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GCSE (9–1) Computer Science

J276/02 Computational thinking, algorithms and programming

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 30 minutes

You may not use:
- a calculator

First name									
Last name									
Centre number						**Candidate number**				

Specimen

INSTRUCTIONS
- Use black ink.
- Complete the boxes above with your name, centre number and candidate number.
- 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.
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **16** pages.

1 Kofi uses his computer to record an audio file of himself playing his guitar.

(a) Outline what happens when the computer converts the music into a file.

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[2]

(b) Kofi increases the sample rate his computer is using to record his guitar.

Explain **two** effects this will have on Kofi's recording.

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[4]

(c) Kofi is e-mailing his recording to a record label. He uses lossy compression to produce the music file.

Explain **two** reasons why using lossy compression is beneficial.

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[4]

Specimen

2 **(a)** Order the following units from smallest to largest:

GB bit PB byte nibble MB

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[1]

(b) Convert the decimal number 191 into an 8 bit binary number.

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[1]

(c) Convert the hexadecimal number 3E into a decimal number. You must show your working.

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[2]

Specimen

(d) There is a subroutine, HEX(), that takes a denary number between 10 and 15 and returns the corresponding hexadecimal number. E.g. HEX(10) would return ”A”, HEX(15) would return “F”.

Write an algorithm, using the subroutine HEX(), to convert any whole decimal number between 0 and 255 into a 2 digit hexadecimal number.

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Specimen

(e) **(i)** Add together the following two 8 bit binary numbers. Express your response in an 8 bit binary form.

01101010

10010110

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[2]

(ii) Identify the problem this addition has created.

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[1]

3 **(a)** Complete a 2 place right shift on the binary number 11001011.

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[1]

(b) Explain the effect of performing a 2 place right shift on the binary number 11001011.

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[2]

(c) Complete the truth table below for the Boolean statement **P = NOT (A AND B).**

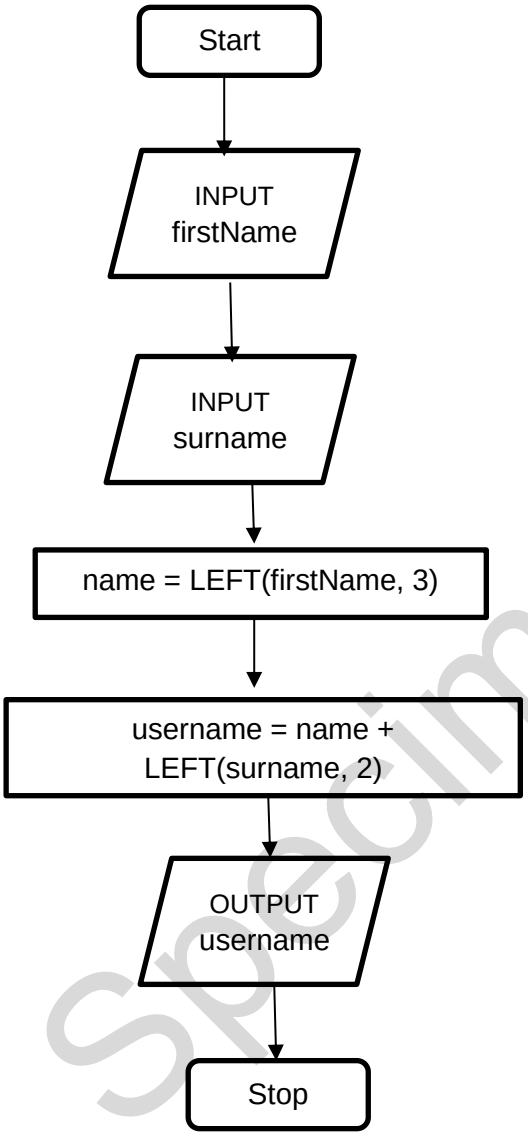
A	B	P
FALSE	FALSE	TRUE
FALSE	TRUE	
TRUE	FALSE	
TRUE	TRUE	FALSE

[2]

Specimen

4 Johnny is writing a program to create usernames. The first process he has developed is shown in the flowchart in **Fig. 1**.

Fig. 1



Specimen

For example, using the process in **Fig. 1**, Tom Ward's user name would be TomWa.

(a) State, using the process in **Fig. 1**, the username for Rebecca Ellis.

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[1]

(b) Johnny has updated the process used to create usernames as follows:

- If the person is male, then their username is the last 3 letters of their surname and the first 2 letters of their first name.
- If the person is female, then their username is the first 3 letters of their first name and the first 2 letters of their surname.

- What would be the username for a male called Fred Biscuit using the updated process?

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[1]

- Write an algorithm for Johnny to output a username using the updated process.

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[6]

Specimen

5 Harry is planning to create a computer game using a high-level programming language.

(a) State why the computer needs to translate the code before it is executed.

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[1]

(b) Harry can use either a complier or an interpreter to translate the code.

Describe **two** differences between how a complier and an interpreter would translate Harry's computer game.

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[4]

6 Heath is researching how long, to the nearest minute, each student in his class spends playing computer games in one week (Monday to Friday). He is storing the data in a 2D array.

Fig. 2 shows part of the array, with 4 students.

Fig. 2

		Students			
		0	**1**	**2**	**3**
Days of the week	**0**	60	30	45	0
	1	180	60	0	60
	2	200	30	0	20
	3	60	10	15	15
	4	100	35	30	45

For example, student 1, on Monday (day 0), played 30 minutes of computer games.

(a) Explain why Heath is using an array to store the data.

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Specimen

(b) **(i)** Identify a data type that could be used to store the number of minutes in this array.

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[1]

(ii) State why this data type is the most appropriate.

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[1]

(c) Heath wants to output the number of minutes student 3 played computer games on Wednesday (day 2). He writes the code:

```
print (hoursPlayed[3,2])
```

The output is 20.

(i) Write the code to output the number of minutes student 0 played computer games on Wednesday.

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[1]

(ii) State the output if Heath runs the code:

```
print (hoursPlayed[2,1])
```

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[1]

(iii) State the output if Heath runs the code:

```
print (hoursPlayed[3,1] + hoursPlayed[3,2])
```

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[1]

(iv) Write an algorithm to output the total number of minutes student 0 played computer games from Monday (day 0) to Friday (day 4).

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[3]

Specimen

(d) Heath has the day of the week stored as a number e.g. 0 = Monday, 1 = Tuesday.

Write a sub-program that takes the number as a parameter and returns the day of the week as a string.

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Specimen

(e) Heath needs to work out the average number of minutes spent playing computer games each day for the class, which contains 30 students. Write an algorithm to output the average number of minutes the whole class spends playing computer games each day.

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[6]

Specimen

7 Willow has created a hangman program that uses a file to store the words the program can select from. A sample of this data is shown in **Fig. 3**.

Fig. 3

crime	bait	fright	victory	nymph	loose

(a) Show the stages of a bubble sort when applied to data shown in **Fig. 3**.

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[4]

(b) A second sample of data is shown in **Fig. 4**.

Fig. 4

amber	house	kick	moose	orange	range	tent	wind	zebra

Show the stages of a binary search to find the word 'zebra' when applied to the data shown in **Fig. 4**.

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[4]

Specimen

8 The area of a circle is calculated using the formula $\pi \times r^2$, where π is equal to 3.142 and r is the radius.

Finn has written a program to allow a user to enter the radius of a circle as a whole number, between 1 and 30, and output the area of the circle.

```
01    int radius = 0
02    real area = 0.0
03    input radius
04    if radius < 1 OR radius > 30 then
05    print ('Sorry, that radius is invalid')
06    else
07    area = 3.142 * (radius ^ 2)
08    print (area)
09    end if
```

(a) Explain, using examples from the program, **two** ways Finn can improve the maintainability of the program.

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[6]

Specimen

(b) Identify **two** variables used in the program.

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[2]

(c) **(i)** Identify **one** item in the program that could have been written as a constant.

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[1]

(ii) Give **one** reason why you have identified this item as a constant.

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[1]

(d) Finn uses an IDE (Integrated Development Environment) to write his programs. Identify **two** features of an IDE that Finn might use.

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[2]

Specimen

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Specimen

Specimen

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