
GCSE

Computer Science

Unit 2 – Computing Fundamentals

Mark scheme

4512/2
June 2017

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Qu	Part	Sub-part	Marking Guidance	Marks
1	a		2 marks for correct answer B7; If incorrect then award a maximum of 1 mark for working if: - converted 183 to 1011 0111 - converted 183 to an incorrect 8-bit binary number but converted this correctly to hexadecimal - attempted division of 183 by 16 to get quotient of 11 and remainder of 7 but incorrectly represented this in hexadecimal	2
1	b		147;	1
1	c		FF; R. 255 or 11111111	1
1	d		Third box only; (Any binary number can also be represented in hexadecimal.)	1
1	e	i	7; R. 8	1
1	e	ii	1; A. it would go up from 7 to 8; allow follow-through from 1ei, e.g. 'it would go up from 5 to 6', but 6 by itself would be rejected R. 8	1
2	a	i	it would pause (execution)// it would stop (temporarily) A. by example of the program in Figure 1	1
2	a	ii	Allowing inspection of the states/variables/program output/flow of execution (at a particular time); A. Reference to logical errors if explained R. Any reference to errors except logical errors.	1
2	b		Watch; A. Watch window, variable watch, variable view, variable viewer, variable explorer, variables panel, watchpoint. Alternative answers should be referred to a senior examiner	1
2	c		Maximum of 3 marks from code completion; code suggestions; inbuilt documentation; syntax colouring; inbuilt (unit) tests; automatic indentation;	3

			stepper; automatic syntax error highlighting; A. any other correct feature R. Line numbers, break points, comments in code R. Watch (reject only if this was the answer given to question 2b)																	
2	d	i	Second box only; (Run-time)	1																
2	d	ii	Third box only; (Syntax)	1																
3	a		1 mark for each correct row. R. mark for a row if more than one box is ticked on that row Correct table shown below: <table><tr><th>Description</th><th>Input Device</th><th>Output Device</th><th>Both</th></tr><tr><td>The device that allows Feature 1 to happen</td><td></td><td>√</td><td></td></tr><tr><td>The device that allows Feature 2 to happen</td><td>√</td><td></td><td></td></tr><tr><td>The device that allows Feature 3 to happen</td><td></td><td>√</td><td></td></tr></table> A. any other clear mark other than a tick	Description	Input Device	Output Device	Both	The device that allows Feature 1 to happen		√		The device that allows Feature 2 to happen	√			The device that allows Feature 3 to happen		√		3
Description	Input Device	Output Device	Both																	
The device that allows Feature 1 to happen		√																		
The device that allows Feature 2 to happen	√																			
The device that allows Feature 3 to happen		√																		
3	b		1 mark for any correct input or output device, examples include: Speakers/headphones/earphones; Gyroscope/accelerometer/motion sensor; Microphone; Haptic/physical feedback device (if clearly different to feature 3); R. button R. the features listed in question, display, eye tracking, vibration	1																
4	a		One mark for each error (order is not important) and another mark for the associated explanation: (Error) A hard drive reads data with a laser; (Explanation) Hard drives use magnets to read data; (Error) A hard drive reads data more quickly than a solid state drive (Explanation) A hard drive has moving parts which make it slower to read data than a solid state drive Note for examiners: explanation must be more than just a	4																

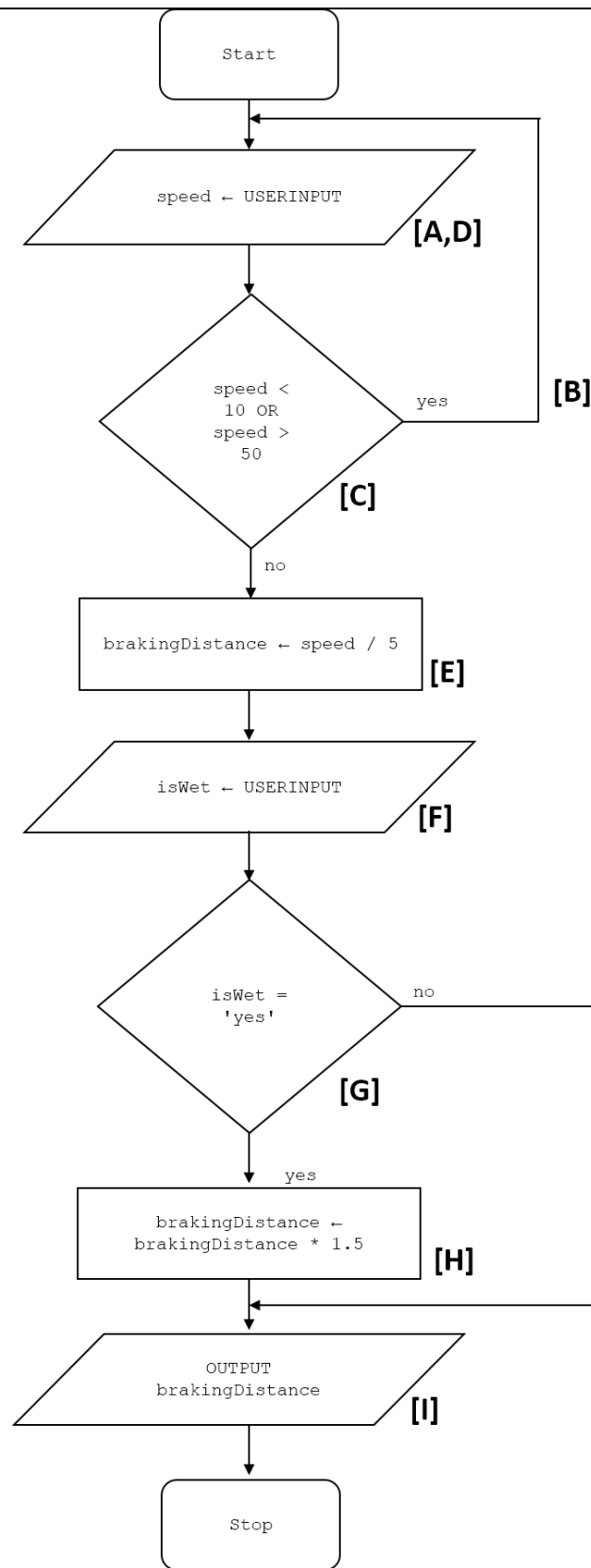
			restatement of the error.		
4	b		Maximum two marks from: data/instructions need to be stored permanently; secondary storage is persistent/not volatile; main memory/RAM is volatile/not persistent;		2
5			High mark range Three advantages/disadvantages (at least one of each) are correctly described. Quality of written communication: The candidate has selected and used a form and style of writing appropriate to purpose and has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another clearly and coherently. Specialist vocabulary has been used appropriately throughout. Text is legible and the meaning is clear. There are few if any errors of spelling, punctuation and grammar.	5-6 marks	6
			Mid mark range Two advantages/disadvantages are correctly described// More than two advantages/disadvantages are described with some errors// Three advantages and no disadvantages or three disadvantages and no advantages are described. Quality of written communication: The candidate has mostly used a form and style of writing appropriate to purpose and has expressed some complex ideas reasonably clearly and fluently. The candidate has usually used well linked sentences and paragraphs. Specialist vocabulary has been used on a number of occasions but not always appropriately. Text is legible and most of the meaning is clear. There are occasional errors of spelling, punctuation and grammar.	3-4 marks	
			Lower mark range One or more advantages/disadvantages are stated// One advantage/disadvantage is correctly described. Quality of written communication: The candidate has used a form and style of writing which has many deficiencies. Ideas are not often clearly expressed. Sentences and	1-2 marks	

			paragraphs are often not well-connected or at times bullet points may have been used. Specialist vocabulary has been used inappropriately or not at all. Much of the text is legible and some of the meaning is clear. There are many errors of spelling, punctuation and grammar but it should still be possible to understand much of the response.			
			No creditworthy material	0 marks		
			Quality of written communication skills The candidate's quality of written communication skills will be one of the factors influencing the actual mark an examiner will give within a level of response. The quality of written communication skills associated with each level is indicated above.			
			Advantages include: • The application allows students to access their notes using any device that connects to the web because the notes are stored in a database connected to the server. • If the programmer wishes to update their program then they can update the program once on the server instead of having to update on many users' machines. • It avoids duplication of data (across devices)/data becoming inconsistent. • Provides a form of (off-site) back up for the student's data. Disadvantages include: • Because the application is web-based the student will have to have an internet connection. • The student's details and notes are held remotely which could be a security risk/potentially makes the students' data less private. • The student can only access the			

			application using a device with the necessary network hardware.			
6			Marks awarded for the following. Maximum of 8 marks awarded if the answer includes any errors. If variables have not been appropriately updated penalise once. [A] 1 mark for user input of speed and assigning to a variable; [B] 1 mark for a loop that checks if the input is [not] in range (Boolean condition may be incorrect); [C] 1 mark for a Boolean condition that correctly ensures the speed is [not] in the correct range and allows for potential reassignment of speed at least once. The type of structure used will indicate whether the condition should be true or false if the input is within range, e.g. for a <code>WHILE</code> loop it will be <code>speed < 10 OR speed > 50</code> or equivalent and for a <code>REPEAT-UNTIL</code> it will be <code>speed ≥ 10 AND speed ≤ 50</code> or equivalent. Use of <code>AND</code> and <code>OR</code> or equivalent logic must be correct; [D] 1 mark for user input occurring again if required (structure need not be correct); [E] 1 mark for dividing the speed by 5 to calculate the braking distance; [F] 1 mark for user input for wet ground; [G] 1 mark for checking if this user input is equal to 'yes' using selection; [H] 1 mark for multiplying the braking distance by 1.5 within this structure (possibly incorrect selection); [I] 1 mark for outputting the braking distance at the end of the algorithm; Marks C and D (but not B) can be awarded if the structure used is selection and not iteration. Examples of answers and how the marks are awarded: Example 1			9

			<pre> speed ← USERINPUT [A] WHILE speed < 10 OR speed > 50 [B,C] speed ← USERINPUT [D] ENDWHILE brakingDistance ← speed / 5 [E] isWet ← USERINPUT [F] IF isWet = 'yes' THEN [G] brakingDistance ← brakingDistance * 1.5 [H] ENDIF OUTPUT brakingDistance [I] </pre> Example 2 <pre> REPEAT [B] speed ← USERINPUT [A,D] UNTIL speed ≥ 10 AND speed ≤ 50 [C] brakingDistance ← speed / 5 [E] isWet ← USERINPUT [F] IF isWet = 'yes' THEN [G] OUTPUT (brakingDistance * 1.5) [H,I] ELSE OUTPUT brakingDistance [Also needed for I] ENDIF </pre> Example 3 <pre> speed ← USERINPUT [A] WHILE NOT (speed ≥ 10 and speed ≤ 50) [B,C] speed ← USERINPUT [D] ENDWHILE isWet ← USERINPUT [F] IF isWet = 'yes' THEN [G] OUTPUT ((speed / 5) * 1.5) [E,H,I] ELSE OUTPUT (speed / 5) [Also needed for E and I] ENDIF </pre>	
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			Example 4	
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7	a	x is not incremented/changed (in the WHILE loop)// x does not increase// they have not made sure it is possible to reach the stopping condition// an infinite loop has been created; A. a correction such as $x \leftarrow x + 1$ N.E. a line is missing	1
7	b	Marks awarded for the following. Maximum of three marks if the answer contains any errors. [A] 1 mark for the correct Boolean condition after UNTIL (equivalent to NOT (response $\neq$ 'end')); [B] 1 mark for assigning user input to response before it is output; [C] 1 mark for using selection to check if response is not 'end'; [D] 1 mark for outputting response within the loop (even if Boolean condition is incorrect); Possible correct answer is: <pre> REPEAT response $\leftarrow$ USERINPUT [B] IF response $\neq$ 'end' THEN [C] OUTPUT response [D] ENDIF UNTIL response = 'end' [A] </pre> Alternative correct answer is: <pre> response $\leftarrow$ USERINPUT [B] IF response $\neq$ 'end' THEN [C] REPEAT OUTPUT response [D] response $\leftarrow$ USERINPUT UNTIL response = 'end' [A] ENDIF </pre>	4
8	a	Fourth box only; (Every manufacturer manufactures two types of robotics kit.)	1
8	b	To uniquely identify every record // unique identifier;	1
8	c	Maximum of two marks from:	2

			Strings cannot be (easily) numerically ordered//the ordering of strings is different to the ordering of numbers; Strings cannot be used in arithmetic//Real numbers can be used in arithmetic; Easier to validate real numbers; Real numbers could use less memory than strings; A. any other reasonable answer R. one answer if both answers are not distinct from one another	
8	d		Marks A and D are to be awarded independently of the other marks. Marks B and C must be awarded as follows. If the 3 correct answers are given award 2 marks, if there are any additional records then award a maximum of 1 mark for either B or C when appropriate. If more than 4 records are given award 0 marks for B and C [A] 1 mark for only correct fields in the correct order (RoboticsKit.Name, Manufacturer.Name, RoboticsKit.Cost) ; [B] 1 mark for correct records where minimum age is greater than 10 (clearly identifiable through the primary key or similar) (AirQuadCam, Drone15); [C] 1 mark for correct records where manufacturer city is Manchester (clearly identifiable through the primary key or similar) (AirQuadCam, Doodler); [D] 1 mark for displaying results in ascending order of RoboticsKit name (permit if records are incorrect as long as a minimum of two records are shown); Correct answer is: AirQuadCam, MechShop, 585.00 Doodler, MechShop, 15.00 Drone15, RobotCity, 499.00 I. Any minor spelling errors	4
9	a		3;	1
9	b		Boolean; A. Bool or programming-language specific term	1
9	c		Real; A. Float or programming-language specific term(eg single, double, decimal)	1

			R. Integer N.E. number	
9	d		RETURN; I. use of upper or lower case A. RETURN cost	1

9	e		1 mark for each correct value in order maximum of 3 marks if any errors. I. missing decimal point and trailing zero/leading £ The correct table is: <table><tr><td>cost</td></tr><tr><td>0.0</td></tr><tr><td>2.0</td></tr><tr><td>7.0</td></tr><tr><td>28.0</td></tr><tr><td></td></tr></table> Examples of partially correct answers: 3 marks as missing first 0 (I. duplicate final 28.0) <table><tr><td>cost</td></tr><tr><td>2.0</td></tr><tr><td>7.0</td></tr><tr><td>28.0</td></tr><tr><td>28.0</td></tr><tr><td></td></tr></table> 2 marks as two correct values are in order (although there are missing values) <table><tr><td>cost</td></tr><tr><td>2.0</td></tr><tr><td>28.0</td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr></table>	cost	0.0	2.0	7.0	28.0		cost	2.0	7.0	28.0	28.0		cost	2.0	28.0				4
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10	a		1 mark for second box; 1 mark for third box; (Sound files store digital data. Sound files are always stored on a computer using binary.)	2																		

			R. if more than two boxes are ticked	
10	b		Maximum of two marks from: (The higher the sample rate) means more measurements are taken (per second); It will be a more accurate (representation of the original sound); There is less chance of missing parts of the original sound; A. Any other reasonable answer.	2

10	c	i	Maximum of three marks from the following. If there are any errors in the answer then a maximum of two marks: (The pixels) are represented in a grid/2D array; 4 combinations of bits are possible// each colour could be represented by different 2-bit combinations; black pixels could be represented as 00; white pixels could be represented as 01; grey pixels could be represented as 10; A. if the three colours are given different values and as long as the three values are all two-bit and distinct from each other A. answer that shows the image represented in binary	3
10	c	ii	One extra colour would not need more than two bits// The number of bits needed per pixel would not increase; A. answer based on example used in 10ci.	1
10	d		Increase the resolution// Increase the number of pixels (in the image)// Increase the pixels per inch (PPI);	1
10	e		Maximum of two marks from: Hexadecimal is more compact (than binary); Binary can be more easily converted to/from hexadecimal (than denary); Hexadecimal is easier (for humans) to read (than binary); It is quicker/more accurate to type (hexadecimal numbers than binary numbers); R. uses less memory	2
11	a		5;	1

11	b	i	1 mark for all correct values of <i>i</i> in the correct order (only 2 and 3); 1 mark for all correct values of <i>h</i> in the correct order (only 5 and 7); 1 mark for second and third values of <i>j</i> (2 and 3); 1 mark for last three values of <i>j</i> in the correct order (1, 2 and 3); 1 mark for second and third values of <i>a</i> (3 and 5); 1 mark for last three values of <i>a</i> in the correct order (0, 4 and 7); <table><tr><td><i>i</i></td><td><i>h</i></td><td><i>j</i></td><td><i>a</i></td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td></td><td></td><td>2</td><td>3</td></tr><tr><td></td><td>5</td><td>3</td><td>5</td></tr><tr><td>2</td><td></td><td>1</td><td>0</td></tr><tr><td></td><td></td><td>2</td><td>4</td></tr><tr><td></td><td>7</td><td>3</td><td>7</td></tr><tr><td>3</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table> I. Different rows used as long as the order within columns is clear and repeated values in columns.	<i>i</i>	<i>h</i>	<i>j</i>	<i>a</i>	1	0	1	0			2	3		5	3	5	2		1	0			2	4		7	3	7	3								6
<i>i</i>	<i>h</i>	<i>j</i>	<i>a</i>																																					
1	0	1	0																																					
		2	3																																					
	5	3	5																																					
2		1	0																																					
		2	4																																					
	7	3	7																																					
3																																								
11	b	ii	(<i>h</i> represents) the higher value; of the sum of the arrays (within <i>arr</i>);	2																																				
11	c		(Its value) does not change;	1																																				
11	d		<code>LEN(arr)</code> instead of <code>2//</code> <code>lenArr ← 3//</code> 2 changed to <code>3//</code> Value changed to 3;	1																																				
11	e		The section within the program where a variable is defined/accessible/usable;	1																																				