



GCSE (9–1)

Computer Science

J276/02: Computational thinking, algorithms and programming

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.














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1. Annotations

Annotation	Meaning
	Tick
	Cross
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Omission mark
	Benefit of doubt given
	Benefit of doubt not given
	Follow through
	Not answered question
	Repeat
	Slash
	Seen
	Not enough
	Too vague

Question		Answer			Mark	Guidance	
1	(a)		ASCII	Extended ASCII	3	1 mark per row	
		Can represent thousands of 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.	✓	✓			✓
	(b)	<ul style="list-style-type: none"> • 1000101 (E) • 1001000 (H) 			2	Ignore leading zeros	
	(c)	(i)	<ul style="list-style-type: none"> • The height / amplitude... • ...as a numerical value • ...of the wave(form) • 			2	DO NOT accept frequency Do not accept "in binary" (given in question)
		(ii)	<ul style="list-style-type: none"> • 48,000 samples taken... • ...per second 			2	BOD How often samples are taken // frequency of samples

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		(iii)	<p>e.g.</p> <ul style="list-style-type: none"> • Reduce the sample rate (from 48KHz to a lower rate) • ...so fewer samples are taken per second • Reduce the bit depth (from 24 bits to a lower bit depth) • ...so less data is used for each sample • Use lossy compression... • ... to remove data (that won't be noticed) • Use lossless compression... • ...to identify patterns in the data • ...store this more efficiently • Reduce the length of the sound file ... • ... by example (from 30 seconds to a lower length) // less data to store 	4	<p>Any 4 points for 1 mark each</p> <p>Allow "compression" by itself for 1 mark if no other compression mark awarded. Allow suitable expansion of this for 1 mark.</p> <p>Do not accept "data is not lost" as expansion for lossless or "data is lost" as expansion for lossy.</p>
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Question		Answer			Mark	Guidance
2	(a)				1	1 mark per row
		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.		✓		

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	(b)	<ul style="list-style-type: none">• Pick middle value / pumpkin // find midpoint• Compare this to house, no match• pumpkin > house...• ...so discard top half of list // focus on bottom half• Pick middle value again, either <u>house</u> or <u>flour</u>...• ...finds value // repeat to find value	4	<p>Do not award generic responses except for BP1 Must clearly show the steps taken for <u>this</u> list to achieve more than 1 mark.</p> <p>Do not award "splits the list in half" for BP1 or 4 – incorrect</p> <p>Allow diagrams to demonstrate the process</p> <p>Allow reasonable attempt at BP3 to allow access to BP4</p>
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Question		Answer	Mark	Guidance
3	(a)	<ul style="list-style-type: none"> Initialises (total) as 0 (outside loop if present) Inputs a number and stores the value Adds the input to the total (initialised in BP1 if present) Prints the total Iterates over BP2-4 (if present)... ...until total is over 100 	6	<u>Example answer</u> <pre>total = 0 while total <=100 x = input("Enter a number") total = total + x print(total) endwhile</pre>
	(b)	(i)	2	One mark for definition, one mark for example Do not accept float as definition Allow fractions as example
		(ii)	2	One mark for definition, one mark for example

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	(c)	(i)	<ul style="list-style-type: none"> Count = 0 Output Count <p>All non-decision boxes and YES from decision boxes linked in a sequential fashion from Start to End.</p> <p>NO from first decision box linked to skip over increment of count</p> <p>NO from second decision box linked back to INPUT</p> <p>Ignore superfluous instructions as long as they do not affect the outcome of the algorithm.</p> <p>BOD misspelling of Count as long as it is recognisable Ignore capitalisation.</p>	5	<pre> graph TD Start([Start]) --> Count[Count = 0] Count --> Input[/Input Value/] Input --> IsOver{Is Value over 50?} IsOver -- Yes --> Add[Add 1 to count] Add --> Have10{Have 10 values been entered?} IsOver -- No --> Have10 Have10 -- Yes --> Output[/Output Count/] Have10 -- No --> Input Output --> End([End]) </pre>
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		<p>(ii)</p> <p>1 mark per bullet point, max 5</p> <ul style="list-style-type: none"> Initialises a count variable to 0 asks user for an input Check if input is over 50... ... increment count variable if True Repeats BP 2 and 3 (if present) until 10 numbers have been entered Outputs count <u>once 10 numbers have been entered</u> 	5	<p><u>Example answer</u></p> <pre> count = 0 for x = 1 to 10 value = input("enter a value") if value > 50 then count = count + 1 endif next x print(count) </pre> <p>Response must be in pseudocode as per question, flowcharts or structured English are NAQ.</p>
	(d)	<p>e.g.</p> <ul style="list-style-type: none"> Abstraction ... focussing on the important elements // ignoring elements that do not contribute to the solution // simplifying the problem Decomposition ...breaking a problem down (into its constituent parts) Algorithmic thinking ...set out the steps needed to solve the problem // represented in a flow chart / as pseudocode 	4	<p>Mark in pairs. 1 mark for name, 1 mark for description. Description must match technique (if given).</p>

Question		Answer	Mark	Guidance	
4	(a)	<ul style="list-style-type: none"> Contents of variable can be changed; contents of constants cannot be changed (while the programming is running) 	1	Both sides needed for mark.	
	(b)	(i)	<ul style="list-style-type: none"> 16 	1	
		(ii)	<ul style="list-style-type: none"> 2 	1	
		(iii)	<ul style="list-style-type: none"> 9 	1	
	(c)	(i)	<ul style="list-style-type: none"> second.substring(3,5) 	1	Ignore print / lack of print. Allow other suitable methods of string manipulation as long as variables used. Allow any valid method that extracts rightmost 5 or 6 characters of <i>second</i> variable.
		(ii)	<ul style="list-style-type: none"> first.substring(0,8) 	1	Ignore print / lack of print. Allow other suitable methods of string manipulation as long as variables used. Allow any valid method that extracts leftmost 8 or 9 characters of <i>first</i> variable.
		(iii)	<ul style="list-style-type: none"> first.substring(9,7) + " " + second "Science " + second first.substring(9,7) + " is great" 	1	Ignore print / lack of print. Allow other suitable methods of string manipulation as long as variables(s) used. Allow alternative concatenation symbols (e.g. & or .). Allow concatenation functions Must have correct spacing in outcome.

Question		Answer	Mark	Guidance										
5	(a)	1011 0010	2	1 mark per nibble. Mark right to left. Must be 8 bits (as per question)										
	(b)	<ul style="list-style-type: none"> • Transistor has two states • 1 represents on, 0 represents off • Each transistor stores one bit • Multiple transistors used to store a binary value 	2	Allow values for BP1										
	(c)	C7	2	1 mark per hex digit, mark from right to left. Max 1 mark if more than 2 characters given.										
	(d)	<ul style="list-style-type: none"> • Incorrect ticked • Data cannot be stored in hexadecimal // all data is stored in binary // hexadecimal is a shortcut for computer scientists 	2	1 mark for identifying issue, 1 mark for reason why. Allow FT for BP2 if candidate agrees but provides further clarification that shows they understand.										
	(e)	<table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; width: 50%;">Binary shift</th> <th style="text-align: right; width: 50%;">Outcome</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 5px;">Right shift of 2 places on 1010 1000</td> <td style="border: 1px solid black; padding: 5px;">0011 1010, divides by 4 with a loss of precision</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Left shift of 1 place on 0010 1101</td> <td style="border: 1px solid black; padding: 5px;">0010 1010, divides by 4</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Right shift of 2 places on 1110 1001</td> <td style="border: 1px solid black; padding: 5px;">0101 1010, multiplies by 2</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Left shift of 3 places on 0001 1111</td> <td style="border: 1px solid black; padding: 5px;">1111 1000, multiplies by 8</td> </tr> </tbody> </table>	Binary shift	Outcome	Right shift of 2 places on 1010 1000	0011 1010, divides by 4 with a loss of precision	Left shift of 1 place on 0010 1101	0010 1010, divides by 4	Right shift of 2 places on 1110 1001	0101 1010, multiplies by 2	Left shift of 3 places on 0001 1111	1111 1000, multiplies by 8	3	3 marks for all connections correctly made 2 marks for 2 or 3 connections correctly made 1 mark for any connection correctly made
Binary shift	Outcome													
Right shift of 2 places on 1010 1000	0011 1010, divides by 4 with a loss of precision													
Left shift of 1 place on 0010 1101	0010 1010, divides by 4													
Right shift of 2 places on 1110 1001	0101 1010, multiplies by 2													
Left shift of 3 places on 0001 1111	1111 1000, multiplies by 8													
	(f)	1100 1100	2	1 mark per nibble. Each pair of nibbles in question can be added individually so no requirement for FT marks.										

Question		Answer		Mark	Guidance								
6	(a)		<table border="1"> <thead> <tr> <th>Function call</th> <th>Returned value</th> </tr> </thead> <tbody> <tr> <td>checkblock(2,1)</td> <td>B</td> </tr> <tr> <td>checkblock(3,0)</td> <td>A</td> </tr> <tr> <td>checkblock(2,3)</td> <td>FREE</td> </tr> </tbody> </table>	Function call	Returned value	checkblock(2,1)	B	checkblock(3,0)	A	checkblock(2,3)	FREE	3	Do not accept "blank" or any other returned value for third call. Ignore case and spelling as long as recognisable.
		Function call	Returned value										
		checkblock(2,1)	B										
		checkblock(3,0)	A										
checkblock(2,3)	FREE												
	(b)		<ul style="list-style-type: none"> • Returns a value // passes back a value 	1									
	(c)	(i)	<ul style="list-style-type: none"> • Parameter values outside index range / larger than 4 / smaller than 0 // -1, 16 is not a valid block 	1	Answer must refer to either array or gameboard / grid / block								
		(ii)	<ul style="list-style-type: none"> • Use selection / IF / Switch-Case / range check • ...check that parameters are ≥ 0 and ≤ 4... • ...Return error code if invalid // set outcome to error 	3	Allow equivalent checks (e.g. < 5 , between 0 and 4) for BP2 Allow reference to <code>r</code> and <code>c</code> as parameters. BOD handle error for BP3 (e.g. repeat until valid) Answer must be a description, code by itself is NAQ								
	(d)		<ul style="list-style-type: none"> • Input two position values separately • calls <code>checkblock()</code> function... • ...with input parameters • ... returned value used in selection • If free, stores "A" to correct index of <code>gamegrid</code> array (FT for incorrect selection) • Loops until free position chosen 	6	If flowchart / structured English, do not allow simple repeat of question. <u>Example answer</u> <pre> loop = True while loop row = input("enter row") col = input("enter column") if checkblock(row,col) == "FREE" then gamegrid[row,col] = "A" loop = False endif endwhile </pre>								

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