

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	<ul style="list-style-type: none"> <li>• Client computers connect to server</li> <li>• Server provides access to a resource/service</li> <li>• In this case hotel staff use client computers to connect to database on server (or other sensible example).</li> </ul>	3 AO1.2	
		ii	<p>e.g.</p> <ul style="list-style-type: none"> <li>• only one point of failure</li> <li>• easier to manage users/access</li> <li>• Easier to backup</li> <li>• Easier to keep data secure.</li> <li>• Technicians can more easily remotely install / monitor.</li> </ul>	2 AO1.1	
	b		<ul style="list-style-type: none"> <li>• Joins computers/devices together on a LAN</li> <li>• Receives packets/data</li> <li>• Recipient's address is given in packet header/it uses the mac address</li> <li>• Send packets/data</li> <li>• Out the correct port /to the specific computer device</li> </ul>	3 AO1.1	

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	c	<p><b>Mark Band 3—High Level (7-9 marks)</b>  The candidate demonstrates a thorough knowledge and understanding of network security. The material is generally accurate and detailed.</p> <p>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.</p> <p>The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered.</p> <p>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</p> <p><b>Mark Band 2—Mid Level (4-6 marks)</b>  The candidate demonstrates reasonable knowledge and understanding of network security; the material is generally accurate but at times underdeveloped.</p> <p>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.</p> <p>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.</p> <p>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</p> <p><b>Mark Band 1—Low Level (1-3 marks)</b>  The candidate demonstrates a basic knowledge of network security; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides a limited</p>	9 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	<p><b>AO1</b>  Malware and viruses are software that can have a negative impact on computer systems  Spyware and keyloggers can record information entered and send back to a third party  Phishing attacks attempt to steal data by fraudulently appearing as legitimate emails asking for secure information  Denial of Service Attacks can overload a computer system with traffic and effectively disable access for legitimate users</p> <p><b>AO2</b>  Hotel's systems could be disrupted by DDOS attacks so no external bookings able to be made.  Phishing and spyware attacks may compromise visitor security and result in financial loss  Malware, viruses could destroy hotel data  Theft of customer data would be an issue under Data Protection Act / GDPR for which the hotel could be prosecuted</p> <p><b>AO3</b>  Education for staff and customers is important to deal with recognising and dealing with threats  Up to date software, limitations of use of devices such as USB sticks and restricted access to wireless networks can all limit risks.  Use of Firewall to restrict traffic entering and leaving the network.  Should be balanced against customer experience; will customers return if they have no access to IT facilities?</p>

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		<p>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.</p> <p><b>0 marks</b> No attempt to answer the question or response is not worthy of credit.</p>			
	d	i	<p>-Customer, Room and Booking entities, must be singular</p> <p>-Customer joined to Booking and Room joined to booking and no other links</p> <p>-Customer to Booking relationship indicated as one-many -Room to Booking relationship indicated as one-many</p>	4 AO2.2	<pre> graph TD     Customer[Customer] --- Booking[Booking]     Room[Room] --- Booking   </pre>
		ii	<ul style="list-style-type: none"> <li>• A field that links to a (primary) key in a second table</li> <li>• Example : Customer ID // RoomID...</li> <li>• ... in Booking table</li> </ul>	3 AO1.1 (1) AO2.1 (2)	
		iii	<ul style="list-style-type: none"> <li>• Hashing for security</li> <li>• ...e.g. hash <u>passwords</u> in database</li> <li>• ...to make sure they cannot be read if they are stolen</li> <li>• Hashing for direct access</li> <li>• ...e.g. Customer/Room/Booking records can be quickly accessed</li> <li>• ...by using hash of index as address</li> </ul>	4 AO1.2 (2) AO2.2 (2)	
	e		<ul style="list-style-type: none"> <li>• Database/relationships are consistent // each foreign key links to an existing/valid primary key</li> <li>• Suitable example of being broken (e.g. if primary key is deleted/updated, foreign keys are no longer valid / changes should be cascaded)</li> </ul>	2 AO1.1 (1) AO1.2 (1)	Accept example that is not related to the database given (as this is an AO1 question)
			<b>Total</b>	30	

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2	a	i	<ul style="list-style-type: none"> <li>Constructor method definition (e.g new)</li> <li>itemname, price passed in as parameters (must use different identifier names to the ones in the question)</li> <li>...and assigned to attributes</li> <li>discount attribute assigned to 0.</li> </ul>	4 AO3.2	<p><u>Example answer</u></p> <pre>public procedure new(nItemName, nPrice)     itemname = nItemname     price = nPrice     discount = 0 endprocedure</pre> <p>Look out for alternative notation e.g.</p> <pre>this.itemname = itemName</pre>
		ii	<ul style="list-style-type: none"> <li>1 mark for creating object with identifier mushypeas =</li> <li>1 mark for creating object as type ItemForSale</li> <li>mark for parameters passed in as needed</li> </ul>	3 AO3.2	<p><u>Example answers</u></p> <pre>mushypeas=new ItemForSale( "mushy peas" , 0.89)</pre> <pre>ItemForSale mushypeas = ItemForSale("mushy peas",0.89);</pre> <pre>mushypeas=ItemForSale( ("mushy peas" ,0.89);</pre> <p>Do not penalise for use of self parameter as used by languages such as Python. Must be correct case and spelling</p>
		iii	<ul style="list-style-type: none"> <li>method definition for calculatePrice()</li> <li>applies percentage discount</li> <li>...returns calculated value</li> </ul>	3 AO3.2	<p>Percentage discount must be applied correctly.</p> <p><u>Example answer</u></p> <pre>function calculatePrice()     newPrice = price - (price * discount/100)     return newPrice end function</pre>
	b		<ul style="list-style-type: none"> <li>discount attribute made private</li> <li>Set method created</li> <li>...that restricts value to maximum 50%</li> </ul>	3 AO2.2	
	c		<ul style="list-style-type: none"> <li>Create new class</li> <li>...inheriting from / subclass of <u>ItemsForSale</u></li> <li>new attribute for stock location</li> <li>calculatePrice() method overridden // new version of calculatePrice() implemented in subclass.</li> </ul>	4 AO2.2	
			<b>Total</b>	<b>17</b>	
3	a	i	1000 1001	1 AO1.2	Correct answer only

### Mark Scheme

Question		Answer/Indicative content		Marks	Guidance
	ii	6D		1 AO1.2	Correct answer only
	iii	AB		1 AO1.2	Correct answer only
	iv	1010 0110 1 mark per nibble		2 AO1.2	Correct answer only
b		<ul style="list-style-type: none"> <li>• 10110.111 in fixed point</li> <li>• Move binary point four places to the left (1.0110111)</li> <li>• Gives mantissa of 10110111</li> <li>• therefore exponent is 4 = 0100</li> <li>• Forming final answer of 10110111 0100</li> </ul>		5 AO1.2	
c	i	• 1001 1010		2 AO1.2	1 mark per nibble, mark left to right
	ii	• 1000 0000 • OR		2 AO2.2	
		Total		14	

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Question			Answer/Indicative content	Marks	Guidance																									
4	a	i	<ul style="list-style-type: none"> <li>left column filled with 1s (<math>\neg A \wedge \neg B</math>) ...</li> <li>right column filled with 1s (<math> A \wedge \neg B</math>)...</li> <li>...Middle 2 columns filled with zero or blank</li> </ul>	3 AO1.2 (1) AO2.2 (2)	<p style="text-align: center;">AB</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr> <tr> <td>00</td><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr> <td>CD</td><td>01</td><td>1</td><td>0</td><td>1</td></tr> <tr> <td></td><td>11</td><td>1</td><td>0</td><td>1</td></tr> <tr> <td></td><td>10</td><td>1</td><td>0</td><td>1</td></tr> </table>		00	01	11	10	00	1	0	0	1	CD	01	1	0	1		11	1	0	1		10	1	0	1
	00	01	11	10																										
00	1	0	0	1																										
CD	01	1	0	1																										
	11	1	0	1																										
	10	1	0	1																										
		ii	<ul style="list-style-type: none"> <li><math>\neg B</math> / NOT B</li> <li>Karnaugh map used to show 1s highlighted with overlap</li> </ul>	2 AO2.2	<p style="text-align: center;">AB</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr> <tr> <td>00</td><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr> <td>CD</td><td>01</td><td>1</td><td>0</td><td>1</td></tr> <tr> <td></td><td>11</td><td>1</td><td>0</td><td>1</td></tr> <tr> <td></td><td>10</td><td>1</td><td>0</td><td>1</td></tr> </table>		00	01	11	10	00	1	0	0	1	CD	01	1	0	1		11	1	0	1		10	1	0	1
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	10	1	0	1																										
	b	i	<ul style="list-style-type: none"> <li>Delay / store a value...</li> <li>...of 1 bit</li> <li>When a signal is given</li> </ul>	2 AO1.1																										
		ii	<ul style="list-style-type: none"> <li>Data input</li> <li>Clock input</li> <li>Q output</li> <li>When clock input goes high...</li> <li>...Q changes to D</li> <li>NOT Q is reverse of Q</li> </ul>	4 AO1.1 (2) AO1.2 (2)																										
			Total	11																										

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		<p>and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>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.</p> <p><b>0 marks</b> No attempt to answer the question or response is not worthy of credit.</p>		
Total			9	
6		<ul style="list-style-type: none"> <li>• Stores current player</li> <li>• ...and alternates between player on each go</li> <li>• Allows a number to be input</li> <li>• ...and validates that this is between 1 and 3</li> <li>• Outputs numbers chosen (e.g. 4, 5, 6)</li> <li>• Checks if number 15 has been reached</li> <li>• ...and displays winning message</li> <li>• ...and stops</li> </ul>	8 AO3.2	<u>Example answer</u> <pre> num = 1 turn = "player 1" while num &lt;= 15     print(turn + "'s turn")     choice = input("how many numbers?")     if choice &gt;= 1 and choice &lt;= 3 then         for y = 1 to choice             print(num)             num = num + 1         next y         //swap turn         if turn == "player 1" then             turn = "player 2"         else             turn = "player 1"         end if     endif endwhile print(turn + " wins!") </pre>
Total			8	

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7	a	<ul style="list-style-type: none"> <li>• Store value in accumulator at address given</li> <li>• BRA // BR</li> <li>• Branch if zero</li> <li>• Branch if <u>zero or positive</u></li> <li>• HLT // COB // END</li> </ul>	5 AO1.1	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Mnemonic</th> <th>Instruction</th> </tr> </thead> <tbody> <tr> <td>ADD</td> <td>Add</td> </tr> <tr> <td>SUB</td> <td>Subtract</td> </tr> <tr> <td>STA</td> <td>Store value in accumulator at address given</td> </tr> <tr> <td>LDA</td> <td>Load (to accumulator)</td> </tr> <tr> <td>BRA</td> <td>Branch always</td> </tr> <tr> <td>BRZ</td> <td>Branch if zero</td> </tr> <tr> <td>BRP</td> <td>Branch if zero or positive</td> </tr> <tr> <td>INP</td> <td>Input</td> </tr> <tr> <td>OUT</td> <td>Output</td> </tr> <tr> <td>HLT</td> <td>End program</td> </tr> </tbody> </table>	Mnemonic	Instruction	ADD	Add	SUB	Subtract	STA	Store value in accumulator at address given	LDA	Load (to accumulator)	BRA	Branch always	BRZ	Branch if zero	BRP	Branch if zero or positive	INP	Input	OUT	Output	HLT	End program	
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BRZ	Branch if zero																										
BRP	Branch if zero or positive																										
INP	Input																										
OUT	Output																										
HLT	End program																										
	b	<ul style="list-style-type: none"> <li>• Inputs two numbers</li> <li>• ..stores at least one of them</li> <li>• Comparison / subtraction to decide which is larger</li> <li>• Jump / output if num1 larger</li> <li>• Jump / output if num2 larger <u>or nums equal</u></li> <li>• Loops back to start after either output</li> </ul>	6 AO3.2	<u>Example answer</u> start INP STA x INP STA y SUB x BRP first LDA x OUT BRA start first LDA y OUT BRA start x DAT y DAT																							
		Total	11																								

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8		<p><b>Mark Band 3—High Level (9-12 marks)</b></p> <p>The candidate demonstrates a thorough knowledge and understanding of procedural and object oriented programming. The material is generally accurate and detailed.</p> <p>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.</p> <p>The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered.</p> <p>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</p> <p><b>Mark Band 2—Mid Level (5-8 marks)</b></p> <p>The candidate demonstrates reasonable knowledge and understanding of procedural and object oriented programming; the material is generally accurate but at times underdeveloped.</p> <p>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.</p> <p>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.</p> <p><b>Mark Band 1—Low Level (1-4 marks)</b></p> <p>The candidate demonstrates a basic knowledge of procedural or object oriented programming; the material is basic and contains some inaccuracies. The</p>	12 AO1.1 (2) AO1.2 (2) AO2.1 (23) AO3.3 (5)	<p><b>AO1</b> Object oriented programming makes use of classes (templates) from which objects are made. Classes have attributes and methods Classes can be encapsulated by making attributes private and providing public access methods Object oriented programming supports inheritance which allows classes to use attributes and methods of parent classes. Object oriented programming supports polymorphism meaning that class attributes and methods can take on many different forms if required.</p> <p><b>AO2</b> OO approach would call on classes per type of player or enemy object Objects made from these classes, so one enemy class may generate many enemy objects, each with different values for their attributes (e.g. speed, energy) Special types of Player or Enemy objects could be instantiated from classes that inherit from the original Player/Enemy classes, but have attributes/methods of their own. Polymorphism would allow for the attributes/methods of Player/Enemy objects to behave differently from normal if required.</p> <p><b>AO3</b> OO promotes a modular approach (procedural through use of subroutines, OO through classes). OO is an abstraction of a real world problem, with classes for each type of things to be modelled and objects for each instance of these. OO has advantages in data security in that encapsulation forces developers/users to use methods (with their built in validation) to access/amend data stored in attributes. OO has advantages in efficiency of design where classes can be reused and can inherit from one another. Procedural programming struggles to support this. OO also offers flexibility through polymorphism.</p>

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		candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.		
		Total	12	

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9	a	i	<ul style="list-style-type: none"> <li>• Paging</li> <li>• ...blocks of memory of equal size / fixed size</li> <li>• Segmentation</li> <li>• ...blocks of memory split logically /variable size</li> </ul>	4 AO1.2	
		ii	<p>e.g.</p> <ul style="list-style-type: none"> <li>• Security</li> <li>• ...does not let programs access memory reserved for other programs.</li> <li>• Multitasking</li> <li>• ...allows multiple programs to run at once</li> </ul>	2 AO1.2	
		iii	<ul style="list-style-type: none"> <li>• (Currently unneeded) pages moved from memory to secondary storage</li> <li>• ...to create room in memory</li> <li>• pages moved back to memory when required</li> </ul>	2 AO1.1	
	b		<ul style="list-style-type: none"> <li>• Software/program</li> <li>• ...that allows the operating system to communicate with hardware</li> </ul> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Printer driver</li> <li>• Webcam driver</li> <li>• Sound card driver</li> <li>• Graphics card driver etc.</li> </ul>	3 AO1.1 (1) AO2.1 (2)	Max two for description, Max one for example

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	c	<p>e.g.</p> <ul style="list-style-type: none"> <li>• Encryption</li> <li>• ...scrambles meaning of data files with a key</li> <li>• Defragmentation</li> <li>• ...organises file segments on secondary storage</li> <li>• Compression</li> <li>• ... reduces size of files</li> <li>• Backup</li> <li>• ...makes regular copies of files in case of loss</li> <li>• Disk Checker</li> </ul>	<p>4</p> <p>AO1.1</p>	<p>Mark in pairs, 2 marks per example.</p> <p>Accept other sensible examples of utility software.</p>
	d	<ul style="list-style-type: none"> <li>• Source code / program code is freely available</li> <li>• ...to edit/amend recompile.</li> </ul>	<p>2</p> <p>AO1.1</p>	
	ii	<p>e.g.</p> <ul style="list-style-type: none"> <li>• Can modify code and adapt IDE to her needs</li> <li>• Is likely to be financially free of cost.</li> <li>• Can recompile to work on different systems</li> <li>• Has the benefit of a community potentially improving the system</li> <li>• Can learn from others</li> <li>• Can ensure no backdoors / malware</li> </ul>	<p>1</p> <p>AO2.1</p>	<p>Do not accept simply seeing the code (previous question).</p>
	e	<ul style="list-style-type: none"> <li>• Sections of code / program file</li> <li>• Written by other authors / already written</li> <li>• Containing useful routines</li> <li>• Suitable example (e.g. GUI routines, databaseaccess routine, encryption, graphics)</li> </ul>	<p>3</p> <p>AO1.1 (2)</p> <p>AO2.1 (1)</p>	<p>Maximum 2 for definition, 1 for example</p>

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	ii	<ul style="list-style-type: none"> <li>• Save time...</li> <li>• ...because no need to rewrite code</li> <li>• Use expertise of others..</li> <li>• ...to complete tasks that require specialist knowledge / abstract away complexity.</li> <li>• Has already been tested/the programmer doesn't have to test it themselves</li> <li>• Making debugging easier/saving time</li> </ul>	2 AO1.2	
	iii	<ul style="list-style-type: none"> <li>• May (significantly) increase size of compiled file...</li> <li>• ...as library contains many routines that aren't being used.</li> <li>• Not written by the programmer</li> <li>• ...so introduces uncertainty / require further testing / programmer needs to spend time familiarising themselves with it</li> </ul>	2 AO1.2	
	iv	<ul style="list-style-type: none"> <li>• Links the main program to libraries</li> <li>• ..can either include them in the final executable code</li> <li>• ..or get the executable code to point to the external libraries</li> </ul>	3 AO1.2	Accept terms static and dynamic for bullets 2 and 3, but only if these are explained.
		Total	28	