OCR
Oxford Cambridge and RSA

Thursday 16 May 2019 – Afternoon

GCSE (9–1) Computer Science

J276/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

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Do not use:
- a calculator

J276 02

Please write clearly in black ink. **Do not write in the barcodes.**

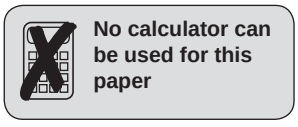
Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

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 **[ ]**.
- This document consists of **24** pages.



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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.

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..... **[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**.

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..... **[1]**

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(iii) Tick (✓) **two** boxes to show the effects of increasing the sampling frequency.

Data type of returned value	Tick (✓) **two** boxes
The file size of the digital recording will be smaller.	
The file size of the digital recording will be larger.	
The quality of playback of the digital recording will be better.	
The quality of playback of the digital recording will be worse.	

[2]

(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.

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..... **[3]**

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

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..... **[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 .....

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Disadvantage .....

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[4]

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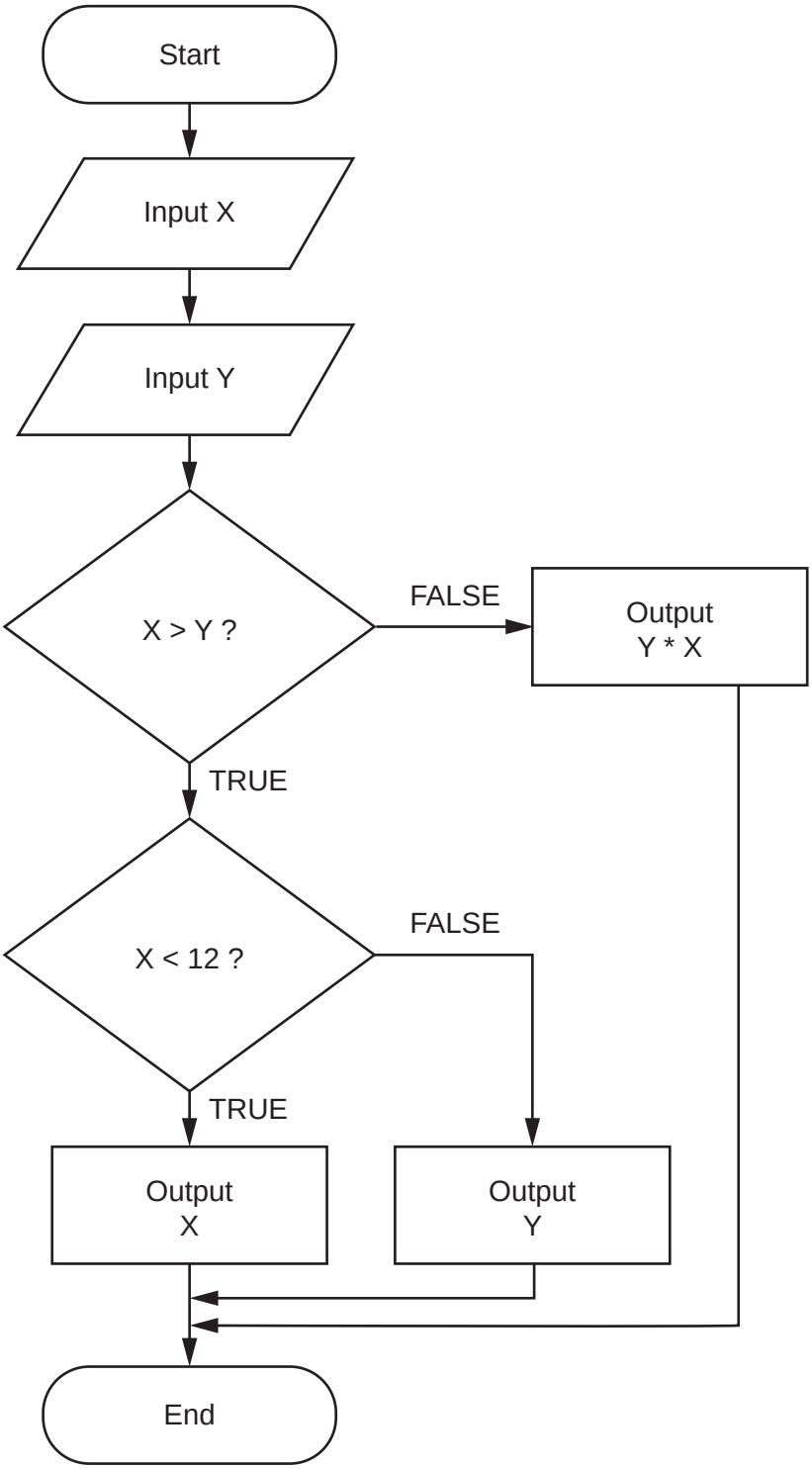
2 A programmer creates an algorithm using a flow chart.



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7

(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.

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

[4]

(b) Write this algorithm using pseudocode.

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..... **[6]**

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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.

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..... **[4]**

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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       pritn("odd")
06  endif
```

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

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

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..... **[1]**

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

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..... **[1]**

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

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

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..... **[1]**

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

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..... **[1]**

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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**.

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

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

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11

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.

```
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(……)
```

[3]

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

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..... **[2]**

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

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..... **[2]**

(c) The symbol **^** is used for exponentiation.

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

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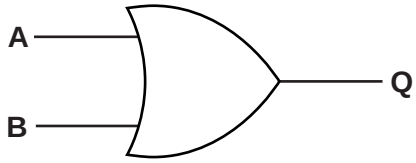
(d) Add the following binary numbers.

```
  1 0 1 1 0 1 1 0
+     1 0 0 1 1 1
```

[2]

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



A	B	Q
0	0	0
0	1	1
	0	
1		

[4]

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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()`.

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(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 .....

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[2]

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(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.

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..... **[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.

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

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(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.

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..... **[2]**

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

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

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..... **[2]**

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

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[2]

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(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.

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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).

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