mark]

The variables `num1`, `num2`, `num3`, `num4` and `num5` in **Figure 5** have an integer data type.

0 5 . 2 Explain why these variables do **not** have a string data type.

[1 mark]

0 5 . 3 The program in **Figure 5** needs to be changed to use numbers with a fractional part (a real number).

State a data type in Python that should be used.

[1 mark]

Do not write outside the box

0 5 . 4 Rewrite the program in **Figure 5** so that it achieves the same result but uses an iteration structure that contains only **one** `input()` statement.

Your answer must be written in Python.

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code.

[5 marks]

8

Turn over ►

Do not write outside the box

0 6 A series of numbers shown in **Figure 6** are to be sorted into ascending order (from smallest to largest).

Figure 6

45	23	78	55	49

0 6 . 1 A bubble sort algorithm has been developed to sort the numbers in **Figure 6**.

Fill in the table to show the steps involved in applying a bubble sort algorithm to sort the numbers shown in **Figure 6**.

You should show the new order every time the order has changed.

[3 marks]

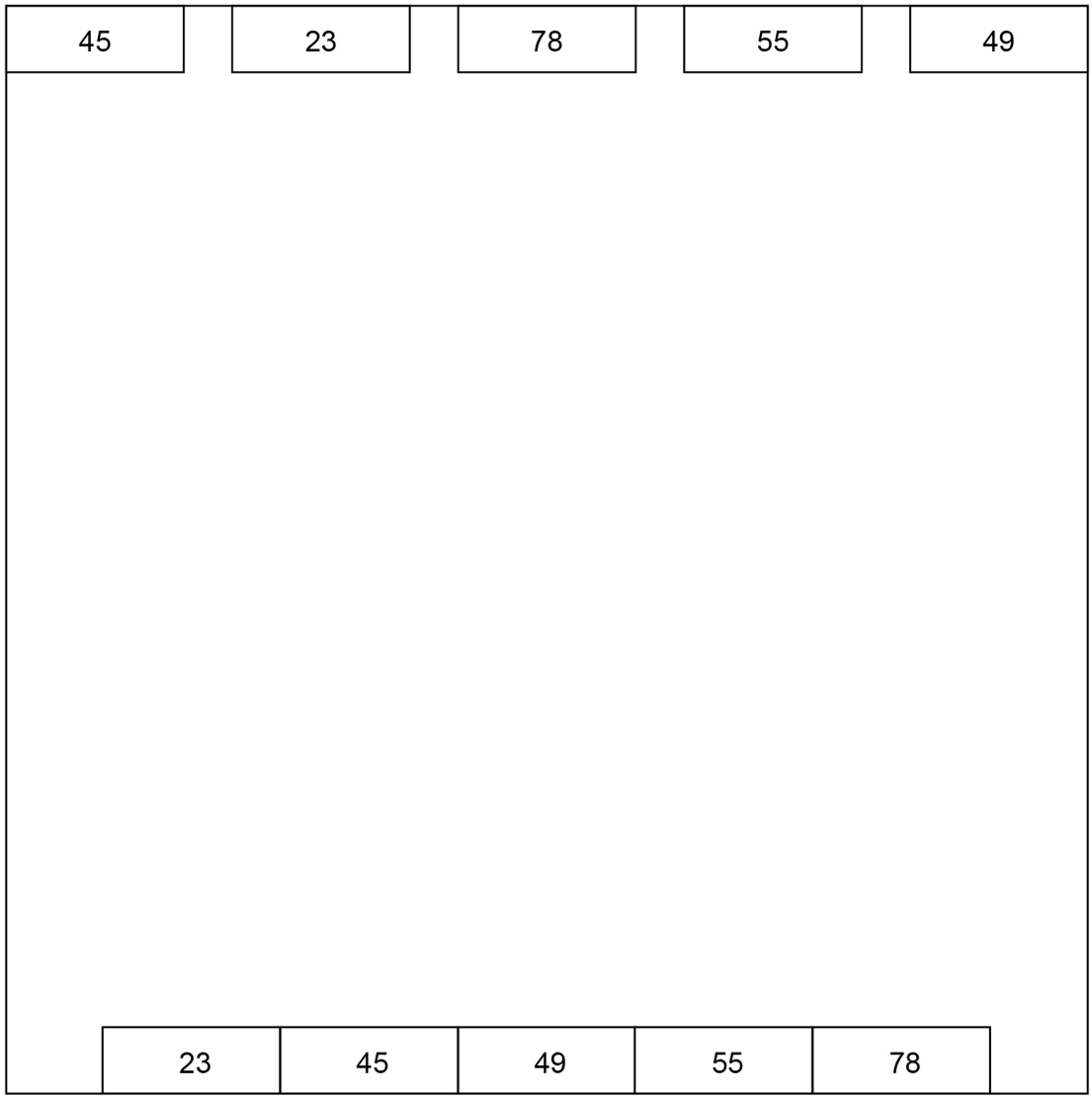
45	23	78	55	49
23	45	49	55	78

Do not write outside the box

0 6 . 2 A programmer decides to use a merge sort algorithm to sort the same values shown in **Figure 6**.

Complete the diagram to show how the **merge** part of the merge sort algorithm is applied to **Figure 6**.

[3 marks]



Question 6 continues on the next page

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0 6 . 3 State **one** advantage and **one** disadvantage of a bubble sort compared to a merge sort.

[2 marks]

Advantage _____

_____

_____

Disadvantage _____

_____

_____

0 6 . 4 The programmer has an array of 2500 numbers, stored in ascending order (smallest to largest).

The programmer needs to write a program to search for a value in the array.

Explain why a binary search is better than a linear search for this array.

[2 marks]

_____

_____

_____

10

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 7 **Figure 7** shows a subroutine written in pseudo-code.

Figure 7

```
SUBROUTINE testSub(number)
   OUTPUT number
   x ← number MOD 2
   OUTPUT x
   IF x = 0 THEN
      RETURN True
   ELSE
      RETURN False
   ENDIF
ENDSUBROUTINE
```

0 7 . 1 Describe the purpose of the subroutine in **Figure 7**.

[1 mark]

0 7 . 2 The subroutine in **Figure 7** is called using `testSub(10)`

Complete the table to show the values output.

[2 marks]

Program Code	Output
`OUTPUT number`	
`OUTPUT x`	

0 7 . 3 The subroutine in **Figure 7** is called using `testSub(8)`

State the value returned.

[1 mark]

Do not write outside the box

0 7 . 4 State the identifier for the parameter in **Figure 7**.

[1 mark]

0 7 . 5 State **two** characteristics of the structured approach to programming.

[2 marks]

1 _____

_____

2 _____

_____

7

Turn over for the next question

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0 8 **Figure 8** shows an algorithm represented using pseudo-code.

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

Figure 8

```
1   b1 ← '0010'
2   b2 ← '0111'
3   new ← ''
4   FOR i ← 0 TO LEN(b1) - 1
5      IF b1[i] = '1' OR b2[i] = '1' THEN
6         IF NOT (b1[i] = '1' AND b2[i] = '1') THEN
7            new ← new + '1'
8         ELSE
9            new ← new + '0'
10        ENDIF
11     ELSE
12        new ← new + '0'
13     ENDIF
14  ENDFOR
15  OUTPUT new
```

0 8 . 1 Complete the trace table for the algorithm shown in **Figure 8**.

You may not need to use all the rows in the table.

[5 marks]

b1	b2	new	i

Do not write outside the box

0 8 . 2 Explain why **line 4** in **Figure 8** uses `LEN(b1) - 1` instead of `LEN(b1)`

[1 mark]

Turn over for the next question

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0 9 **Figure 9** shows five algorithms, represented using pseudo-code.

Figure 9

A

```
numbers ← [44, 1, 2, 14, 68]
counter ← 0
total ← 0
WHILE counter < 5
   index ← counter
   total ← total + numbers[index]
   counter ← counter + 1
ENDWHILE
OUTPUT total
```

B

```
numbers ← [44, 1, 2, 14, 68]
total ← 0
FOR a ← 0 TO LEN(numbers) - 1
   total ← total + numbers[a]
ENDFOR
OUTPUT total
```

C

```
numbers ← [44, 1, 2, 14, 68]
total ← 0
FOR a ← 1 TO 7
   total ← total + numbers[a]
ENDFOR
OUTPUT total
```

D

```
numbers ← [44, 1, 2, 14, 68]
total ← 0
WHILE total > 0
   total ← total + numbers[total]
ENDWHILE
OUTPUT total
```

E

```
numbers ← [44, 1, 2, 14, 68]
total ← 0
x ← 1
REPEAT
   total ← total + numbers[x]
UNTIL x = 5
OUTPUT total
```

Do not write outside the box

The algorithms in **Figure 9** have been written to calculate the total of the five values in the array `numbers`. Not all of the algorithms work.

Complete the table by ticking (✓) **one** box in **each** column (**A**–**E**).

[2 marks]

	Algorithm				
	A	**B**	**C**	**D**	**E**
Algorithm totals the five values					
Algorithm does **not** total the five values					

8

Turn over for the next question

Do not write outside the box

1 0 A programmer is writing an algorithm, using pseudo-code, to store the results of running events.

The programmer uses a record data structure.

Each record stores:
- the name of the running event
- the runner's number
- the time in seconds for that runner in that event.

Figure 10 shows the record structure.

Figure 10

```
RECORD Runner
    event : String
    runnerNumber : Integer
    time : Real
ENDRECORD
```

1 0 . 1 **Figure 11** shows pseudo-code used to create two records using the structure in **Figure 10**.

Figure 11

```
race1 ← Runner('400 m', 23, 51.35)
race2 ← Runner('400 m', 14, 63.26)
```

Complete the line of pseudo-code to create a new record that contains the following data:

event	**runnerNumber**	**time**
200 m	10	32.59

[1 mark]

race3 ← _____

1 0 . 2 Complete the line of pseudo-code needed to output the time of `race2`

[1 mark]

OUTPUT race2 _____

Do not write outside the box

1 0 . 3 The programmer wants to find the fastest time for a particular running event.

The times for all the runners in the event are stored in an array of real numbers called `times`

Write a Python program to find the fastest time.

Your program must:
- find the smallest value in the array (ie the fastest time)
- output the smallest value
- work with any size of array.

For example, if `times` contains 28.5, 26.3 and 30.0, the output should be 26.3

The program you write **must not** use any built-in routines to find the smallest value in an array or to sort the array into an order.

You do not need to write code to create the array `times`

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code accurately.

[6 marks]

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8

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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1 1 A word game is being developed using Python.

A word is displayed as a series of asterisks (`*`) equal to the number of letters in the word.

For example, the word `apple` would be displayed as `*****`

The player guesses one letter at a time. If the letter is in the word, the letter will replace the asterisk(s) wherever the letter occurs.

For example, if the player enters `p` then the word `apple` will be displayed as `*pp**`

Only lower-case letters are used in the word game.

Figure 12 shows a subroutine used in the program for this word game.

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

Figure 12

```
1  def findLetter(word, letter, hidden):
2      newHidden = ""
3      for i in range(len(word)):
4          if word[i] == letter:
5              newHidden = newHidden + letter
6          else:
7              newHidden = newHidden + hidden[i]
8      return newHidden
```

1 1 . 1 The subroutine call `findLetter("system", "s", "*y**em")` is made.

What is the value of the variable `letter` when **line 4** is first executed?

Shade **one** lozenge.

[1 mark]

A `*y**em` ⬭

B `s` ⬭

C `sys**m` ⬭

D `system` ⬭

Do not write outside the box

1 1 . 2 The subroutine call `findLetter("system", "s", "*y**em")` is made.

What is the value of the variable `newHidden` when **line 6** is first executed?

Shade **one** lozenge.

[1 mark]

A `s` ⬭

B `sys` ⬭

C `sys**m` ⬭

D `system` ⬭

1 1 . 3 The subroutine call `findLetter("system", "s", "*y**em")` is made.

Identify how many times the loop would iterate.

Shade **one** lozenge.

[1 mark]

A 1 ⬭

B 2 ⬭

C 6 ⬭

D 7 ⬭

1 1 . 4 The subroutine call `findLetter("system", "s", "*y**em")` is made.

What value is returned?

Shade **one** lozenge.

[1 mark]

A `s` ⬭

B `sy*tem` ⬭

C `sys*em` ⬭

D `system` ⬭

Question 11 continues on the next page

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1 1 . 5 A Python program is being written to determine if a player wins or loses the word game.

- The player wins if they correctly guess all of the letters in the word within eight guesses or fewer.
- The player loses if they have had eight guesses and there are still letters remaining that they have not guessed correctly.

Figure 13 shows the beginning of the program.

Figure 13

```
word = input()
hidden = ""
for i in range(len(word)):
    hidden = hidden + "*"
```

Extend the program in **Figure 13**.

Your program must:

- keep repeating the following until the user has had eight guesses or there are no asterisks left in `hidden`
  - get the user to enter a letter
  - call the `findLetter` subroutine (from **Figure 12**)
  - update the value of `hidden` using the value returned from `findLetter`
  - display the new value of `hidden`
- check if the new value of `hidden` contains any asterisks
  - if there are any asterisks in `hidden` display the message `You lost`
  - if there are no asterisks in `hidden` display the message `You won`

The program you write **must not** use any built-in routines to check if a string contains another string/character or to count the number of asterisks.

You **should** use indentation as appropriate, meaningful variable name(s) and Python syntax in your answer.

The answer grid below contains vertical lines to help you indent your code accurately.

[10 marks]

```
word = input()
hidden = ""
for i in range(len(word)):
    hidden = hidden + "*"
```

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Turn over ►

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END OF QUESTIONS

14

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ANSWER IN THE SPACES PROVIDED

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