OCR
Oxford Cambridge and RSA

GCE

Computer Science

Unit **H446A/01:** Computer systems

Advanced GCE

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

Annotations

Annotation	Meaning
A	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 Examiners**. 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 make use of acquired knowledge and understanding not always taken.	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 an example or relate an aspect of knowledge or understanding to the context provided.	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 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	Mark	Guidance
1	a	i	- (Single) Control Unit - (Single) Arithmetic Logic Unit - (Special) registers within CPU - Instructions and Data stored in same area of memory - Instructions and Data stored in same format - A single set of buses / same bus for instructions & data (to connect CPU to Memory and I/O) (1 Mark per -, Max 2)	2 (AO1.1)	Accept acronyms ALU,CU

Question			Answer	Mark	Guidance
		ii	Two separate areas of memory… …one for instructions & one for data./instructions and data can be accessed concurrently. Different (sets of) buses… … one for instructions & one for data./ instructions and data can be accessed concurrently. Pipelining… …whilst an instruction is being executed the next can be decoded and the subsequent one fetched. Use of Cache… …A small amount of high performance memory is (next to the CPU) / which stores frequently used data/instructions Virtual cores/Hyper-threadingTM … …Treating a physical core as two virtual cores. Multiple Cores… …Each core acts as a separate processing unit. Onboard Graphics… …Built in circuitry for graphics processing. (1 Mark for identifying feature, 1 mark for description)	2 (AO1.2)	Accept any reasonable description. Do not accept “64-bit” e.g. Performance boosting mode… …Clock speed can be temporarily increased for performance boost. Out of Order Execution… …Instructions can be executed before earlier ones if they are ready. Super Scalar… …Multiple instructions can be executed simultaneously.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>b</td><td>i</td><td>
<table>
<tr><th>Input</th><th>Green Light</th><th>Red Light</th></tr>
<tr><td>1</td><td>✓</td><td></td></tr>
<tr><td>2</td><td>✓</td><td></td></tr>
<tr><td>3</td><td>✓</td><td></td></tr>
<tr><td>4</td><td>✓</td><td></td></tr>
<tr><td>5</td><td>✓</td><td></td></tr>
<tr><td>6</td><td></td><td>✓</td></tr>
<tr><td>7</td><td></td><td>✓</td></tr>
<tr><td>8</td><td></td><td>✓</td></tr>
<tr><td>9</td><td></td><td>✓</td></tr>
</table>
Rows 1-4 correct 1 Mark
Rows 5-9 correct 1 Mark
</td><td>2
(AO3.3)</td><td>Accept T for a tick. Penalise if blank table elements have content.</td></tr>
<tr><td></td><td></td><td>ii</td><td>- The value 11 is stored in the MAR.
- 11 is sent down the address bus.
- A read signal is sent down the control bus.
- 0 is sent (back from memory) down the data bus.
- 0 is stored in the MDR…
- …and then copied to the ACC
(1 Mark per -, max 6)</td><td>6
(AO1.2)</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance

		iii	- Takes in a value from user.
			- If value is 5 or less it shows green
			- Otherwise it shows Red
			
			(1 Mark per -, max 3)
				3
				(AO 3.2)
					Do not credit structured English
					Example
					
					`value = input("Enter a Value")`
					`if value <=5 then`
					`  print("GREEN")`
					`else`
					`  print("RED")`
					`endif`
					
					Accept equivalents to `<=5` (e.g. <6)
					For Green/Red (or 1/0) accept any pseudocode equivalent (GreenLightOn(), Output 1, print(1) Output Green etc.) as long as the logic is correct.

Question			Answer	Mark	Guidance
		iv	**Mark Band 3–High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of assembly code and high level languages. 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 assembly code and high level languages; 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 sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed.	**9** AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	**AO1** Assembly code uses mnemonics to represent machine code instructions/opcodes. High level languages use more natural/mathematical notation. Assembly code consists of simple instructions As such many more lines of assembly code are required to perform the same task as a few lines of a high level language. Assembly code is specific to the instruction set of a given processor. High Level languages are not architecture specific. **AO2** Assembly code allows the programmer to choose the exact instructions so they can write code that is highly efficient. It also allows them to have direct control of how memory is used via addressing modes. Direct control of hardware. High level language compilers have optimisers that can also try and do this (and in some cases may outperform a human writing in assembly code). As high level code is more intuitive and easier to read it is easier to follow, debug and build as part of a team. It can also be written in a much shorter time frame. The high level code can be recompiled for different architectures. High level languages come in a variety of paradigms so programmers can choose according to the problem/their preference. **AO3** Assembly language is best suited to situations such as:

Question			Answer	Mark	Guidance
			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 assembly code and high level languages; the material is basic and contains 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.		-compilers or interpreters don't exist for the target CPU i.e. embedded systems -highest possible performance is critical -memory is very limited. For larger projects which don't fall under the constraints above high level languages are likely to be preferable.

Question			Answer	Mark	Guidance
2	a	i	- Provide a (user) interface - Manage hardware/peripherals - Manage CPU usage / handles interrupts - Provide security - Provide platform to run other software - Provide utilities for system maintenance (1 Mark per -, Max 3)	3 (AO1.1)	If candidate names utility software, allow BP6
		ii	Paging	1 (AO1.1)	
		iii	- Operating system uses area of secondary storage as virtual memory. - Move unused pages/parts (of program A and/or B) into virtual memory - Load program C into (physical) memory. (1 Mark per -, Max 3)	3 (AO2.1)	

Question			Answer	Mark	Guidance

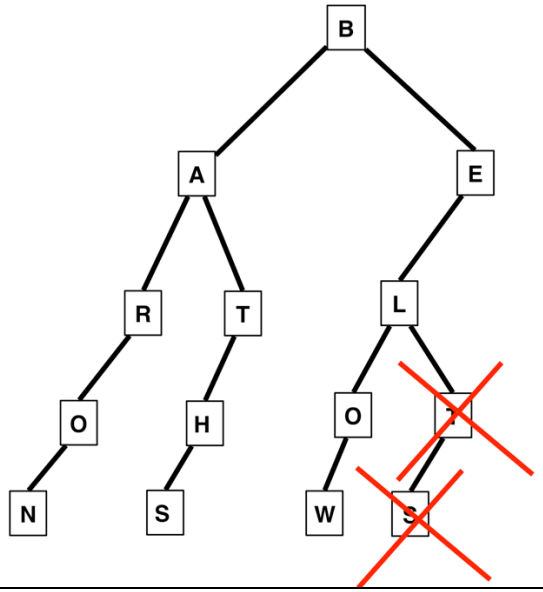
	b	i	- Tags to make “Features” a heading (accept h1, h2, h3 etc.)
			- Correct use of ol
			- Correct use of li tags
			- Use of <a tag Around the text “Download the Factsheet”
			- correct use of href=”factsheet.pdf”
			(1 Mark per -, max 5)
				5 (AO3.2)	For making Features a heading only accept `strong`/`b` if accompanied by code to increase font size.
					
					`<h1>Features</h1>`
					`The new OCR Smart Watch:`
					`<ol>`
					`<li>Uses the CB2 RISC processor for long battery life</li>`
					`<li>Stores up to 20hrs of music</li>`
					`<li>Tracks fitness</li>`
					`</ol>`
					`<a href="factsheet.pdf">Download The Factsheet</a>`
					
					Li close tags are optional

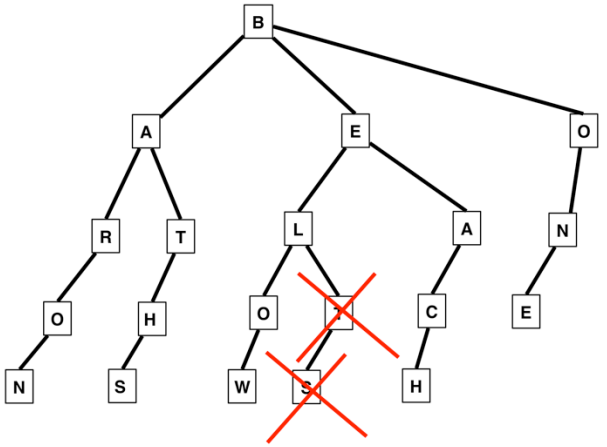
		ii	- A program called a spider/crawler/bot - Traverses the web / following the links. - It takes each word in the document - …It adds an entry for the page (under the word) in the index… - …alongside the word’s position on the page. (1 Mark per -, Max 3)	3 (AO2.1)	
		iii	- RISC has a smaller instruction set (than CISC) - Requires fewer transistors / less complex circuitry - Means less power is required. (1 Mark per -, Max 3)	3 (AO1.2)	

Question			Answer	Mark	Guidance
3	a		- Gets/selects/outputs the flight numbers from the 'Flight' table - Of flights with the destination JFK - It returns OC0089 and OC7750 (1 Mark per -, Max 2)	2 (AO2.2)	
	b		- `SELECT *` changed to `DELETE` - `Halifax` changed to `Heathrow` `DestinationName='Heathrow'` / `DestinationCode='LHR'` - Added `AND DepartureDate=4/7/18` (1 Mark per -, Max 3)	3 (AO3.2	`DELETE FROM Flight WHERE DestinationName='Heathrow' AND DepartureDate=4/7/18` Accept quotation marks or #s around the date. Do not give first mark if asterisk is kept (i.e. DELETE *) The Departure Date condition could be placed before the Destination Name.
	c	i	It is not unique/ the same value can appear in multiple records	1 (AO2.1)	
		ii	It is likely to be used to search for / index / sorted on	1 (AO2.1)	
	d	i	-No Repeating fields/data -Data is atomic -Has a primary Key (1 Mark per -, max 2)	2 (AO2.1)	

Question			Answer	Mark	Guidance
		ii	-Is in First Normal Form -Every field is dependent on the primary key. (1 Mark per -, max 2)	2 (AO2.1)	
		iii	- Has a transitive relationship/ A non-key field depends on another non-key field. - `DestinationName` depends on `DestinationCode` (1 Mark per -, max 2)	2 (AO1.2)	
	e		- CSV/Comma Separated Value (file)… - A (text) file/format with values separated by commas (or some other delimiter) - XML/eXstensible Markup Language… - …A markup language that uses tags to denote data. - SQL/Structured Query Language… - …A language for creating/querying databases Accept any reasonable answer. 1 mark for naming method, 1 mark for valid description.	2 (AO2.1)	Other examples include: - RSS/Really Simple Syndication/Rich Site Summary… - ….A URL is given which points to an XML file which is periodically checked by a browser/program. - API/Application Programming Interface… - …A prewritten set of subroutines/interfaces that provide access to the company's data. - JSON/JavaScript Object Notation… - …text format that can easily be changed to and from JavaScript Objects. Candidates may provide other valid answers (e.g. REST, SOAP etc.). Descriptions may differ from those given. Accept any valid description.

Question			Answer	Mark	Guidance
4	a		- Wide Area Network - Collection of connected computers/devices over a large geographical area - Often using 3rd party communications channels (1 Mark per -, max 2)	2 (AO1.1)	
	b	i	- Allowing them to communicate - By ensuring all devices follow the same rules/standards - So they interpret data/signals in the same way (1 Mark per -, max 2)	2 (AO1.2)	
		ii	-Application -Transport -Internet -Network Interface/(Data) Link/Physical (1 Mark per -, max 4)	4 (AO1.1)	

Question			Answer	Mark	Guidance
5	a		Foot mouse/pedal… … press key/click button to send signal. Camera/eye tracker… …Move/blink to send signal Microphone… …Make sound to send signal Puff/suck switch… ..blow/suck to send signal. Accept any sensible answer. 1 mark for naming of input device, 1 mark for use.	2 (AO2.1) Identify (1), AO2.2) Describe (1)	First mark must be hardware not software
	b	i	- T and S removed /T removed/Link between L and T removed… - …No further nodes removed (1 Mark per -, Max 2)	2 (AO2.1)	

Question			Answer	Mark	Guidance
		ii	- BEACH added - BONE added (1 Mark per -, Max 2)	2 (AO2.1)	 Whether branches point left or right or order of branches is irrelevant. As long as branches form the words without unnecessary repetition of nodes, award the marks.
	c		- Free of cost - Right to inspect/amend/recompile source code - Can tailor the program to their specific needs - Code open for bugs to be spotted and fixed. (1 Mark per -, Max 2)	2 (AO1.2)	

Question			Answer	Mark	Guidance
6			**Mark Band 3–High Level (9-12 marks)** The candidate demonstrates a thorough knowledge and understanding of computing related laws and modern issues that fall under them. 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 is able to assess the extent to which the law is able to keep up with changes in technology. 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 (5-8 marks)** The candidate demonstrates reasonable knowledge and understanding of computing related laws and modern issues that fall under them; 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 makes a reasonable attempt to come to a conclusion as to whether the law is able to keep up with changes in technology.	12 AO1.1 (2) AO1.2 (2) AO2.1 (3) AO3.3 (5)	Points may include but aren't limited to: **AO1 Knowledge and Understanding** Laws that regulate technology include: the Data Protection Act… …which regulates how personal data is stored. The Computer Misuse Act… …which regulates unauthorised access. The Copyright and Patents Act… …regulated intellectual property. Regulation of Investigatory Powers Act… …Regulates how government agencies can use IT for surveillance **AO2 Application** Computer Misuse Act is harder to enforce with the increased use of DDoS attacks (often involving unwitting participants). The Internet of things is likely to make such attacks even more common place. People are connecting to the internet in new ways using mobile networks/public Wi-Fi making attacks potentially difficult to track. Films/Music etc. are being shared in new ways. Streaming is common – often this is legitimate but the global nature of it can bring licensing issues into play. Fast internet speeds, peer to peer and the dark web all contribute to making piracy more prevalent and harder to track. Digital watermarking can be used to track piracy. End to end encryption makes government monitoring of communications trickier.

Question			Answer	Mark	Guidance
			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 (1-4 marks)** The candidate demonstrates a basic knowledge of computing related laws and modern issues that fall under them; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. 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.		**AO3 Evaluation** May conclude that although technology develops quickly the laws are broad enough to cover all eventualities. Alternatively, may conclude that people are always looking for ways of using technology to access loophole in the law / to avoid detection. Look for a well-reasoned conclusion. Could decide either for or against but should be backed up with examples.

Question			Answer	Mark	Guidance
7	a		- Needs to be able to respond instantly to changes… - …such as someone stepping in front of car (or other sensible example) - RTOS offers a guaranteed response time. - A non RTOS might be busy dealing with other tasks and not respond until it is too late. (1 Mark per -, Max 3)	3 (AO1.2)	

	b	i	- Created Obstacle object called bollard
			- Has put the correct arguments in, in the correct order.
			(1 Mark per -, Max 2)
				2 (AO3.2)	Examples
					`bollard=new Obstacle(false, 7.8, 8)`
					`Obstacle bollard = Obstacle(false, 7.8, 8);`
					`bollard=Obstacle(False, 7.8, 8)`
					
					Do not penalise for use of `self` parameter as used by languages such as Python.

		ii	-The attribute `distance` is private… -…and therefore updated with the method `update distance`	2 (AO3.2)	

Question			Answer	Mark	Guidance
		iii	- Reduces the chance of errors/inconsistences - Ensures objects can only be changed in the way intended/ Ensuring changes are consistent with how the object should behave - Protecting data/ Can't be changed accidentally (1 Mark per -, Max 2)	2 (AO1.2)	Read 'securing' as 'protecting'

Question			Answer	Mark	Guidance

	c		- First line Clear use of inheritance of Obstacle.
			E.g.:
			Person inherits Obstacle /
			Person extends Obstacle /
			Person : Obstacle /
			Person(Obstacle)
			
			In the method
			- Less than 2 metres triggers brake
			- Equal to but not greater than 2 metres triggers brake.
			- Less than or equal to 2 metres triggers horn
			- Less than or equal to 5 metres triggers horn
			(1 Mark per -, Max 5)
				5 (AO3.2)	`class Person inherits Obstacle`
					
					`public procedure updateDistance(givenDistance)`
					`if givenDistance<=5 then`
					`Controls.beepHorn()`
					`if givenDistance<=2 then`
					`Controls.applyBrakes()`
					`endif`
					`endif`
					`distance = givenDistance`
					`endprocedure`
					
					`endclass`
					
					NB a number of ways exist of writing the method – be careful of the logic. Two such correct examples are below.
					`if givenDistance<=5 then`
					`Controls.beepHorn()`
					`endif`
					`if givenDistance<=2 then`
					`Controls.applyBrakes()`
					`endif`
					
					`if givenDistance<=2 then`
					`Controls.beepHorn()`
					`Controls.applyBrakes()`
					`elseif givenDistance<=5 then`
					`Controls.beepHorn()`
					`endif`

Question			Answer	Mark	Guidance
	d		Advantages of an automated driver are it is potentially: - safer than a human driver (due to quicker reaction speeds etc.). - cheaper as no wage to cover. - less likely to make mistakes with route. Disadvantages of an automated driver are it is potentially: - May not be able to understand natural speech. - May be limited in terms of the roads on which it can operate. - Vulnerable to hacking. - Only as good as the program running it – a bug in the code could cause catastrophic accidents. - May prioritise safety of pedestrians over that of the passenger. (e.g. may take actions that may put the passenger at risk to save the lives of numerous people outside the car.) - No discussion possible with the driver / no "human presence" to reassure nervous customers. Max 1 advantage and max 1 disadvantage	2 (AO2.2)	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>8</td><td>a</td><td></td><td>- American Standard Code for Information Interchange
- A character set
- Maps values to characters
- Uses 7-bits/ 8-bits per character
(1 Mark per -, Max 2)</td><td>2
(AO1.1)</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>Row shift as below (1 Mark)
<table><tr><td>P</td><td>S</td><td>E</td><td>T</td><td>O</td></tr><tr><td>E</td><td>T</td><td>M</td><td>C</td><td>R</td></tr><tr><td>S</td><td>A</td><td>G</td><td>E</td><td>S</td></tr><tr><td>R</td><td>P</td><td>L</td><td>E</td><td>Y</td></tr><tr><td>G</td><td>G</td><td>Q</td><td>U</td><td>O</td></tr></table>Column Shift as below (1 Mark)
<table><tr><td>G</td><td>G</td><td>Q</td><td>U</td><td>O</td></tr><tr><td>P</td><td>S</td><td>E</td><td>T</td><td>O</td></tr><tr><td>E</td><td>T</td><td>M</td><td>C</td><td>R</td></tr><tr><td>S</td><td>A</td><td>G</td><td>E</td><td>S</td></tr><tr><td>R</td><td>P</td><td>L</td><td>E</td><td>Y</td></tr></table></td><td>2
(AO1.2)</td><td>cao</td></tr>
</table>

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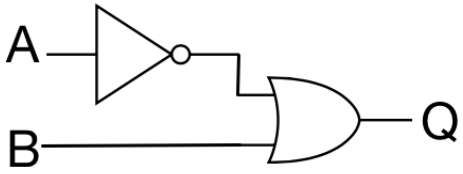
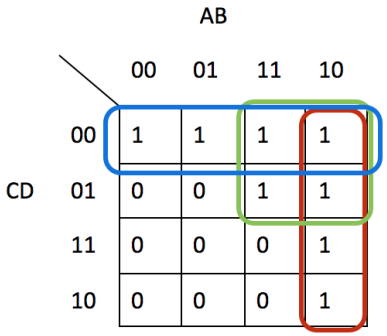
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>c</td><td></td><td>- Procedure correctly defined with parameters.
- Procedure manipulates the correct row of grid.
- Sensible use of for loop to iterate through the array without generating out of bounds exception.
- Correctly shifts each row.
(1 Mark per -, Max 4)</td><td>4
(AO3.1)</td><td>When checking to see if out of bounds exception keep in mind that in some languages the loop boundaries are exclusive. When unsure give the benefit of the doubt. The final mark is meant to offer stretch and challenge. Be cautious of wrong answers on face value seems to work. For example, the following will <u>not</u> work:
<pre>procedure shiftRow(rowNumber, places)
    for i = 0 to places
        grid[rowNumber,i+1]= grid[rowNumber,i]
    next i
endprocedure</pre>Possible solutions include…
<pre>procedure shiftRow(rowNumber, places)
    array temp[5]
    for i=0 to 4
        temp[i]=grid[rowNumber,i]
    next i
    for i=0 to 4
        newPos=(i+places)MOD 5 //% is the same as MOD
        grid[rowNumber,newPos]=temp[i]
    next i
endprocedure</pre>And..
<pre>procedure shiftRow(rowNumber, places)
    for i=1 to places
        temp1=grid[rowNumber, 4]
        temp2=0
        for j =0 to 4
            temp2=grid[rowNumber,j]
            grid[rowNumber,j]=temp1
            temp1=temp2
        next j
   next i
end procedure</pre>Note: within solutions, allow for columns to be referenced first eg <code>grid[i,rowNumber]</code></td></tr>
</table>

Question			Answer	Mark	Guidance
	d		**Mark Band 3–High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of modern encryption and the difference between symmetric and asymmetric encryption. 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 modern encryption and the difference between symmetric and asymmetric encryption; 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.	**9** AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	**AO1** Modern encryption is many orders stronger than that used in a pre-computer era. Asymmetric encryption uses different keys for encryption and decryption. Symmetric encryption uses the same key for encryption and decryption. Asymmetric encryption algorithms tend to involve more processing than symmetric algorithms. **AO2** Modern encryption can be used without specialist knowledge. Often users may not even be aware their data is being encrypted (e.g. HTTPS, messaging systems) Asymmetric encryption is often used when exchanging data. For example credit card details over the internet. Symmetric encryption is best suited when the same person is encrypting and decrypting. For example when backing up data. **AO3** The strength and ease of use of encryption has made it widely used on the Internet. E-Commerce would not be possible without it. Governments are no longer able to easily crack encrypted messages they intercept (as far as we know). This gives individuals unprecedented levels of privacy But also means those communicating for nefarious purposes can do so undetected.

Question			Answer	Mark	Guidance
			The candidate provides a sound 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 modern encryption and the difference between symmetric and asymmetric encryption; the material is basic and contains 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		

Question			Answer	Mark	Guidance
9	a		10101001 ← Answer, 1 Mark 111111 ← Carry bits, 1 Mark	2 (AO1.2)	
	b		1 02~~2~~2 ← Borrowed bits, 1 Mark 1~~100~~1111 00111001 10010110 ← Answer, 1 Mark	2 (AO1.2)	Allow 2 marks for any other valid method with working shown. If converted to denary and calculated, no marks.
	c		370F 1 Mark for the first two digits (i.e. 37) 1 Mark for the last two digit (i.e. 0F)	2 (AO1.2)	
	d		-Exponent is 2 -Mantissa becomes 010.01 -Value is 2.25 (1 Mark per -, Max 3)	3 (AO1.2)	
	e		01100 0000 1 Mark for mantissa, 1 mark for exponent. 10000 0100 1 Mark for mantissa, 1 mark for exponent.	4 (AO1.2)	
	f		10111001	1 (AO1.2)	cao
	g		11111111	1 (AO1.2)	cao

Question			Answer	Mark	Guidance
10	a		 - A going into NOT gate. - B and NOT A going into OR gate (and Q coming out of it) (1 Mark per -, Max 2)	2 (AO1.2)	
	b		-Groups correctly identified (with no further groups). - Answer includes ¬ C∧¬D - Answer includes A∧¬B - Answer includes A∧¬C - All three sections joined with ∨s in any order but with no further sections. E.g. (A∧¬B)∨(A∧¬C)∨(¬ C∧¬D) The brackets aren't necessary (1 Mark per -, Max 5)	5 (AO1.2)	

Question	Assessment Objectives							Total
	AO1.1	AO1.2	AO2.1	AO2.2	AO3.1	AO3.2	AO3.3	
1ai	2							2
1aii		2						2
1bi							2	2
1bii		6						6
1biii						3		3
1biv	2	2	2				3	9
2ai	3							3
2aii			1					1
2aiii		3						3
2bi					5			5
2bii			3					3
2biii		3						3
3a				2				2
3b					3			3
3ci			1					1
3cii			1					1
3di			2					2
3dii			2					2
3diii		2						2
3e			2					2
4a	2							2
4bi		2						2
4bii	4							4

5a			1	1				2
5bi			2					2
5bii			2					2
5c		2						2
6	2	2	3				5	12
7a		3						3
7bi					2			2
7bii				2				2
7biii		2						2
7c					5			5
7d				2				2
8a	2							2
8b		2						2
8c					4			4
8d	2	2	2				3	9
9a		2						2
9b		2						2
9c		2						2
9d		3						3
9e		2						2
9f		2						2
9g		1						1
9h		1						1
10a		2						2
10b		5						5
								0
								0

								0
								0
								0
TOTALS	19	55	24	7	19	3	13	140

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