OCR
Oxford Cambridge and RSA

Accredited

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**			

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.

- ……

  ……

- ……

  ……

[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.

- ……

  ……

- ……

  ……

[4]

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

GB bit PB byte nibble MB

……..

[1]

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

……..

[1]

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

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[2]

(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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[4]

(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]

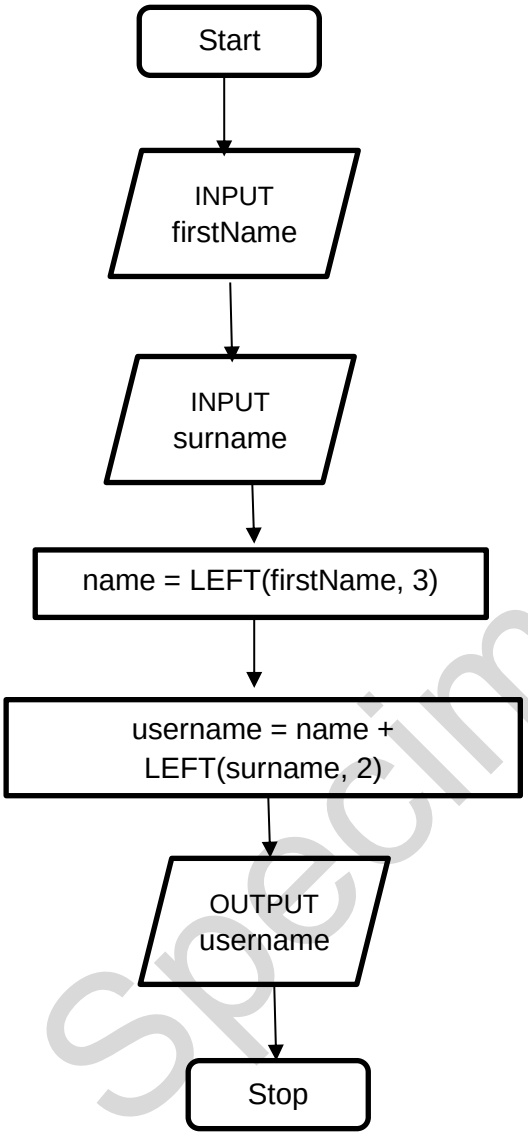
(c) Complete the truth table below for the Boolean statement **P = NOT (A AND B).**

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

[2]

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



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.

……..

[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]

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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[2]

(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.

……..

[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])
```

……..

[1]

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

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

……..

[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]

(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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[5]

(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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[8]

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]

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]

(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.

……..

[1]

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

……..

[1]

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

……..

……..

[2]

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OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

GCSE (9–1) Computer Science

J276/02 Computational thinking, algorithms and programming

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 80

DRAFT

This document consists of 12 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on–screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log–in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

	Assessment Objective
AO1	Demonstrate knowledge and understanding of the key concepts and principles of computer science.
AO1 1a	Demonstrate knowledge of the key concepts and principles of computer science.
AO1 1b	Demonstrate understanding of the key concepts and principles of computer science.
AO2	Apply knowledge and understanding of key concepts and principles of computer science.
AO2 1a	Apply knowledge of key concepts and principles of computer science.
AO2 1b	Apply understanding of key concepts and principles of computer science.
AO3	Analyse problems in computational terms: • to make reasoned judgements • to design, program, evaluate and refine solutions.
AO3 1	To make reasoned judgements (this strand is a single element).
AO3 2a	Design solutions.
AO3 2b	Program solutions.
AO3 2c	Evaluate and refine solutions.

Question			Answer	Marks	Guidance
1	a		• The height of the wave is measured/sampled (at regular/set intervals) • Turned into/stored as binary	**2 (AO1 1b)**	1 mark for each bullet, to a maximum of 2.
	b		• The quality will improve ... • ... because the sound wave is more accurate to the original • The file size will increase ... • ... because there are more samples to store	**4 (AO1 1b)**	1 mark for each bullet. (1 mark for identification of the effect, one mark for an explanation)
	c		• Lossy means the decompressed file is not identical to the original ... • ...the difference is unlikely to be noticed by humans • Lossy will decrease the file size ... • ... so it can be sent via e-mail	**4 (AO2 1a)**	1 mark for each bullet. (1 mark for identification of the effect, one mark for an explanation)
2	a		bit , nibble, byte, MB, GB, PB	**1 (AO1 1b)**	Correct Answer Only
	b		10111111	**1 (AO1 1b)**	Correct Answer Only
	c		• Working; (3 * 16) + 14 **OR** 00111110 • 62	**2 (AO1 1b)**	1 mark for correct answer, 1 for valid method of working
	d		• Taking a number as input • Using HEX subroutine correctly • Calculating Digit 1 • Calculating Digit 2 INPUT decimal digit1 = decimal DIV 16 IF digit1>=10 THEN digit1=HEX(digit1) digit2 = decimal – (digit1*16) IF digit2>=10 THEN digit2=HEX(digit2)	**4 (AO3 2b)**	1 mark for each bullet. There are no marks associated with data types or conversions of data types. If used, a flowchart should represent the bulleted steps in the answer column.
	e	i	0000 0000	**2 (AO1 1b)**	Correct Answer Only 1 mark per nibble
		ii	overflow	**1 (AO1 1b)**	Correct Answer Only

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>00110010</td><td>1
(AO1 1b)</td><td>Correct Answer Only</td></tr>
<tr><td></td><td>b</td><td></td><td>• The number is divided by 4
• Loss of accuracy ...
• ... the bits on the right are removed</td><td>2
(AO2 1b)</td><td>1 mark per bullet to a maximum of 2.</td></tr>
<tr><td></td><td>c</td><td></td><td><table><tr><th>A</th><th>B</th><th>P</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td>TRUE</td></tr><tr><td></td><td></td><td>TRUE</td></tr><tr><td></td><td></td><td></td></tr></table></td><td>2
(AO1 1b)</td><td>1 mark for each correct answer in table.</td></tr>
<tr><td>4</td><td>a</td><td></td><td>• RebEl</td><td>1
(AO2 1b)</td><td>Correct Answer Only (allow any case)</td></tr>
<tr><td></td><td>b</td><td>i</td><td>• UitFr</td><td>1
(AO2 1b)</td><td>Correct Answer Only (allow any case)</td></tr>
<tr><td></td><td></td><td>ii</td><td>• Taking firstname, surname and gender as input
• Checking IF gender is male/female (using appropriate selection)
• For male ...Generating last 3 letters of surname using appropriate string manipulation
• ...Generating first 2 of letters of firstname and adding to previous
• For female.... correctly calculating as before
• Correct concatenation and output

input firstname, surname, gender
if gender = “Male” then
username = RIGHT(surname, 3) + LEFT(firstname,2)
else
username = LEFT (firstname,3) + LEFT(surname,2)
end if
print (username)</td><td>6
(AO3 2b)</td><td>1 mark for each correct bullet to a maximum of 6.

If used, a flowchart should represent the bulleted steps in the answer column</td></tr>
</table>

Question			Answer	Marks	Guidance
5	a		• To convert it to binary/machine code • The processor can only understand machine code	1 (AO1 1a)	Maximum 1 mark
	b		• Compiler translates all the code in one go… • …whereas an interpreter translates one line at a time • Compiler creates an executable… • …whereas an interpreter does not/ executes one line at a time • Compiler reports all errors at the end… • …whereas an interpreter stops when it finds an error	4 (AO1 1b)	1 mark to be awarded for the correct identification and one for a valid description up to a maximum of 4 marks. No more than 2 marks for answers relating only to interpreters and no more than 2 marks for answers only relating to compilers.
6	a		• Allows multiple items of data to be stored … • ….. under one identifier/name • Can store a table structure • Reduces need for multiple variables	2 (AO1 1b)	1 mark for each bullet to a maximum of 2.
	b	i	Integer	1 (AO2 1b)	Any data type that stores a whole number only
	b	ii	It is a whole number/ no decimals/ to the nearest minute.	1 (AO2 1b)	
	c	i	print (hoursPlayed[0,2])	1 (AO2 1b)	Correct Answer Only
		ii	0	1 (AO2 1b)	Correct Answer Only
		iii	80	1 (AO2 1b)	Correct Answer Only
		iv	• Adding all correct elements • Outputting correctly • Using a loop e.g. total = 0 for x = 0 to 4	3 (AO3 2b)	1 mark per bullet to a maximum of 3. If used, a flowchart should represent the bulleted steps in the answer column

Question			Answer	Marks	Guidance
			total = total + hoursPlayed[0,x] next x print (total)		
	d		• Appropriate declaration of a function that takes day number as parameter and returns day • Use of selection (if/switch) • Appropriate comparison • Correct identification of each day • Case default e.g. function returnDay(dayNo As String) As String switch dayNo case 0: returnDay = “Monday” case 1: returnDay = “Tuesday” case 2: returnDay = “Wednesday” case 3: returnDay = “Thursday” case 4: returnDay = “Friday” case default: returnDay = “Invalid” endswitch endfunction	**5 (AO3 2b)**	1 mark per bullet to a maximum of 5. If used, a flowchart should represent the bulleted steps in the answer column.
6	**e**		• Loop 0 to 29 • Loop 0 to 4 • Accessing hoursplayed[x,y] • Addition of hoursplayed[x,y] to total • Calculating average correctly outside of loops	**6 (AO3 2b)**	Accept any type of average calculation (mean, median, mode). If used, a flowchart should represent the bulleted steps in the answer column.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>

- Outputting the results

e.g.
total = 0
for x = 0 to 29
  for y = 0 to 4
    Total = total + hoursPlayed[x,y]
  next y
next x
average = total / (30*5)
print (average)
</td><td></td><td></td></tr>
<tr><td>7</td><td>a</td><td></td><td>
<table>
<tr><td>crime</td><td>bait</td><td>fright</td><td>victory</td><td>nymph</td><td>loose</td></tr>
<tr><td>bait</td><td>crime</td><td>fright</td><td>victory</td><td>nymph</td><td>loose</td></tr>
<tr><td>bait</td><td>crime</td><td>fright</td><td>nymph</td><td>victory</td><td>loose</td></tr>
<tr><td>bait</td><td>crime</td><td>fright</td><td>nymph</td><td>loose</td><td>victory</td></tr>
<tr><td>bait</td><td>crime</td><td>fright</td><td>loose</td><td>nymph</td><td>victory</td></tr>
</table>
</td><td>4
(AO2 1b)</td><td>1 mark for each row from row 2 – 5. Allow multiple swaps in one stage, where it is clear that a bubble sort has been applied.</td></tr>
<tr><td></td><td>b</td><td></td><td>

- Comparing zebra to orange
- Greater, so split and take right side
- Further comparison (1 or 2 depending on choices made)
- Correct identification of zebra using methodology above

e.g.

compare zebra to orange

greater, split right

compare to wind
</td><td>4
(AO2 1b)</td><td>1 mark per bullet (multiple ways through, marks awarded for appropriate comparison and creation of sub groups).</td></tr>
</table>

Question			Answer	Marks	Guidance
			greater, split right compare to zebra		
8	a		• Comments/annotation… • …To explain the key functions/sections • …E.g. any relevant example, such as line 4 checks the input is valid • Indentation… • …To show where constructs/sections start and finish • …E.g. indenting within IF statement • Using constants… • …so numbers can be updated easily • …E.g. π	**6 (AO2 1b)**	1 mark for identification of an example from the programme. 1 mark for explanation of how it aids maintainability. 1 mark for contextualisation. Maximum of 3 marks per method.
	b		• radius • area	**2 (AO1 1b)**	
	c	i	• 3.142 • 2 • 1 • 30	**1 (AO2 1a)**	Maximum of 1 mark
	c	ii	• The number does not need to be changed while the program is running • The number can be updated once and it updates throughout	**1 (AO1 1a)**	Maximum of 1 mark
	d		• Error diagnostics (any example) • Run-time environment • Editor (any feature such as auto-correct, auto-indent) • Translator • Version control • Break point • Stepping	**2 (AO1 1a)**	1 mark per bullet to a maximum of 2 marks. Only 1 example per bullet, e.g. auto-correct and auto-indent would only gain 1 mark.

Assessment Objective (AO) Grid

Question	Maths	AO1 1a	AO1 1b	AO2 1a	AO2 1b	AO3 1	AO3 2a	AO3 2b	AO3 2c	Total
1 (a)		0	2	0	0	0	0	0	0	**2**
1 (b)		0	4	0	0	0	0	0	0	**4**
1 (c)		0	0	4	0	0	0	0	0	**4**
2 (a)		0	1	0	0	0	0	0	0	**1**
2 (b)	m	0	1	0	0	0	0	0	0	**1**
2 (c)	m	0	2	0	0	0	0	0	0	**2**
2 (d)	m	0	0	0	0	0	0	4	0	**4**
2 (e) i	m	0	2	0	0	0	0	0	0	**2**
2 (e) ii		0	1	0	0	0	0	0	0	**1**
3 (a)	m	0	1	0	0	0	0	0	0	**1**
3 (b)	m	0	0	0	2	0	0	0	0	**2**
3 (c)	m	0	2	0	0	0	0	0	0	**2**
4 (a)		0	0	0	1	0	0	0	0	**1**
4 (b) i		0	0	0	1	0	0	0	0	**1**
4 (b) ii		0	0	0	0	0	0	6	0	**6**
5 (a)		1	0	0	0	0	0	0	0	**1**
5 (b)		0	4	0	0	0	0	0	0	**4**
6 (a)		0	2	0	0	0	0	0	0	**2**
6 (b)i		0	0	0	1	0	0	0	0	**1**
6 (b) ii		0	0	0	1	0	0	0	0	**1**
6 (c) i		0	0	0	1	0	0	0	0	**1**
6 (c) ii		0	0	0	1	0	0	0	0	**1**
6 (c) iii		0	0	0	1	0	0	0	0	**1**
6 (c) iv		0	0	0	0	0	0	3	0	**3**
6 (d)		0	0	0	0	0	0	5	0	**5**
6 (e)		0	0	0	0	0	0	6	0	**6**

Question	Maths	AO1 1a	AO1 1b	AO2 1a	AO2 1b	AO3 1	AO3 2a	AO3 2b	AO3 2c	Total
7 (a)		0	0	0	4	0	0	0	0	**4**
7 (b)		0	0	0	4	0	0	0	0	**4**
8 (a)		0	0	0	6	0	0	0	0	**6**
8 (b)		0	2	0	0	0	0	0	0	**2**
8 (c) i		0	0	1	0	0	0	0	0	**1**
8 (c) ii		1	0	0	0	0	0	0	0	**1**
8 (d)		2	0	0	0	0	0	0	0	**2**
Total		**4**	**24**	**5**	**23**	**0**	**0**	**24**	**0**	**80**

m = mathematical content

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