YEAR 11

COMPUTER SCIENCE

AQA 8525

CONSOLIDATION PACK

OUT OF 110

Pseudocode & Algorithm Model Answers

EXAMPLE

0 7 . 6 Develop an algorithm, using either pseudo-code or a flowchart, that prompts the user to enter three values. It should output `'duplicate'` if at least two of these values are the same.

The start of the algorithm has been written for you.

[3 marks]

```
v1 ← USERINPUT
v2 ← USERINPUT
v3 ← USERINPUT
```

ANSWER USING PSEUDOCODE

An example of a fully correct answer:

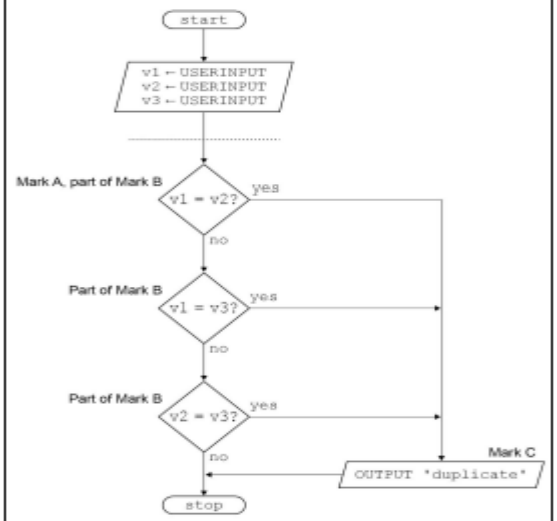
```
v1 ← USERINPUT
v2 ← USERINPUT
v3 ← USERINPUT
IF v1 = v2 THEN              [A, part B]
   OUTPUT 'duplicate'         [part C]
ELSE
   IF v1 = v3 THEN           [part B]
      OUTPUT 'duplicate'     [part C]
   ELSE
      IF v2 = v3 THEN            [part B]
         OUTPUT 'duplicate'      [part C]
      ENDIF
   ENDIF
ENDIF
```

An alternative fully correct answer is:

```
v1 ← USERINPUT
v2 ← USERINPUT
v3 ← USERINPUT
IF v1 = v2 OR v1 = v3 OR v2 = v3 THEN[A, B]
   OUTPUT 'duplicate'                  [C]
ENDIF
```

ANSWER USING FLOWCHART

An example of a fully correct flowchart answer is:



L shape of symbols

11.1 The size of a sound file is calculated using the following formula:

size (in bits) = sampling rate * sample resolution * seconds

To calculate the size **in bytes**, the number is divided by **8**

The algorithm in **Figure 12**, represented using pseudo-code, should output the size of a sound file in **bytes** that has been sampled 100 times per second, with a sample resolution of 16 bits and a recording length of 60 seconds.

A subroutine called `getSize` has been developed as part of the algorithm.

Complete **Figure 12** by filling in the gaps using the items in **Figure 11**.

You will not need to use all the items in **Figure 11**.

[6 marks]

Figure 11

bit	byte	getSize	OUTPUT
rate	res	RETURN	sampRate
seconds	size	size + 8	size * 8
size / 8	size MOD 8	SUBROUTINE	USERINPUT

Figure 12

```
SUBROUTINE getSize(_____, _____, seconds)
    _____ ← sampRate * res * seconds
    size ← _____
    _____ size
ENDSUBROUTINE

OUTPUT _____(100, 16, 60)
```

6 marks for AO3 (program)

1 mark for each correct item in the correct location

```
SUBROUTINE getSize(sampRate, res, seconds)
    size ← sampRate * res * seconds
    size ← size / 8
    RETURN size
ENDSUBROUTINE

OUTPUT getSize(100, 16, 60)
```

I. Case

R. Incorrect order of parameters

Answer all questions below: Use your knowledge organiser for reference if you need to revive before this test.

1. Explain one advantage of the structured approach to programming.

……
……
……
……

[2marks]

2.

Explain why `rest` could have been defined as a **constant** in the algorithm shown in **Figure 1**.

Figure 1

```
1 seconds ← 0
2 rest ← 50
3 REPEAT
4    bpm ← getBPM()
5    effort ← bpm - rest
6    IF effort ≤ 30 THEN
7       OUTPUT 'faster'
8    ELSE
9       IF effort ≤ 50 THEN
10         OUTPUT 'steady'
11      ELSE
12         OUTPUT 'slower'
13      ENDIF
14   ENDIF
15   wait(60)
16   seconds ← seconds + 60
17 UNTIL seconds > 200
```

[1mark]

3.

Figure 1 shows a value represented as a bit pattern.

Figure 1

10110000

A binary shift can be used to divide the value in **Figure 1** by 4

State the result of this shift?

Your answer **must** be in binary.

.....

.....

[1mark]

4.

Figure 11 shows a binary search algorithm that has been programmed in Python.

Figure 11

```
animals = ["cat", "dog", "hippo", "llama", "ox", "rat", "tiger", "wolf"]
animalToFind = input("What animal would you like to find? ")
validAnimal = False
start = 0
finish = len(animals) - 1
while validAnimal == False and start <= finish:
  mid = (start + finish) // 2
  if animals[mid] == animalToFind:
    validAnimal = True
  elif animalToFind > animals[mid]:
    start = mid + 1
  else:
    finish = mid - 1
print(validAnimal)
```

Complete the trace table for the program in **Figure 11** if the user input is wolf

Part of the table has already been filled in.

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

animalToFind	validAnimal	start	finish	mid
wolf	False	0	7	3

[4marks]

5.Write pseudocode that simulates the roll of a dice, generating and outputting a random number between 1 and 6.

.....

.....

.....

.....

[2marks]

6. Calculate the minimum file size in bits of a 10 pixel by 10 pixel image with a colour depth of 3 bits.

.....
.....
.....
.....

[1mark]

7.. Calculate the minimum file size in bytes of a 10 pixel by 10-pixel image with 12 different colours.

.....
.....
.....
.....

[1mark]

8.

Figure 7 shows part of a program written in Python.

Figure 7

```
validChoice = False
while validChoice == False:
   choice = int(input('Enter your choice [1 - 10]'))
   if choice >= 1 and choice <= 10:
     validChoice = True
   else:
     print('Invalid choice')
print('Valid choice')
```

Complete the following **test plan** for the code shown in **Figure 7**.

Test type	Test data	Expected result
Normal data	5	Valid choice message displayed
Invalid data		
Boundary data		

[2Marks]

9.

Figure 8 shows an algorithm represented using pseudocode.

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

Figure 8

```
1 names ← ['Lily', 'Thomas']
2 name1 ← 'Sarah'
3 name2 ← 'Freddie'
4 OUTPUT name1[0]
5 OUTPUT LEN(names)
6 var ← SUBSTRING(0, 3, name1)
7 OUTPUT var
```

`SUBSTRING` returns part of a string.

For example, `SUBSTRING(3, 5, 'programming')` will return the string `'gra'`

Two extra lines are being added to the end of the algorithm in **Figure 8**.

Fill in the gaps so the output from the new final line will be the string `'Thomasrah'`.

```
var ← SUBSTRING( _____ , _____ , name1)
OUTPUT names[ _______ ] + var
```

[2 Marks]

10.

A programmer needs to choose between two algorithms, Algorithm A and Algorithm B,to solve a problem. Algorithm A takes 500 milliseconds to process 1,000 items, while Algorithm Btakes 300 milliseconds to process the same number ofitems. However, Algorithm A uses less memory than Algorithm B. Explain one situation where the programmer might prefer Algorithm A over Algorithm B, even though itis slower

……
……

……

……

[2 Marks]

11.

```
RECORD Film
   title : String
   certificate : String
   year : Integer
   beingShown : Boolean
ENDRECORD
hulk ← Film('Hulk', '12A', 2005, False)
ironMan ← Film('Iron Man', '12A', 2008, False)
antMan ← Film('Ant-Man', '12A', 2015, False)
filmCollection ← [antMan, hulk, ironMan]
year ← 0
position ← 0

FOR i ← 0 TO ①
 IF filmCollection[i].year > year THEN
    year ← filmCollection[i].year
    position ← i
 ENDIF
ENDFOR
OUTPUT filmCollection[position].title, ' is the newest film'
```

What should the label ① in **Figure 8** be replaced by?

Identify one choice.

A. 3

B. LEN(filmCollection)

C. C LEN(filmCollection) – 1

D. Position

[1 Mark]

12.

A library sorts their books based on a book code. Show the steps that a merge sort would take to put the following list of book codes into ascending alphabetical order (from A to Z). POE12 , BAC97 , FLY77 , JAV16 , TAL86 , AND18 , ZAR09 , HOP86

[4marks]

13.

Explain one advantage of a merge sort compared to a bubble sort.

……..
……..

……..

……..

[2marks]

14.

Look at the following Python code:

```
a = True
b = False
print("a and b:", a and b)
print("a or b:", a or b)
```

State the output of each print statement.

……..
……..

……..

……..

[2marks]

15.

Write a Python program that allows a taxi company to calculate how much a box taxifare should be.

The program should:

- allow the user to enter the journey distance in kilometres (no validation is required)
- allow the user to enter the number of passengers (no validation is required)
- calculate the taxifare by
- charging £2 for every passenger regardless of the distance
- charging a further £1.50 for every kilometre regardless of how many passengers
- there are
- output the final taxifare.

You should use meaningful variable name(s), correct syntax and indentation in your answer.

[7marks]

16.

Fill in the blank arrays to show the steps involved in applying the bubble sort algorithm to the array `[3, 5, 1, 4, 2]`.

You **only** need to show the missing steps where a change is applied to the array.

3	5	1	4	2
1	2	3	4	5

[5marks]

17.

Figure 7 shows part of a program written in Python.

Figure 7

```
validChoice = False
while validChoice == False:
   choice = int(input('Enter your choice [1 - 10]'))
   if choice >= 1 and choice <= 10:
     validChoice = True
   else:
     print('Invalid choice')
print('Valid choice')
```

Complete the following **test plan** for the code shown in **Figure 7**.

Test type	Test data	Expected result
Normal data	5	Valid choice message displayed
Invalid data		
Boundary data		

[2marks]

18.

The following subroutines control the way that labelled blocks are placed in box different columns.

`BLOCK_ON_TOP(column)`	returns the label of the block on top of the column given as a parameter.
`MOVE(source, destination)`	moves the block on top of the source column to the top of the destination column.
`HEIGHT(column)`	returns the number of blocks in the specified column

This is how the blocks A, B and C are arranged at the start.

Draw the final arrangement of the blocks after the following algorithm has run.

```
MOVE(0, 1)
MOVE(0, 2)
MOVE(0, 2)
```

[3marks]

19.

Eight minutes of sound has been digitally recorded. The **sampling rate** used was 25 000 Hertz and the **sample resolution** used was 4 bits.

Calculate the minimum file size for the recording.

Give your answer in **megabytes**.

You **should** show your working.

.....

.....

.....

[4marks]

20.

Explain what effects increasing the sampling rate would have on the recording.

.....

.....

.....

[2marks]

21.

Table 1 is a frequency table that contains the frequency of characters in a string.

Table 1

A	6
B	2
C	3

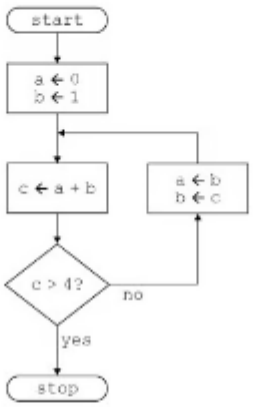
Use the frequencies given in **Table 1** to **draw a Huffman tree** that represents the string.

[3marks]

22.

Figure 4 shows an algorithm presented as a flowchart.

Figure 4



Complete the trace table for the algorithm in **Figure 4**.

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

a	b	c

[3marks]

23.

Analogue sound must be converted to a digital form for storage and processing in a computer. A 50-second sound has been recorded at a sample rate of 40000 Hz. Two bytes have been used to store each sample of the sound.

Calculate the file size of the sound file in megabytes. Show your working.

……..

……..

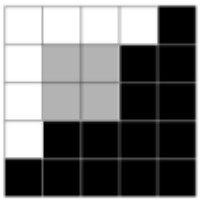
……..

[2marks]

24.

Figure 1 shows a 5 pixel x 5 pixel image. A minimum colour depth of two bits is needed to store the image.

Figure 1



Explain how the image in **Figure 1** can be represented as a bitmap.

……

……

……

[3marks]

25.

A 10-pixel x 10 pixel image contains five different colours. Calculate the minimum file size, in bits, of this image when represented as a bitmap. You should show your working.

……

……

……

[2marks]

26

A black and white image has been compressed using **run length encoding** (**RLE**).

The first bit in each byte of the bit pattern represents the colour and the remaining seven bits of the byte represent the number of pixels in the run.

The image has a run of 60 black pixels followed by a run of 30 white pixels and is represented by the bit pattern shown in **Figure 2**.

Figure 2

0	0	1	1	1	1	0	0	**1**	0	0	1	1	1	1	0

Using the same RLE method, **give the bit pattern** for a black and white image that has a run of 64 white pixels followed by a run of 15 black pixels.

[2marks]

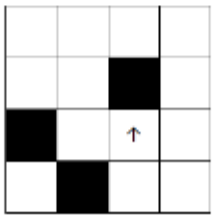
27

Four separate subroutines have been written to control a robot.

- `Forward(n)` moves the robot n squares forward.
- `TurnLeft()` turns the robot 90 degrees left.
- `TurnRight()` turns the robot 90 degrees right.
- `ObjectAhead()` returns `true` if the robot is facing an object in the next square or returns `false if` this square is empty.

Draw the path of the robot through the grid below if the following program is executed (the robot starts in the square marked by the ↑ facing in the direction of the arrow). If a square is black then it contains an object

```
WHILE ObjectAhead() = true
TurnLeft()
IF ObjectAhead() = true THEN
TurnRight()
TurnRight()
ENDIF
Forward(1)
ENDWHILE
Forward(1)
```



[3marks]

28

A sound engineer is recording a singer. Describe why the sound must be converted to a digital format before it can be stored on a computer system.

……

……

.....

.....

.....

.....

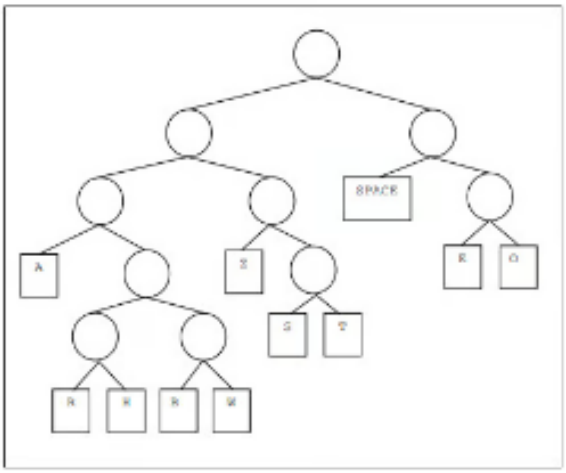
[2marks]

29

Using the **Huffman code** in **Figure 3**, **complete the table** to show the Huffman coding for the characters O, SPACE and B.

Character	Huffman coding
O	
SPACE	
B	

Figure 3



[3marks]

30

Using **Huffman coding**, the text ZOE SAW A ZEBRA AT THE ZOO can be stored in 83 bits.

Calculate how many additional bits are needed to store the same piece of text using ASCII.

Show your working.

.....

.....

.....

.....

.....

.....

[3marks]

31

Figure 13 shows an algorithm represented in pseudo-code. A developer wants to check the algorithm works correctly.

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

Figure 13

```
1 arr[0] ← "c"
2 arr[1] ← "b"
3 arr[2] ← "a"
4 FOR i ← 0 TO 1
5     FOR j ← 0 TO 1
6         IF arr[j + 1] < arr[j] THEN
7             temp ← arr[j]
8             arr[j] ← arr[j + 1]
9             arr[j + 1] ← temp
10        ENDIF
11    ENDFOR
12 ENDFOR
```

Complete the trace table for the algorithm shown in **Figure 13**.

Some values have already been entered.

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

arr			i	j	temp
[0]	[1]	[2]			
c	b	a			

[6marks]

32.

1 0 **Figure 9** shows a subroutine represented using pseudo-code.

Figure 9

```
SUBROUTINE calculate(n)
   a ← n
   b ← 0
   REPEAT
      a ← a DIV 2
      b ← b + 1
   UNTIL a ≤ 1
   OUTPUT b
ENDSUBROUTINE
```

The `DIV` operator is used for integer division.

1 0 . 1 Complete the trace table for the subroutine call `calculate(50)`

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

[4 marks]

n	a	b	OUTPUT
50			

[4marks]

0 7 Write a Python program to check if an email address has been entered correctly by a user.

Your program must:

- get the user to input an email address
- get the user to input the email address a second time
- output the message `Match` **and** output the email address if the email addresses entered are the same
- output the message `Do not match` if the email addresses entered are not the same.

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]

[5marks]

34

Figure 13 shows an algorithm, represented using pseudo-code, that should display currency names in reverse alphabetical order, starting with `yen`.

There are errors in the logic of the algorithm.

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

Figure 13

```
1   SUBROUTINE diffCurrencies(currencies)
       currencies ← ['baht', 'dollar', 'euro',
2                    'koruna', 'lira', 'rand',
                     'rupee', 'yen']
3      RETURN currencies[x]
4   ENDSUBROUTINE
5
6   FOR i ← 8 TO 0 STEP 1
7      OUTPUT(diffCurrencies(i))
8   ENDFOR
```

Rewrite **line 1** and **line 6** from **Figure 13** to make the algorithm work as intended.

[3 marks]

Line 1 _____

_____

Line 6 _____

_____

[3marks]

35

0 8 Write a Python program that inputs a character and checks to see if it is lowercase or not.

Your program should work as follows:

- gets the user to enter a character and store it in a suitable variable
- determines if the entered character is a lowercase character
- outputs `LOWER` if the user has entered a lowercase character
- outputs `NOT LOWER` if the user has entered any other character.

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

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

[7 marks]

[7marks]

11.3 State **three** advantages of using subroutines.

[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

[3marks]

37

14.2 Using Python, write a subroutine to help a museum review the number of visitors in a month.

The subroutine must:

- have the identifier `countDays`
- have the number of days a museum was open in the last month as a parameter
- get the user to enter the number of visitors to the museum for each of those days
- count how many of those days the museum had more than 200 visitors
- return the count.

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]

[6marks]