

Friday 19 November 2021 – Afternoon GCSE (9–1) Computer Science

J276/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

a calculator							
					2 7 6	0 2	
Please write cle	arly in blac	k ink. Do r	not wri	te in the barcodes.			
Centre number				Candidate number			
First name(s)							

INSTRUCTIONS

Last name

- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- · Answer all the questions.

INFORMATION

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

ADVICE

· Read each question carefully before you start your answer.



Answer all the questions.

- 1 ASCII, extended ASCII and Unicode are all examples of character sets.
 - (a) Tick (\checkmark) one or more boxes in each row to identify whether each statement applies to each character set.

	ASCII	Extended ASCII	Unicode
Can represent thousands of different characters, including Russian and Chinese symbols.			
Can represent European characters such as ç or â.			
Uses different character codes for upper-case and lower-case letters.			

[3]

(b) The character **D** is represented by the binary ASCII code **1000100** Give the ASCII code for the following characters in binary. E H [2]

(C)	Sou	nd data is also sampled and stored in binary.
	A 30	0-second section of sound data is sampled at a rate of 48 KHz using 24 bits per sample.
	(i)	Describe the data that is recorded when sound is sampled.
		[2]
	(ii)	Explain what is meant by a sample rate of 48 KHz.
		[2]
	(iii)	Describe how the file size of the sound recording could be reduced.

.....[4]

2	An insertion	sort is used	to put the	following word	s into ascending	alphabetical order.
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pumpkin flour	wall	house	wall
---------------	------	-------	------

(a) Tick (✓) one box in each row to identify whether each statement about the insertion sort is true or false.

Statement	True (✓)	False (✓)
The list of words is initially split into a sorted set and an unsorted set.		
The insertion sort uses a divide stage and then a conquer stage.		
The list of words must be in order before the insertion sort can start.		
Each word is inserted into the correct place in the array, one by one.		
The insertion sort will not work because the word "wall" appears twice.		

(b) The sorted list of words is shown below.

flour	house	pumpkin	wall	wall
		P 4P		

[5]

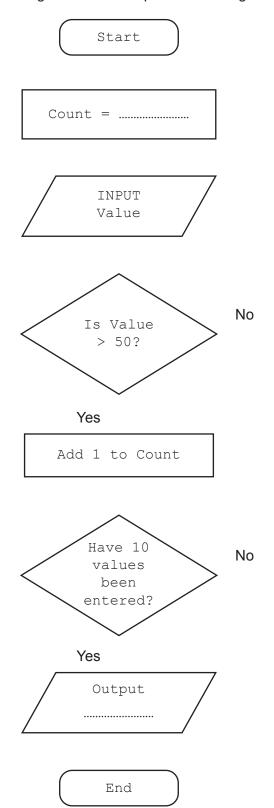
Explain how a binary search would be used to try to find whether the word "house" appears in this list.
[4]

Taylor is writing an algorithm to record the results of an experiment.

Tay	lor ne	eeds to be able to enter a numeric value which is added to a total which initially starts at 0
Eve	ery tir	me she enters a value, the total is output.
The	e algo	orithm repeats until the total is over 100.
(a)	Wri	te an algorithm to implement Taylor's requirements.
		[6]
(b)	The	input to the program could be an integer or real value.
	(i)	State what is meant by a real data type and give an example of this data type.
	/ >	
	(ii)	State what is meant by an integer data type and give an example of this data type.
		[2]

3

- (c) For the next part of the experiment, Taylor needs to be able to enter 10 values and count how many of the values are over 50, outputting this value once all values have been entered.
 - (i) Complete the following flowchart to implement this algorithm.



(ii) Write a pseudocode algorithm that uses iteration to allow Taylor to:

	 enter 10 values count how many values are over 50 output the count of values over 50 after all 10 values are entered.
	[5]
(d)	Taylor used computational thinking techniques to develop the algorithms.
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	4	A programmer	declares	the	following	variables.
--	---	--------------	----------	-----	-----------	------------

first =	- '	"Comp	uter	Science"
second	=	"is	great	- "

(a)	Sta	te one difference between a variable and a constant.	
(b)	Sta	te the output from the following lines of program code.	
	(i)	<pre>print(first.length)</pre>	-4-
	(ii)	print(second.length DIV 3)	[1]
			[1]
((iii)	print(3 ^ 2)	
			[1]
(c)		ngs can be concatenated (joined together) using the + operator. For example, int ("Maths " + second) will output Maths is great	
	Use outp	e string manipulation with the variables first and/or second to produce the folloput.	wing
	(i)	great	
			[1]
	(ii)	Computer	
			[1]
((iii)	Science is great	
			[1]

5	(a)	Convert the denary value 178 into an 8-bit binary number.	
			[2]
	(b)) Computers make use of electronic switches called transistors.	
		Describe how transistors can be used to store a value in binary.	
			[2]
	(c)	Convert the binary value 1100 0111 into hexadecimal.	
			[2]
	(d)	Azmi says, "hexadecimal is used because it takes up less storage space in the compumemory than binary."	uter's
		Tick one box to identify whether Azmi is correct. Justify your answer.	
		Tick (✓)	
		Correct	
		Incorrect	
		Justification	
			[2]

(e) Binary shifts can be used for multiplication and division.

Draw one line from each shift on the left to its correct outcome on the right.

Binary shift

Outcome

Right shift of 2 places on 1010 1000

00111010, divides by 4 with a loss of precision

Left shift of 1 place on 00101101

00101010, divides by 4

Right shift of 2 places on 1110 1001

01011010, multiplies by 2

Left shift of 3 places on 0001 1111

1111 1000, multiplies by 8

(f) Add the following 8 bit binary integers, giving your answer in binary.

00110110

+ 10010110

[2]

[3]

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6 OCRBlocks is a game played on a 5 × 5 grid. Players take it in turns to place blocks on the board. The board is stored as a two-dimensional (2D) array with the identifier gamegrid

Fig. 6.1 shows that players A and B have placed three blocks each so far.

	0	1	2	3	4
0	Α			В	
1					
2		В			
3	A		В		
4			Α		

Fig. 6.1

The function checkblock() checks whether a square on the board has been filled. When checkblock(4,2) is called, the value "A" is returned.

```
function checkblock(r,c)

if gamegrid[r,c] == "A" or gamegrid[r,c] == "B" then
    outcome = gamegrid[r,c]

else
    outcome = "FREE"

endif
    return outcome
endfunction
```

(a) Give the returned value when the following statements are called.

Function call	Returned value
checkblock(2,1)	
checkblock(3,0)	
checkblock(2,3)	

[3]

(b)		e one feature of checkblock() that shows that it is a function and not a procedure.
		[1]
(c)	Whe	en checkblock (-1,6) is called, an error is produced.
	(i)	State why this function call will produce an error.
		[1]
	(ii)	Describe how validation could be added in to the ${\tt checkblock}$ () function to stop this error from occurring.
		[3]

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(d) Write an algorithm to allow player A to select a position for their next block on the game board.

The algorithm must:

 ask the player for the position of their block on the boa 	oard
---	------

- use the <code>checkblock()</code> function to check if this position is free
- if the position is free, add the letter "A" to the position chosen in the gamegrid array
 if the position is not free, repeat the above steps until a free position is chosen

• If the position is not free, repeat the above steps until a free position is chosen.
[6]

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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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