GCE

Computer Science

Unit **H046/01:** Computing principles

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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Annotations

Annotation	Meaning
⋀	Omission mark
BOD	Benefit of the doubt
C	Subordinate clause / consequential error
✖	Incorrect point
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	No benefit of doubt given
P	Point being made
REP	Repeat
✔	Correct point
TV	Too vague
0	Zero (big)
BP	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.
L1	Level 1
L2	Level 2
L3	Level 3

Subject - specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper and its rubrics
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet Instructions for **Examiner**s. If you are examining for the first time, please read carefully Appendix 5 Introduction to Script Marking: **Notes for New Examiners**.

 Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

USING THE MARK SCHEME

Please study this Mark Scheme carefully. The Mark Scheme is an integral part of the process that begins with the setting of the question paper and ends with the awarding of grades. Question papers and Mark Schemes are developed in association with each other so that issues of differentiation and positive achievement can be addressed from the very start.

This Mark Scheme is a working document; it is not exhaustive; it does not provide 'correct' answers. The Mark Scheme can only provide 'best guesses' about how the question will work out, and it is subject to revision after we have looked at a wide range of scripts.

The Examiners' Standardisation Meeting will ensure that the Mark Scheme covers the range of candidates' responses to the questions, and that all Examiners understand and apply the Mark Scheme in the same way. The Mark Scheme will be discussed and amended at the meeting, and administrative procedures will be confirmed. Co-ordination scripts will be issued at the meeting to exemplify aspects of candidates' responses and achievements; the co-ordination scripts then become part of this Mark Scheme.

Before the Standardisation Meeting, you should read and mark in pencil a number of scripts, in order to gain an impression of the range of responses and achievement that may be expected.

In your marking, you will encounter valid responses which are not covered by the Mark Scheme: these responses must be credited. You will encounter answers which fall outside the 'target range' of Bands for the paper which you are marking. Please mark these answers according to the marking criteria.

Please read carefully all the scripts in your allocation and make every effort to look positively for achievement throughout the ability range. Always

be prepared to use the full range of marks.

LEVELS OF RESPONSE QUESTIONS:

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

- **Highest mark**: If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.
- **Lowest mark**: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.
- **Middle mark**: This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.

	AO1	AO2	AO3
High (thorough)	Precision in the use of question terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and understanding.	Knowledge and understanding shown is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.	Concerted effort is made to consider all aspects of a system/problem or weigh up both sides to an argument before forming an overall conclusion. Judgements made are based on appropriate and concise arguments that have been developed in response resulting in them being both supported and realistic.
Middle (reasonable)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to	Knowledge and understanding applied to context. Whilst clear evidence that an argument builds and develops through response there are times when opportunities are missed to use	There is a reasonable attempt to reach a conclusion considering aspects of a system/problem or weighing up both sides of an argument. However the impact of the conclusion is often

	make use of acquired knowledge and understanding not always taken.	an example or relate an aspect of knowledge or understanding to the context provided.	lessened by a lack of supported judgements which accompany it. This inability to build on and develop lines of argument as developed in the response can detract from the overall quality of the response.
Low (basic)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply knowledge and understanding in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.	Little or no attempt to prioritise or weigh up factors during course of answer. Conclusion is often dislocated from response and any judgements lack substance due in part to the basic level of argument that has been demonstrated throughout response.

	Assessment Objective
AO1	Demonstrate knowledge and understanding of the principles and concepts of computer science, including abstraction, logic, algorithms and data representation.
AO1.1	Demonstrate knowledge of the principles and concepts of abstraction, logic, algorithms, data representation or other as appropriate.
AO1.2	Demonstrate understanding of the principles and concepts of abstraction, logic, algorithms, data representation or other as appropriate.
AO2	Apply knowledge and understanding of the principles and concepts of computer science including to analyse problems in computational terms.
AO2.1	Apply knowledge and understanding of the principles and concepts of computer science.
AO2.2	Analyse problems in computational terms.
AO3	Design, program and evaluate computer systems that solve problems, making reasoned judgements about these and presenting conclusions.
AO3.1	Design computer systems that solve problems.
AO3.2	Program computer systems that solve problems.
AO3.3	Evaluate computer systems that solve problems, making reasoned judgements about these and presenting conclusions.

Question			Answer	Marks	Guidance
1	a	i	-Small piece of memory/used for storing data (1) -Within the processor (1)	**2** **AO1.1**	Accept 'location' for MP1
		ii	-Single control unit (1) -Single ALU (1) -Follows fetch, decode, execute cycle (1) -Data and Instructions stored in the same memory / format(1) (Max 1)	**1** **AO1.1**	Do not accept use registers – in the question
	b		-STA	**1** **AO1.2**	Accept STO
	c	i	-The location of the **next** instruction (to be fetched).	**1** **AO1.2**	Do not accept 'Line number'
		ii	- BRZ - BRP - BRA (1 per -, max 2)	**2** **AO1.2**	Accept 'Branch if Zero' or 'Branch if Positive' or 'Branch Always'

| 2 | | | | Mark Band 3–High Level
(7-9 marks)
The candidate demonstrates a thorough knowledge and understanding of a wide range of ways a computer's performance can be improved and justifies how these measures improve performance; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well-balanced. Evaluative comments are consistently relevant and well-considered.
There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Mark Band 2 –Mid Level
(4-6 marks)
The candidate demonstrates reasonable knowledge and understanding of a range of methods of improving a computer's performance and justifies how many of these improve performance; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate provides a reasonable discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed.
There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.

Mark Band 1-Low Level
(1-3 marks)
The candidate demonstrates a basic knowledge of how a computer's performance can be improved. Limited understanding is shown of how these measures improve performance; the material is basic and contains some inaccuracies. The candidate | 9

AO1.1

(2)

AO1.2

(2)

AO2.1

(2)

AO3.3

(3) | **AO1: Knowledge and Understanding**

The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:

Methods of improving performance

- Replace CPU with faster CPU

- Add more/Faster RAM

- Add a graphics card

- Upgrade to faster secondary storage

- Update OS

- Install a lighter weight OS

- Defragment the hard disk

- Check for viruses and spyware.

AO2.1: Application

The selected knowledge/examples should be directly related to the specific question. The example below is not prescriptive or exhaustive:

- A newer CPU may have a faster clock speed and so execute more instructions per second. It may have multiple cores and so be able to execute several programs simultaneously (or one in parallel). It may have more cache meaning comparatively slower RAM can be accessed less frequently.

- More RAM means more programs can be open simultaneously |

makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated.

The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.

0 marks
No attempt to answer the question or response is not worthy of credit.

without the need to use much slower virtual memory.

- Adding a graphics card will speed up the rendering of 3D graphics as GPU has specialist instructions and can apply the same instruction to multiple pieces of data simultaneously.

- The slower the secondary storage the longer it takes to load files/program/data. A faster secondary storage device can improve this. May choose to use flash memory (i.e. SSD)

- OS makers often release updates and some of these will improve performance.

- Some lighter weight operating systems use fewer system resources allowing the system to devote more to running the user's applications.

- A fragmented HDD runs slowly as time is spent finding parts of the files. This is reduced by defragmenting and storing the parts of the file contiguously.

- Malware can slow down a computer. Removing it will improve performance.

AO3.3: Evaluation

The following is indicative of possible evaluation points that candidates may refer to but is not prescriptive or exhaustive:

Hardware improvements (i.e. CPU, RAM, secondary storage and GPU) have costs attached but likely to have most impact.

The higher performance the hardware, the more cost incurred.

(NB candidates aren't expected to know relative costs of components.)

GPU unlikely to benefit student in this scenario (unless their course requires

				graphics processing). Defragmenting HDD is free and so should be performed. Running anti-malware programs is free/low cost and should be done as a precaution against losing data anyway. Moving to lighter weight software can potentially be free if the user considers open source software.	
3	a		1. Creates / declares / defines a variable (called total) (1) and assigns it an empty / blank (string). (1) 2. A loop that iterates 200,000 times. (1) 3. - 4. Concatenates (the string version of) j to total. (1)	**4** **AO3.3**	For point 1 accept 'blank value' for empty string For point 4 accept *add* instead of *concatenates* <u>only</u> if it is clear it is building a string and not adding a numeric value. Accept 'append'.

4	b		-A (data structure) that operates on a first in last out basis (1) -When going back a page you want to go back to the last page visited/when displaying the history we want to start with the most recent first (1)	**2** **AO1.2**	Accept 'LIFO' or 'FILO'

4	a		- Where weight is less than 4 and volume is less than 0.3m^3 returns 5... (1)
			
			- ...And only when both weight<4 and volume is<0.3 (1)
			
			- Where weight is >= 4 and volume >= 0.3 it returns the larger of weight * 2 if that is larger (than volume*20)... (1)
			
			- ...and volume * 20 if that is larger (than weight * 2). (1)
				4
				
				AO3.2
					Example
					
					``
					function getCost(weight, volume)
					
					    if weight < 4 and volume < 0.3 then
					
					        return 5 (Accept getCost = 5)
					
					    else
					
					        cost=weight*2
					
					        if cost<volume*20 then
					
					            cost=volume*20
					
					        end if
					
					        return cost (Accept getcost = cost)
					
					    end if
					
					endfunction
					``

	b		- Customer and parcel are both entities (1) - 1:M relationship from customer to parcel (1)	**2** **AO1.2** **(1)** **AO2.2**	

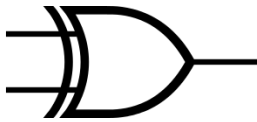|					
			Customer — Parcel	**(1)**	
	c	i	- Has no moving parts… (1) … less likely to be damaged / data loss (1) - Consumes less power… (1) …meaning battery needs recharging less often (1) - Unaffected by magnetic fields.. (1) - …which could lead to data loss. (1) - Faster access speed… (1) - …so photographs can quickly be written to it / browsed. (1) (Mark in pairs)	**2** **AO1.2** **(1)** **AO2.1** **(1)**	
		ii	- Lossy compression (1) Any 2 of the following, must be in context: - Some loss of detail is acceptable (1) - Unlikely to be noticeable (1) - Will make the file size smaller than lossless(1)	**3** **AO1.2** **(1)** **AO2.1** **(2)**	Do not accept 'smaller' on its own, must be 'smaller than lossless'. Do not accept lossless compression as most appropriate. In this case give zero marks for the justification also.

14

5	a		6F	1 AO2.1	
	b	i	11101101	1 AO2.1	
		ii	10010011	1 AO2.1	
	c		*212* ~~*002*~~ ~~1100~~0011 01110010 01010001 1 Mark for answer 1 Mark for showing working using appropriate binary method.	2 AO2.1	NB some candidates represent carries with **10** as binary 2 rather than **2** Accept answer with missing leading zero.
	d		1 $^5/_8$ is 1.101 in fixed point (1 Mark) *binary point needs moving one place giving* *01101 001* One mark for Mantissa 01101	3 AO2.1	

			One mark for exponent 001		
6	a			1 AO1.1	Accept diagram of gate only without input / output
	b		OR gate outputs true if at least one of its inputs is true (1) XOR gate output true if and only if one of its inputs is true. (1)	2 AO1.2	Accept appropriate, correctly labelled, truth tables. One mark for each truth table.

| c | i |

A	B	C	D	Output
1	1	1	1	1
1	1	1	0	1
1	1	0	1	1
1	1	0	0	1
1	0	1	1	1
1	0	1	0	1
1	0	0	1	1
1	0	0	0	1
0	1	1	1	1
0	1	1	0	1
0	1	0	1	1
0	1	0	0	1
0	0	1	1	1
0	0	1	0	1
0	0	0	1	1
0	0	0	0	0

1 Mark (rows 1–4), 1 Mark (rows 5–8), 1 Mark (rows 9–12), 1 Mark (rows 13–16)

4
AO2.2

| | | ii | | 2 | Accept answer without brackets. |

$(A \lor B) \lor (C \lor D) \equiv$ Output

$A \lor B$ (1 Mark)

$\lor (C \lor D)$ (1 Mark)

AO2.2 Accept alternative notation i.e. OR , +

7	a		- Stands for "Transmission Control Protocol / Internet Protocol"… (1) - Protocol(s)/set of rules… (1) - …for communicating across a network / the internet. (1) - Each protocol belongs to a different layer. (1) - The layers are: Application, Transport, Internet, Link (1) - (Starting at the Application layer) data is further encapsulated as it as it is passed to the next layer. (1)	**1** **AO1.1** **2** **A01.2**	Accept layers in any order. Accept Data Link instead of Link. Ignore any mention of Physical layer. Do not accept Network for Internet layer. MP3 is dependent on either MP1 or MP2 being awarded.
	b		- Fewer characters can be represented (1) - Characters from different languages can't be represented. (1)	**1** **AO1.2**	Accept: Special symbols, such as emoticons, can't be represented.

| c | | | - Program iterates through the queue `words` (1)

- First word is added to display (1)

- Subsequent words added on the same line (1)

- Unless a word won't fit, in which case it is moved to the next line (1)

- Words have spaces between them. (1)

- Use of sensible variable names (allow single letter variables for `for` loop counters. (1)

- Use of indentation (1) | **7**

AO3.2

(5)

AO3.1

(2) | <pre>global array display[20,4]

…

procedure updateDisplay(words[])

    xPos=0

    yPos=0

    for i=0 to words.size-1

        temp=words.remove()

        if xPos+1+temp.length>20 then

            yPos=yPos+1

            xPos=0

        endif

        for j=0 to temp.length-1

            display[xPos+j, yPos]=temp.substring(j,1)

        next j

        xPos=xPos+temp.length+1

    next i

  endprocedure</pre>
Accept 'row major' array in pseudocode provided it is consistent throughout. |

| 8 | | | | **Mark Band 3–High Level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of technical and design measures that make a website accessible; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well-balanced. Evaluative comments are consistently relevant and well-considered. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2 –Mid Level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of technical and design measures that make a website accessible; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation The candidate provides a reasonable discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-3 marks)** The candidate demonstrates a basic knowledge of how a website can be made accessible. Limited understanding shown of how these design or technical issues behind it; the material is basic and contains | 9 **AO1.1** **(2)** **AO1.2** **(2)** **AO2.1** **(2)** **AO3.3** **(3)** | **AO1: Knowledge and Understanding** The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: Methods of improving accessibility: Using text alternatives for images Changing styles using CSS Avoiding combining colours that may be indistinguishable by those with colour blindness. Using character sets and fonts that support different alphabets. Using server side processing to amend the content shown. Writing web pages to facilitate screen readers (such as giving hyperlinks meaningful names and not just "click here"). Using tables for tabular data (as they are intended) and not layout (again to aid screen readers). Ensuring that all content can be accessed with the keyboard alone in a logical way. Avoiding CAPTCHA. **AO2.1: Application** The selected knowledge/examples should be directly related to the specific question. The example below is not prescriptive or exhaustive: -Using the `alt` attribute with the `img` tag allows descriptive text to be shown where the image cannot be loaded or the user has disabled images (e.g. a |

some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.*

0 marks

No attempt to answer the question or response is not worthy of credit.

screen reader).

-By having multiple external style sheets the look of the page can be switched. This might include changing the layout for smaller devices or increasing font size and contrast of colours for people who are visually impaired.

-JavaScript may be used to allow users to switch style sheets without having to reload the page

-Choosing colours is important as to people with colour blindness might for example not be able to see green text on a red background.

-Designers also need to have an awareness of the cultural meanings of colours.

-Use of Unicode supports all character sets.

-If the website is processed Server side the content itself can be changed according to the user. The language used may be determined by the user's IP address. Cookies may be used to save the user's preferences.

AO3.3: Evaluation

The following is indicative of possible evaluation points that candidates may refer to but is not prescriptive or exhaustive:

Simple design considerations can have a positive effect on accessibility. Colours and fonts affect readability. A good design can be accessible to a wide audience. Standards exist to help maximum accessibility for those with disabilities.

Use of web technologies can then personalise the output to help ensure the site is specifically accessible to the individual.

Question	Assessment Objectives							Total
	AO1.1	AO1.2	AO2.1	AO2.2	AO3.1	AO3.2	AO3.3	
1ai	2	0	0	0	0	0	0	2
1aii	1	0	0	0	0	0	0	1
1b	0	1	0	0	0	0	0	1
1ci	0	1	0	0	0	0	0	1
1cii	0	2	0	0	0	0	0	2
2	2	2	2	0	0	0	3	9
3a	0	0	0	0	0	0	4	4
3b	0	2	0	0	0	0	0	2
4a	0	0	0	0	0	4	0	4
4b	0	1	0	1	0	0	0	2
4ci	0	1	1	0	0	0	0	2
4cii	0	1	2	0	0	0	0	3
5a*m*	0	0	1	0	0	0	0	1
5bim	0	0	1	0	0	0	0	1

5biim	0	0	1	0	0	0	0	1
5cm	0	0	2	0	0	0	0	2
5dm	0	0	3	0	0	0	0	3
6a	1	0	0	0	0	0	0	1
6b	0	2	0	0	0	0	0	2
6cim	0	0	0	4	0	0	0	4
6ciim	0	0	0	2	0	0	0	2
7a	1	2	0	0	0	0	0	3
7b	0	1	0	0	0	0	0	1
7c	0	0	0	0	2	5	0	7
8	2	2	2	0	0	0	3	9
	9	**18**	**15**	**7**	**2**	**9**	**10**	**70**

PMT