OCR
Oxford Cambridge and RSA

GCE

Computer Science

H446/01: Computer systems

A Level

Mark Scheme for June 2023

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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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM assessor

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Contradictory Responses
   When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space or no valid attempt at an answer (e.g. "I don't know")

   Award Zero '0' if:

   - there is an attempt at an answer that is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
To determine the level – start at the highest level and work down until you reach the level that matches the answer
To determine the mark within the level, consider the following:

Descriptor	**Award mark**
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of the doubt
	Incorrect point
	Follow through
	Not answered question
	No benefit of doubt given
	Point being made
	Repeat
	Correct point
	Too vague
	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.
	Level 1

L2	**Level 2**
L3	**Level 3**

12. 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.

13. Subject Specific Marking Instructions

Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point

- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks (apart from QER question)
- A BOD or FT annotation needs to be accompanied by a tick
- QER – One annotation from: L1, L2 or L3, according to the level awarded, the page not annotated with the level needs a SEEN annotation. Do not include any ticks, crosses or other annotations on this question – other than SEEN and one from: L1, L2 or L3
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

	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.

Question			Answer	Mark	Guidance
1	(a)	(i)	e.g. ● **Fewer** mistakes (likely to be made) // **More** accurate ● Faster as you can apply the same formula to multiple cells // By example ● What-if analysis can be performed ● Values can be changed and results **automatically (re)calculated** (by using formulas) ● Can be shared electronically	1	Do not accept "faster" on its own without clarification of what/why it is faster.
1		(ii)	e.g. ● Database/DBMS ● …to store/query/sort data about customers/staff/stock ● Word processor ● …to create documents / letters / invoices for clients/staff ● Presentation software ● …to create presentations for clients/staff ● Email software ● …for staff to communicate with each other or with customers ● Graphics manipulation ● …to produce adverts / images for sales ● Web browser ● ….to view websites to purchase materials/stock // view competitor's website	4	Mark in pairs – one mark for naming type of application software, one for the example. Application type must be correct to give example. Do not accept brand names for first mark but FT for example. Ignore brand names if description given after E.g. Outlook / Email application Accept other sensible application software (such as CAD, Desktop Publishing). Do not accept special purpose / bespoke / utility software. Do not accept spreadsheet (given in question) Example must be relevant to the business

<table>
<tr>
<td>1</td>
<td></td>
<td>(iii)</td>
<td>

No access to source code
Cannot modify//improve to meet business needs
Cannot fix bugs
(Usually) cost to purchase licences // licence conditions to meet//ongoing fees

</td>
<td>3</td>
<td>Do not award a reverse of the mark point by describing open source</td>
</tr>
<tr>
<td>1</td>
<td>(b)</td>
<td></td>
<td>
<table>
<tr><th>Statement</th><th>True</th><th>False</th></tr>
<tr><td>BIOS stands for Boot Input Output Standard</td><td></td><td>✔</td></tr>
<tr><td>The BIOS can be used to alter hardware settings, such as which storage device the computer boots from.</td><td>✔</td><td></td></tr>
<tr><td>BIOS settings are stored in RAM</td><td></td><td>✔</td></tr>
</table>
</td>
<td>3</td>
<td>1 mark per row.</td>
</tr>
</table>

1	(c)		● Stored away from the computer(s)/remote… ● … so in case of disaster, data is not also damaged ● All of the data (from multiple machines) can be backed up **at the same time** ● Can be accessed from elsewhere / other machines ● Storage can be expanded as necessary//no limit on size ● Speed of access is not a priority for a backup ● Can make recovery from another site easier ● No physical space needed for backup hardware ● No on site maintenance required ● Allows more local storage capacity for data	2	Allow multiple interpretations of virtual storage (e.g. cloud / devices not connected directly to the computer) Do not allow space on its own or memory for storage
1	(d)	(i)	e.g. ● Share hardware (e.g. printers) ● Share files ● Share Internet connection ● Centralised security ● Log on / access files from any machine on the LAN ● Central maintenance ● Central backup / storage ● Central installation / update of programs ● Can monitor user activity ● Can control access levels // Centralised user admin ● Access an intranet	3	Mark first answer in each answer space
1	(d)	(ii)	● A set of rules // an agreement ● Used to ensure the (proper / successful) **transfer of data** between devices // used to govern the **transmission/communication** between devices ● May specify format of data / error checking / etc	2	Allow suitable example of contents of a protocol for MP3 Do not award a rule - must be plural

1	**(d)**	**(iii)**	1 mark per protocol listed e.g. ● HTTP // Hypertext Transfer Protocol ● HTTPS // Hypertext Transfer Protocol Secure ● TCP // Transmission Control Protocol ● IP // Internet Protocol ● UDP // User Datagram Protocol ● FTP // File Transfer Protocol ● Ethernet ● WPA // Wi-Fi Protected Access ● DHCP // Dynamic Host Configuration Protocol ● SMTP // Simple Mail Transfer Protocol ● POP // Post Office Protocol ● IMAP // Internet Message Access Protocol ● RDP // Remote Desktop Protocol ● VoIP // Voice over Internet Protocol	2	Mark first answer in each answer space If mentioned one protocol with 2 versions e.g. IPv4 & IPv6 - only 1 mark If they've written the protocol in full but got any word wrong, no mark awarded
1	**(d)**	**(iv)**	● To apply protocols in order / one after the other ● To provide independence of layers // Layers can be modified without affecting other layers // Layers are self-contained ● Hides details from previous or next layer(s) // is an abstraction ● Each layer is well defined / does a specific job ● Breaks **tasks** down into manageable units // Groups similar protocols together ● Improved troubleshooting (easier identification of the layer that causes the issue) ● Each layer only communicates with adjacent layers // simplifies interfacing ● Hardware/software can be manufactured to fit into one specific layer ● Allows for standards for individual tasks/layers to be developed // for compatibility	3	

1	**(e)**	**(i)**	● Real time	1	Correct answer only
1	**(e)**	**(ii)**	● Multi-tasking… ● …runs multiple **programs at the same time** ● Multi-user… ● … allows multiple **users at the same time** (must be clear that candidate is not discussing an OS that simply has multiple accounts) ● Distributed… ● …allows multiple computers to work together **on a single task** ● Embedded… ● …has a dedicated/limited function ● …is read-only / cannot be changed	6	Mark in pairs Allow real time if not given as previous answer Do not accept "runs on an embedded system" as expansion of embedded OS, this is NE.

1	**(f)**		● Interrupt checked for at start/end of each fetch-execute cycle ● If the interrupt is of a lower/equal priority to the current process then the current process continues ● (If interrupt raised) contents of **registers** copied to stack ● Flags are set to determine if interrupts are enabled / disabled ● Program counter changed to point to Interrupt Service Routine (ISR) // ISR runs ● After interrupt complete, previous **register** values restored back from stack ● Flag is reset ● If higher priority interrupt received during servicing of interrupt… ● …this is added to stack and new interrupt dealt with	3	

1	(g)		**Mark Band 3 – High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of memory management carried out by operating systems. 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 thoroughly assess the importance of memory management to an efficient and secure system. 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 memory management carried out by operating systems. 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 assess the importance of memory management to an efficient and secure system.	9	*The following shows example content that may form part of a candidate's answer. It is not intended to be an exhaustive resource, nor should a candidate be expected to specifically cover any particular amount of this.* **Knowledge (AO1)** ● Memory management means to ensure that RAM is used efficiently and not wasted ● Removes data not needed anymore (garbage collection), frees up space and allocates memory to applications ● Paging or segmentation may be used to split up memory ● Paging uses fixed size divisions whereas segmentation uses varying size divisions ● Paging is where memory is divided physically ● Segmentation is where memory is divided logically ● Virtual memory may be used when RAM is (almost) full to enable applications to continue to run **Application (AO2)** ● If RAM is unavailable or full, applications cannot be loaded ● Data transferred out of RAM into virtual memory to free up space and then transferred back again when needed ● Also includes security so that data stored in memory is not vulnerable ● Memory management is important for a well-running machine. If not, RAM would rapidly run out and fill up with unneeded data/instructions and so no new applications could run ● Paging causes internal fragmentation whereas segmentation causes external fragmentation ● A page table is used to map page location which is slower than a segmentation table

			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 memory management carried out by operating systems; 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 unsupported assertions. Any discussion of the importance of memory management will be vague or lacking detail. 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		● It is easier for the OS to manage page locations as they can be stored non-contiguously. Segments can be non-contiguous but work better contiguously **Evaluation (AO3)** ● RAM is much more expensive than secondary storage (per unit/GB) so virtual memory is useful rather than having to buy more RAM ● Over use of virtual memory causes slow down and even disk thrashing if pages have to be swapped back and forth too often ● Paging can be more effective because any free memory space can be used to swap data in and out whereas with segments, lots of space will sit unused until a segment the right size is available ● Segmentation errors can cause memory leakage which would cause the system to crash ● Security issues – applications can only access memory allocated to them so (for example) a malicious application cannot access the memory allocated to a banking app. Also when applications are closed, data is removed before being reallocated so that applications cannot see historic data

Question			Answer	Mark	Guidance

2	(a)		• value == "E"
			• value == "S"
			• (numone+numtwo)
			• value
			• "E"
				5	All string values must be in quotes. Allow single or double quotes.
					
					Don't allow single = for MP1&2. Penalise once and FT for multiple occurrences.
					
					Case needs to match that used in the question
					
					Needs to have brackets for MP3
					
					do
					value = input("Enter a value")
					if value == "E" then
					num = numbers.pop()
					print(num)
					elseif value == "A" or value == "S" then
					numone = numbers.pop()
					numtwo = numbers.pop()
					if value == "A" then
					numbers.push(numone + numtwo)
					elseif value == "S" then
					numbers.push(numtwo - numone)
					endif
					else
					numbers.push(value)
					endif
					until value == "E"

2	(b)	(i)	• 8, 7 • 15 • 15,6	3	One mark per stack diagram
2	(b)	(ii)	• 12 • 7 • 15	3	

2	**(b)**	**(iii)**	● S causes the two values inputted to be popped and only one value to be pushed back // 4 and 2 are popped and 2 is pushed ● A causes an attempt to pop **two values but only one present / not two values there** ● Causing a **stack** underflow	3	
2	**(c)**	**(i)**	● Stack is LIFO / FILO ● Queue is FIFO / LILO ● Stack uses one pointer (for head) ● Queue uses two pointers (head and tail) ● Stack, data is popped/pushed from the top ● Queue, data is dequeued from the from the start and enqueued onto the back // a queue can be circular	2	Mark in pairs Accept descriptions of LIFO / FIFO for MP1 and 2
2	**(c)**	**(ii)**	● Array is of fixed/defined size // static ● List size can be changed // no defined size // dynamic ● Array holds data of single data type ● List can hold data of multiple / different types	2	Mark in pairs
2	**(c)**	**(iii)**	● A tuple cannot be changed **at runtime** // a tuple is immutable	1	
2	**(c)**	**(iv)**	● **Go to** the first position indicated by the start pointer ● From the first position, **read** the next pointer value… ● …follow this pointer value and **access** the data item	3	Accept answers relating to locations given by pointers Allow acceptable diagram illustrating the same points

Question			Answer	Mark	Guidance
3	(a)	(i)	● BD	1	Correct answer only
3	(a)	(ii)	● 2AF	1	Correct answer only
3	(b)	(i)	● 1110 1011	1	Correct answer only
3	(b)	(ii)	● 1001 0101	1	Correct answer only
3	(b)	(iii)	● Calculations are more easily **performed** on two's complement ● Two's complement allows for a (negligible) larger range of numbers to be stored // by example ● No additional hardware is required in two's complement // Addition and subtraction are carried out using only an adder ● Two's complement has only one representation for 0	1	Accept the reverse of the MP
3	(c)		● -15.75 is 10000.01 (in fixed point two's complement) ● Binary point moved **4** places **left** ● Mantissa 1000 0010 ● Exponent 0100	4	Mantissa must be 8 bits, exponent must be 4 bits Accept alternative working for MP2 if appropriate. If mantissa AND exponent are correct with any working, 4 marks

3	**(d)**		● Exponent is -2 ● Binary point moved **2** places l**eft** (0.001) // 0.5 x 2^{-2} ● 0.125 // 1/8 (one eighth)	3	MP2 is for correct working of whichever method is used. If answer is correct and working is shown, 3 marks
3	**(e)**		● precision / accuracy ● range / size / magnitude	2	

Question			Answer	Mark	Guidance
4	(a)	(i)	● Assembly language uses mnemonics ● HLL uses English-like words ● Assembly language uses an assembler to convert to machine code ● HLL uses a translator (compiler/interpreter) to convert to machine code ● Assembly language is a one-to-one conversion to machine code ● HLL may produce multiple lines of machine code per line of code // one-to-many ● Assembly language requires more knowledge of the processor // allows direct control of the processor ● HLL provides more abstraction // requires less knowledge of the processor ● Assembly language is likely to be specific to the processor type used // is machine dependent ● HLL is portable // can be used for multiple processor types // programmer can pick from a number of HLLs and paradigms // is machine independent	4	Mark in pairs. Allow examples (e.g. JMP, print) for MP1 and 2
4	(b)	(i)	● Can execute multiple **instructions** / FDE cycles **at the same time //** some **instructions** in the program can be run **in parallel**	1	Do not accept just "multiple instructions" Do not accept tasks/programs for instructions

4	**(b)**	**(ii)**	● Some instructions may not be able to be run in parallel ● An instruction may be dependent / waiting for other instructions to be completed ● Other factors influence processing speed – clock speed / cache / bottlenecks / etc ● Program / OS needs to be written to specifically use multiple cores	2	

4*	(c)		**Mark Band 3 – High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of encryption and hashing and how they can be used to store data and communicate securely. 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 weigh up both technologies which results in a supported and realistic judgement covering when each can be used. This is well balanced. 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 encryption **and** hashing and how they can be used to store data and communicate securely; 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 showing some recognition of either technology. This may not be well-balanced, covering one side significantly more than the other, although both sides will be present.		*The following shows example content that may form part of a candidate's answer. It is not intended to be an exhaustive resource, nor should a candidate be expected to specifically cover any particular amount of this.* **Knowledge (AO1)** ● Encryption converts data into data that cannot be understood (ciphertext) using a key. ● Symmetric encryption uses the same key for both encryption and decryption ● Asymmetric encryption uses two keys, one for encryption, one for decryption ● Encryption is two-way, so data can be restored to original form, but key is required. ● Hashing is a one-way (non-reversible) mathematical process that produces a value from the input value. **Application (AO2)** ● For robot's data storage, symmetric encryption is useful as no keys to share/transmit. ● For robot-robot/user communication, asymmetric encryption / public key encryption means that only the public key needs to be shared. Data can be encrypted/decrypted with this while the private key is kept secure ● Also possible to verify identity of sender / origin of data using asymmetric encryption. ● Hashing is useful for information (e.g. password) that needs to be verified but does not need to be known at any point; once hashed, it is impossible to return to it. **Evaluation (AO3)** ● Encryption useful for most data storage as anyone hacking into the robot will not be able to read/understand the data.

			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 encryption or/and hashing and how they can be used to store data and communicate securely; 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 unsupported assertions. Any discussion will be almost entirely one-sided. 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.		● Hashing is useful for data storage of password / other items that need to be verified, hash of input compared against hash stored to confirm correctness. ● Hashing is not useful for data that needs to be returned to the user as impossible to return to. ● Encryption useful for data transmission as data intercepted cannot be decrypted without the key.

4	**(d)**	**(i)**	• and • href • Login • text/password • submit	5	<html> <head> <title>Robot User Interface</title> </head> <body> Robot directives - Serve the company trust - Protect data - Uphold standards Updates Login <form action="dologin.php"> Password <input type = "text" name="pw"> <input type = "submit"> </form> </body> </html> HTML tags are not case sensitive Correct answer only

4	**(d)**	**(ii)**	● h1 and other code contained in { }
			● color :white;
			● background-color : red;
			//background: red;
				3	Ignore presence or lack of <style> tags. Ignore lack of semicolons
					
					Penalise misspelling of "color" once and then FT
					
					h1 {
					color:white;
					background-color: red;
					}
					
					White can be #FFFFFF or #FFF
					Red can be #FF0000 or #F00

4	**(e)**	**(i)**	● <u>Copyright Designs and Patents Act</u> Any two from: ● Gives the author (the programmers) ownership/copyright of the photographs ● …no need to apply // this is automatic ● Others cannot use/distribute // can be prosecuted/fined for using/distributing… ● …without permission ● Permission can be granted / bought / licenced	3	Must be full name of Act for MP1 FT for versions of Copyright or nothing for MP2-6
4	**(e)**	**(ii)**	● Ask permission of **author / photographer / owner** ● Use images marked as copyright free (e.g. Creative Commons Licence) ● Purchase (licence to use) image	2	Do not accept just "ask permission"

4	**(f)**	**(i)**	● DELETE FROM TblAccessLog ● WHERE UserType = "NotNeeded"	2	Do not accept DELETE * or inclusion of field names Need quotation on MP2 For field and table names, case must match - only penalise once and FT Do not award MP2 if == is used instead of =
4	**(f)**	**(ii)**	● Each attribute name is unique ● Primary key identified ● No repeated **attributes** ● All data in attributes must be atomic (cannot be further split up) // by example	2	Do not accept repeated data / data redundancy (higher than 1NF) unless specified that this is within one field Allow fields/properties as alternative to attribute
4	**(f)**	**(iii)**	● DateAccessed… ● …has non-atomic data // data can be split up (into separate dates)	2	

Question			Answer	Mark	Guidance
5	(a)		• 9	1	

5	(b)		• **input and store/use** a value from user
			• call **doCheck** function with value input from user **and save/use returned value**
			• open and close text file in write/append mode, if given
			• write value returned to text file
			• Write value input to text file
				5	Example code:
					`num = input("enter a number")`
					`value=doCheck(num)`
					`txtfile = openWrite("storedvalues.txt")`
					`txtfile.writeLine(num)`
					`txtfile.writeLine(value)`
					`txtfile.close()`
					
					MP2 - **doCheck** is case sensitive
					
					MP3 - need speech marks around file name

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td>● ¬ (A ∨ B) // NOT (A OR B)
● ∨ C // XOR C</td><td>2</td><td>First MP requires brackets, NOT A or B is incorrect.

Can be written in different order (e.g. C XOR NOT (B OR A) as long as logically correct.

Accept (A + B) ⊕ C</td></tr>
<tr><td>6</td><td>(a)</td><td>(ii)</td><td>● 1 mark for first two rows (1,0)
● 1 mark for next two rows (0,1)
● 1 mark for next four rows (0,1,0,1)

<table>
<tr><th>A</th><th>B</th><th>C</th><th>P</th><th>Marking Guidance</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td rowspan="2">1 Mark</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td rowspan="2">1 Mark</td></tr>
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<tr><td>1</td><td>0</td><td>0</td><td>0</td><td rowspan="4">1 Mark</td></tr>
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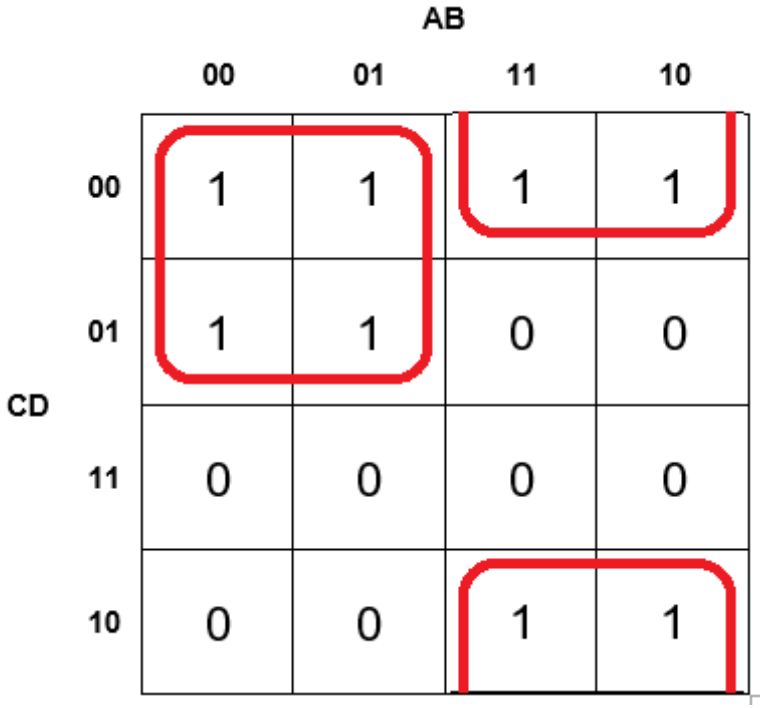
</table>
</td><td>3</td><td></td></tr>
</table>

6	(b)		• Correct highlighting on K map as shown • ¬A ∧ ¬C // $\bar{A}.\bar{C}$ // NOT A AND NOT C… • A ∧ ¬D // $A.\bar{D}$ // A AND NOT D… • …v // + // OR joining the 2 correct expressions together	4	 Do not penalise candidates who attempt to simplify even further (e.g. NOT A AND NOT C = NOT (A OR C) using De Morgan's). MP1 - correct answer only MP4 is dependent on MP2 & 3

Question			Answer	Mark	Guidance
7*			**Mark Band 3 – High Level (9-12 marks)** The candidate demonstrates a thorough knowledge and understanding of The Regulation of Investigatory Powers Act (RIPA) 2000. 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 weigh up both sides of the argument which results in a supported and realistic judgement covering the benefits and drawbacks of the Act. This is well balanced. 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 The Regulation of Investigatory Powers Act (RIPA) 2000; 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 showing some recognition of benefits and/or drawbacks. This may not be well-balanced, covering one side significantly more than the other, although both sides will be present.	12 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	*The following shows example content that may form part of a candidate's answer. It is not intended to be an exhaustive resource, nor should a candidate be expected to specifically cover any particular amount of this.* **Knowledge (AO1)** ● Implements additional rights regarding surveillance / monitoring of individuals and acquisition of communications data ● Provides the right for many organisations (including the Police and security services) to do this. ● Purpose is to detect crime and defend national security (e.g. terrorism, public disorder) ● Gives access to individuals' private communications, such as emails, text messages, phone calls, Internet history. ● Some people feel this is an invasion of their privacy **Application (AO2)** ● Monitoring can be carried out by far more organisations than just the Police and Security services – for example, local councils, the pension regulator and the Environment Agency are all able to use surveillance or request data about individuals. ● If files are encrypted, the Act gives powers to force the handover of keys (from individuals or organisations) with a 2 year prison sentence possible on refusal. ● Wide ranging powers have allowed Police and Security services to intercept criminals' communications and stop / disrupt crime. **Evaluation (AO3)** ● In the modern world, it is important that Police and Security services are given the power to deal with electronic communications in this way. Many crimes

			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 The Regulation of Investigatory Powers Act (RIPA) 2000; 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 unsupported assertions. Any conclusion, if present, will be almost entirely one-sided. 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.		(e.g. terrorism) can be detected and stopped before they occur, making the public safer. ● However, some say that it is now a "snooper's charter", with more organisations using their powers for minor offences such as detecting those lying about their address to get children into a better school or fly-tipping. ● Many communication tools (e.g. WhatsApp) now include end-to-end encryption by default so that messages cannot be divulged by the organisation because they do not have access to it. Other encryption tools include plausible deniability.

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