

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Thursday 16 May 2019 – Afternoon**

**GCSE (9–1) Computer Science**

**J276/02 Computational thinking, algorithms and programming**

**Time allowed: 1 hour 30 minutes  
plus your additional time allowance**

**DO NOT USE:  
a calculator**

**Please write clearly in black ink.**

**Centre number**

--	--	--	--	--

**Candidate number**

--	--	--	--

**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**No calculator can be used for this paper**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS**

**Use black ink.**

**Answer ALL the questions.**

**Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.**

## **INFORMATION**

**The total mark for this paper is 80.**

**The marks for each question are shown in brackets [ ].**

**BLANK PAGE**

**Answer ALL the questions.**

- 1 (a) A radio station records an interview with a computer scientist using a computer and audio recording software.**

- (i) Explain how sampling is used to store audio recordings.**

---

---

---

---

---

---

---

---

---

---

**[2]**

**A second interview with the computer scientist is recorded. Before this interview, the sampling frequency in the audio software is increased.**

**(ii) Define what is meant by the term SAMPLING FREQUENCY.**

---

---

---

---

---

**[1]**

(iii) Tick (✓) TWO boxes to show the effects of increasing the sampling frequency. [2]

<b>Data type of returned value</b>	<b>Tick (✓) TWO boxes</b>
<b>The file size of the digital recording will be smaller.</b>	
<b>The file size of the digital recording will be larger.</b>	
<b>The quality of playback of the digital recording will be better.</b>	
<b>The quality of playback of the digital recording will be worse.</b>	

**(b) The radio station uses a digital camera to take a photograph of the computer scientist for their website. The photograph is stored as a bitmap image.**

**(i) Describe how bitmap images are represented in binary.**

---

---

---

---

---

---

---

---

---

---

---

**[3]**

**(ii) Explain why computers represent data in binary form.**

---

---

---

---

---

---

---

**[2]**

The image is compressed using lossy compression before being uploaded to the radio station's web server. The image will be used on the radio station's website.

- (iii) Describe ONE advantage and ONE disadvantage of using lossy compression on the image that will be used on the website.

Advantage \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_

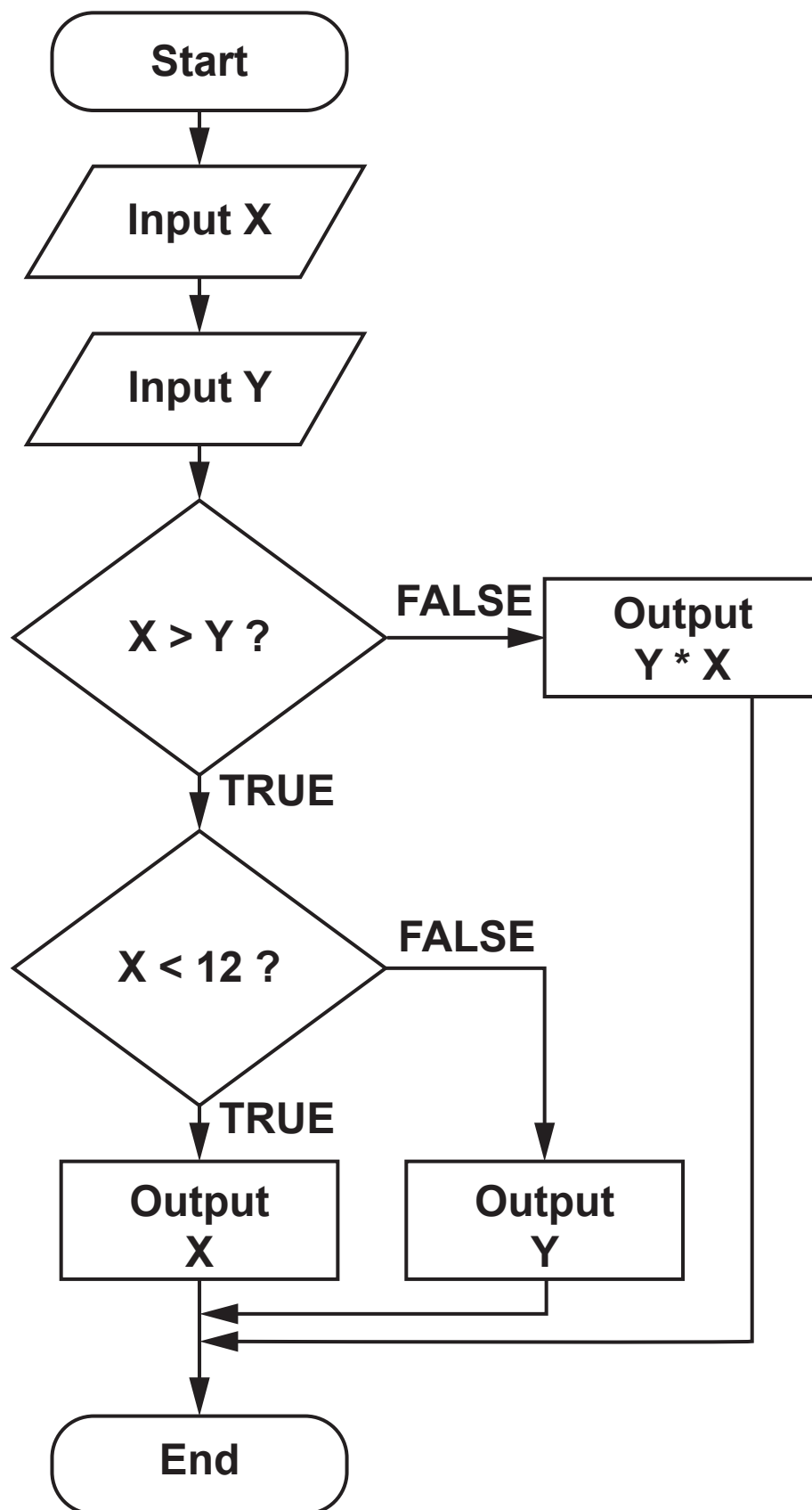
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[4]

- 2 A programmer creates an algorithm using a flow chart.



- (a) Complete the table to give the output when each of the following set of values are input into the algorithm as X and Y. [4]

Input value of X	Input value of Y	Output
15	10	
6	5	
2	3	
12	2	

**(b) Write this algorithm using pseudocode.**

[illegible]

**The algorithm is written in a high-level language. The high level code must be translated into machine code before a computer processor can execute it.**

**(c) Describe TWO methods of translating high level code into machine code.**

**1** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**2** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ **[4]**

- 3 Louise writes a program to work out if a number entered by the user is odd or even. Her first attempt at this program is shown.

```
01 num = input("enter a number")

02 if num MOD 2 >= 0 then

03     print("even")

04 else

05     pritrn("odd")

06 endif
```

- (a) The program contains a logic error on line 02.

- (i) State what is meant by a logic error.

---

---

[1]

- (ii) Give a corrected version of line 02 that fixes the logic error.

---

---

[1]

**(b) The program contains a syntax error on line 05.**

**(i) State what is meant by a syntax error.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(ii) Give a corrected version of line 05 that fixes the syntax error.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

- 4 Elliott plays football for OCR FC. He wants to create a program to store the results of each football match they play and the names of the goal scorers. Elliott wants individual players from the team to be able to submit this information.

(a) (i) Define what is meant by ABSTRACTION.

---

---

---

---

[2]

(ii) Give ONE example of how abstraction could be used when developing this program.

---

---

[1]

**(b) Describe TWO examples of defensive design that should be considered when developing this program.**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ **[4]**

The number of goals scored in each football match is held in an array called `goals`. An example of this array is shown.

```
goals = [0, 1, 3, 0, 4, 5, 2, 0, 2, 1]
```

Elliott wants to count how many matches end with 0 goals.

(c) Complete the following pseudocode for an algorithm to count up how many matches with 0 goals are stored in the array and then print out this value. [3]

```
01 nogoalscount = 0
02 for count = 0 to (goals.length-1)
03     if goals[.....] == 0 then
04         nogoalscount .....
05     endif
06 next count
07 print(.....)
```

- 5 (a) Convert the hexadecimal number A3 to denary.  
Show your working.

---

---

---

---

---

[2]

- (b) Convert the binary number 1011011 to denary.  
Show your working.

---

---

---

---

---

[2]

(c) The symbol  $\wedge$  is used for exponentiation.

Give the result of  $a^b$  when  $a = 3$  and  $b = 2$ .

---

---

---

---

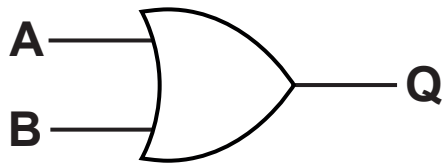
---

[1]

(d) Add the following binary numbers. [2]

$$\begin{array}{r} \phantom{+} 1\ 0\ 1\ 1\ 0\ 1\ 1\ 0 \\ + \phantom{1} 1\ 0\ 0\ 1\ 1\ 1 \\ \hline \end{array}$$

(e) Complete the truth table for the following logic gate. [4]



A	B	Q
0	0	0
0	1	1
	0	
1		

**6 OCR Land is a theme park aimed at children and adults. Entrance tickets are sold online. An adult ticket to OCR Land costs £19.99, with a child ticket costing £8.99. A booking fee of £2.50 is added to all orders.**

**(a) A function, `ticketprice()`, takes the number of adult tickets and the number of child tickets as parameters. It calculates and returns the total price to be paid.**

**(i) Use pseudocode to create an algorithm for the function `ticketprice()`. [6]**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

- (ii) Tick (✓) ONE box to identify the data type of the value returned from the function `ticketprice()`, justifying your choice.

Data type of returned value	Tick (✓) ONE box
Integer	
Real	
Boolean	
String	

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[2]

**(b) OCR Land regularly emails discount codes to customers. Each discount code includes a check digit as the last character.**

**(i) Give ONE benefit of using a check digit for the discount code.**

---

---

---

---

---

**[1]**

**(c) A list of valid discount codes is shown below.**

**[NIC12B, LOR11S, STU12M, VIC08E, KEI99M,  
WES56O, DAN34S]**

**(i) State ONE reason why a binary search would not be able to be used with this data.**

---

---

---

---

---

**[1]**

- (ii) Give the name of ONE searching algorithm that would be able to be used with this data.

---

---

[1]

**BLANK PAGE**

(d) OCR Land keeps track of the size of queues on its rides by storing them in an array with the identifier `queuesize`. It uses the following bubble sort algorithm to put these queue sizes into ascending numerical order.

```
01 swaps = True
02 while swaps
03     swaps = False
04     for p = 0 to queuesize.length-2
05         if queuesize[p] > queuesize[p+1] then
06             temp = queuesize[p]
07             queuesize[p] = queuesize[p+1]
08             queuesize[p+1] = temp
09             swaps = True
10         endif
11     next p
12 endwhile
```

- (i) Explain the purpose of the Boolean variable swaps in this bubble sort algorithm.

---

---

---

---

---

---

---

---

---

---

[2]

- (ii) Explain the purpose of lines 06 to 08 in this bubble sort algorithm.

---

---

---

---

---

---

---

---

---

---

[2]

**(iii) Describe ONE way that the maintainability of this algorithm could be improved.**

---

---

---

---

---

---

---

---

**[2]**

**(iv) Give the names of TWO other sorting algorithms that could be used instead of bubble sort.**

**1** 

---

---

**2** 

---

---

**[2]**

- (e) One ride in OCR Land has a minimum height of 140 cm to ride alone or 120 cm to ride with an adult.

Create an algorithm that:

asks the user to input the height of the rider, in centimetres

if needed, asks if they are riding with an adult

outputs whether or not they are allowed to ride

repeats this process until 8 people have been allowed to ride. [8]

---

---

---

---

---

---

---

---

---

---

---

[illegible]

[illegible]

---

---

---

---

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

**If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).**






[illegible]



