Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	1 mark for each valid IP v4: • 4 groups of denary numbers between 0 and 255 separated by full stops (example v4: 123.16.46.72) v6 • 8 groups of hex numbers between 0 and FFFF separated by colons. Double colon can appear **once** and replaces any number of groups of consecutive 0000 (example v6: 0252:5985:89ab:cdde:a57f:89ad:efcd:00fe) (example v6: F513:8C:2A::999:0000 expanded would be F513:8C:2A:0000:0000:0000:999:0000)	2	V6 Each hex number can be between 1 and 4 digits **Examiner's Comments** Many candidates found this question challenging with few candidates giving valid IP addresses. IPv4 was more commonly accurate, although a common error was giving numbers greater than 255. Few candidates were able to give an IPv6 address. Common errors including giving 6 groups of numbers and separating each group with a full stop.
		ii	1 mark each to max 2 • (usually presented in) hexadecimal / denary / binary • 6 groups of numbers / 12 (hex) numbers • … each group has paired/2-digit (hex) numbers / 8 bit binary number • 48 bits long • Separated by colons/hyphens • (The first half/part) contains the **manufacturer ID** / (first half/part) identifies the manufacturer • (The second half/part) contains the **serial number** / (second half/part) identifies the device	2	MP1 'numbers' is NE Allow both marks for a valid example. NB '6 pairs of numbers' gets MP2 and MP3. '4 pairs of numbers' gets MP3 **Examiner's Comments** The most common responses given marks included identifying that it is usually in hexadecimal and that the groups are separated by colons or hyphens. Some candidates identified the two separate parts of the MAC address.
	b	i	1 mark each for benefit 1 for application to max 4 e.g.	4	Mark in pairs. Mark each benefit space to the candidates' benefit. An

			• Fast connection/speed / high bandwidth / consistent bandwidth • … e.g. reduce delays at check in / by example for airport • Secure / unlikely to have unauthorised access/hacked / data transmissions are likely to be safe • … e.g. so that data about passengers/staff/aeroplanes is not intercepted / by example for airport • Little interference / little chance of data loss / reliable • … e.g. flight status is received without delay / by example for airport • Long range transmission • … e.g. airport has a large floor area/terminals / by example for airport		expansion/application for a benefit can be awarded in the other answer space. 1 benefit and 1 expansion for each answer space. Max 2 marks per answer space. **Max 3** marks if expansions have no direct application to the **airport** and its **computers** connecting using **wired** connections. If the second expansion is not applied, annotate with **^** NOT cost The question is not a comparison to wireless, but accept answers worded in this way. Fast on its own is NE. 'faster to connect' is NE because this couldbe to set up the connection as opposed to the bandwidth. **<u>Examiner's Comments</u>** Candidates were often able to identify benefits of wired connections but did not include application to the airport. For example, identifying that data was more secure but then repeating this same point by saying data is less likely to be intercepted. To gain the extra marks candidates needed to consider why each point was important in the airport, for example security is important due to the sensitive or private data that is being transmitted around the airport, or the high risk data that could potentially interfere with flights.

					The most common benefits included the faster transmission speed and the increased security.
		ii	1 mark each to max 3 e.g. • Staff do not need to be in one-place / movement of staff / can work whilst moving to another part of the airport / can be accessed from any location (in range) • Staff can be more responsive to customers/requests • Allows a larger number of connections/devices / more scalable … • … without the disruption/cost of installing more cables • Some devices do not allow physical/wired connection / allow wider range of type of device (or by example such as vehicles/mobile devices/aeroplanes) • Easier to add/connect more devices • Do not need to find/use a physical connection/wire / can allow you to connect in a place where there isn't a cable/connection • For use as a backup if the wired connection fails	3	Do not award cost on its own. Do not award range on its own. Allow explanation of how a wireless network will benefit the passenger as well as the airport and staff. Allow in reverse if clear, for example wired restricts staff to one location. **Examiner's Comments** In this question candidates needed to consider why wireless connections should also be allowed. Some candidates inaccurately took this as instead of wired and explained why this should be used instead, for example because they won't need any cables in the airport. A common response was that wireless was cheaper than wired, when there was already a wired connection so adding a wireless connection as well would be an extra cost instead of saving money. Common responses included the ability to move around and stay connected, as well as the larger number of devices that could connect. Some candidates identified that devices may not have ports that allow for a physical wired connection. The stronger responses included direct application to the airport, for example

					identifying the need for staff to respond to problems whilst in different areas of the airport such as tracking luggage or communicating problems.
	c	i	1 mark each for drawing showing: • 5 computers, 2 printers and 1 switch **all clearly labelled** • All devices directly connected to the **switch** / all computers connected to **switch** and each printer to a switch/computer(s) • Only 8 devices **and** no additional connections other than to the switch (or central device, or printers to only one computer each)	3	Allow any type of computer e.g. PC, laptop. Do not accept client for computer. MP1 there must be at least 5 computers, at least 2 printers, at least 1 switch **Examiner's Comments** Many candidates were able to draw a diagram that included the five computers, the switch and the two printers. Some candidates did not label these items, instead drawing eight boxes without identify which device each one represented. Candidates often joined these devices to the switch, with printers occasionally being connected to other computers that were then connected to the switch. Some candidates did not identify the central device, or incorrectly included an extra central device such as a router or a server. Some candidates then included extra connections that created a mesh network instead of a star topology.
		ii	1 mark for benefit e.g. • Easier to add new nodes / easier to setup BOD • Central device can monitor/control **transmissions** • Faster data transmission	2	Speed, cheaper etc. on its own is NE Server is irrelevant. Read whole benefit and award a valid benefit. Read

			• Fewer data collisions • One connection/computer breaks the network still works • Less cost of **cables** 1 mark for drawback e.g. • Switch fails the network fails / reliant on a central device (working) / single point of failure • Extra cost of **central device/switch**		whole drawback and award a valid drawback. Do not award contradictory statements. **Examiner's Comments** Candidates were often able to give an appropriate benefit, most commonly that it was easier to add a new computer to the network. Candidates also commonly identified the drawback that the network is dependent on the central device.
		iii	1 mark each to max 3 e.g. • Connects the devices together in the network / allows devices to communicate in the network • **Receives** data from (all) devices in the star topology • Record/register/store the address of devices connected to it … • … in a table • Uses MAC address of devices • Direct data to **destination** • … if address not recorded transmit to all devices	3	**Examiner's Comments** Candidates commonly identified that the data from each computer in the network is sent directly to the switch, as well as this data then being sent to the destination. Some candidates confused a switch with a hub and identified that the data was sent to all devices connected to it. Some of the stronger responses identified how the switch records the MAC addresses of devices connected to it and used these to identify which device the data needed to the transmitted to. **Misconception** A common misconception was that a switch performed the same role as a server, with candidates incorrectly identifying that the switch

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>stored the data for devices in the network and that the switch provided services to the connected devices.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>19</td><td></td></tr>
<tr><td>2</td><td>a</td><td>i</td><td>1 mark for each protocol
<table><tr><th>Task</th><th>Protocol</th></tr><tr><td>Requesting a webpage from a web server</td><td>HTTP / HTTPS</td></tr><tr><td>Entering a username and password to access their bank account</td><td>HTTPS</td></tr><tr><td>Downloading a text document from a web server</td><td>FTP / HTTP / HTTPS</td></tr><tr><td>Checking for new emails in their inbox</td><td>IMAP / POP</td></tr></table></td><td>4</td><td>Mark first answer in each box.

Allow full name to be written e.g. file transfer (protocol).

Accept POP3 or any other version

<u>Examiner’s Comments</u>

Many candidates demonstrated an understanding of common protocols. The most common correct responses were giving HTTP and HTTPS as protocols for the first two tasks.

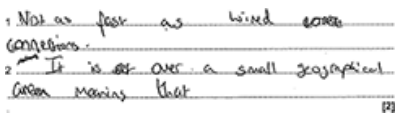
Responses to the last two tasks were more commonly inaccurate. A range of protocols were given including SMTP for email.</td></tr>
<tr><td></td><td></td><td>ii</td><td>1 mark each to max 2:

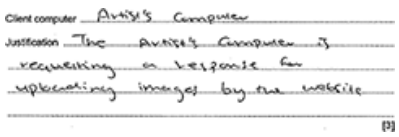
• Each layer is independent / layers are not reliant on other layers
• One layer can be changed without affecting the others / a layer can function without needing/changing/impacting any other layer / self-contained
• Separates tasks so they can be developed independently
• A developer can focus on only one layer / developer can specialise
• Allows for standards for individual tasks/layers to be developed / for compatibility
• Manufacturers can develop hardware to fit into one particular layer
• To group together similar protocols</td><td>2</td><td>Max 1 in each answer space

<u>Examiner’s Comments</u>

Candidates were often able to show an understanding of layers but could not say why layers are used. The most common responses referred to the need for independence between layers, and that it provides the ability to change one layer without having to change/impact on any other layers.</td></tr>
</table>

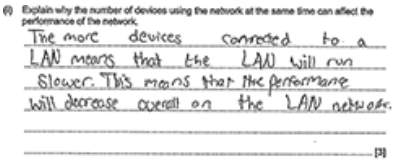
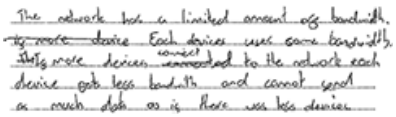
	b	i	1 mark from: • Uses dedicated/own/internal hardware / no external/third party hardware/infrastructure / computers use MAC addresses to communicate within the LAN	1	**Examiner's Comments** Candidates often gave a benefit of a LAN instead of a characteristic. This was often in comparison to a WAN. Examples included that it is cheaper, or that you can share devices and transfer data. Some responses identified the use of owner-owned hardware, or that third-part hardware was not required.
		ii	1 mark each to max 4: e.g. • Allows **more** devices to connect … • …for example televisions, mobile phones • Easy to connect (devices) / Easier to setup (wireless connections) / By example e.g. easier for guests to connect their devices • Home is likely small area • … so short distance wireless is sufficient • Devices can move around / can use devices in different areas / can connect from anywhere in the house / can use where wires don't reach / can access from a larger area (than wired) • … by example e.g. student is using a laptop so does not need to be tied to one place / by example e.g. they don't have to disconnect before moving / e.g. they can stay connected whilst moving • Cheaper to **purchase/install/setup** for new devices / no cost for (new/replacement) wires/hardware • …because no **additional/fewer** wires are needed • Fewer trip hazards from trailing wires / reduce risk of damage to cables / fewer cables to damage • More compatible / some devices only have wireless connections	4	Easier/cheaper on their own is NE **Examiner's Comments** Candidates were often able to explain the benefits of including wireless connections. Common answers included the ability to be mobile and move around the home and allowing a wider range of devices to connect to the network. Some candidates extended their answers by explaining or justifying the wider range of devices. For example by stating mobile phones do not have wired ports. Some responses answered the question as though it was excluding wired connections all together and that the wires were being replaced; this did not answer the question asked which was the benefits of it including wireless – as well as wired.

		iii	1 mark each to max 2: e.g. • Prone to interference / by example • Limited range of signal • Slower rate of transmission / less bandwidth / reduced network performance/ increased latency / BOD slower connection / more users reduces rate of transmission / bandwidth /performance etc. • Increased risk of **security** concerns / by example e.g. A hacker could connect to the wireless connection • Less stable connection • Higher chance of collisions / Higher error rate	2	MP3 needs to say what is slower / decreased e.g. It's slower, is NE Mark first drawback in each answer space. Less reliable is TV on its own for MP 5 **Examiner's Comments** Candidates often demonstrated a good understanding of the drawbacks of wireless connections. Common responses included lower bandwidth and possible interference from other devices and/or objects. In this response some candidates stated that wireless connections could be slower – but did not give enough information to explain what was slower. Exemplar 1  1 Not as fast as wired connections. 2 It is ok over a small geographical area meaning that [2] The response in Exemplar 1 has identified that wireless is "not as fast as wired connections". However, the candidate has not specified what it is not as fast at doing. To gain the mark, the candidate could refer to the transmission speed, the speed that errors are corrected, the speed that it loads, etc.
			Total	**13**	

3		i	1 mark for identification: • Artist's computer / computer uploading the images / BOD The artist 1 mark each for justification to max 2: e.g. • Sends the files/data for storage/to the **host**/web **server** / the files are stored on the web **server** • Performs the user's actions … • .. and sends the results to the web **server** • Sends a **request** to the web **server**… • … to **store/upload** its files • It does not store data for others to access • Confirmation of upload/error is received (from server) for display	3	Incorrect computer, do not award justification. Be careful the justification is talking about the upload of images to the web server, not the download. Accept host for web server. If 'user's computer' is given for identification, this is NE – read on for justification.If 'user viewing the website' or similar is given this is incorrect. **Examiner's Comments** Many responses identified the artist's computer as being the one that is acting as a client. Fewer responses were able to justify this, for example they described a different scenario, such as downloading the images to view the website, instead of the given scenario of the client uploading the files. Exemplar 2  In this response the candidate has identified the correct computer. The justification states that it is requesting a response, but not where this response is from, and then that the images are uploaded to the website when in this scenario they should be referring to the server in the client-server relationship.

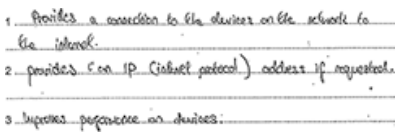
		ii	1 mark for identification: • Web server 1 mark each for justification to max 2: e.g. • The images/data are stored on / uploaded to / sent to / hosted on the web server • Web server receives a request (from the artist's computer to upload the images) • Web server executes/responds to the request / Web server is doing the processing/handling the (request to) upload • Web server returns confirmation/error of the processing/upload	3	If computer is incomplete or inaccurate e.g. server/website instead of web server. Do not award computer, but award justification. Allow FT in justification if the same inaccurate term is used, for example 'website' is given as computer (NE), but justification is: 'images are sent to the website' (FT for website instead of web server). Incorrect computer, do not award justification. **Examiner's Comments** Fewer candidates were able to accurately identify the server in this scenario. Many candidates identified the website as a server when a website is not a computer. Some candidates who identified the webserver were also able to justify their choice by identifying the actions it was performing in the scenario. Exemplar 3 Server computer website server Justification the website server receives and processes data and does not send it back The response in Exemplar 3 has correctly identified the webserver as the computer. They have also identified that this server (the computer) receives the data and processes the data.
			Total	**6**	

4	a	i	1 mark each to max 3 • Slower transmission of data / less data can be transmitted **at the same time** / the transmission rate decreases / time to send/receive increases • (More devices mean) more data is being transmitted (at a time) • **Bandwidth** will be split between all the devices (sending data) / each device uses some of the bandwidth • …this means that there is less **bandwidth for each device** • Devices have to wait **longer** before they can transmit / **increased** latency • If the maximum bandwidth is used then devices cannot transmit • Central device/switch/router has to handle more requests and may run slower • **More** collisions (likely) / **higher** error rate … • …more data has to be retransmitted • Loss of **more** packets … • …more data has to be retransmitted	3	The question is why. More devices do not decrease the bandwidth of the network. They decrease the amount allocated/available to each device. Do not accept higher contention ratio. This term means the number of users on a connection, and is therefore repeating the question. **<u>Examiner's Comments</u>** Most candidates took the approach of describing how more devices affected the performance of the network. Candidates could often explain how more devices meant more traffic, which then used up the bandwidth. Some candidates were able to identify that each device would have less dedicated time. More candidates described the bandwidth as being split and having less of it for each device. Some responses required more precision. A common response was that the performance would decrease, or the speed would decrease. The question asked why the performance was affected, so stating that it was affected was not enough to answer the question. Answers such as the network is slower, or the network runs slower do not specify what

					part of the network – networks contain many components and devices and answers needed to demonstrate and understanding of which part was affected. Exemplar 1  (i) Explain why the number of devices using the network at the same time can affect the performance of the network. The more devices connected to a LAN means that the LAN will run slower. This means that the performance will decrease overall on the LAN network. [3] This response states that the LAN will run slower and that the performance will decrease. This is not enough to explain why the performance is affected. Exemplar 2  The network has a limited amount of bandwidth. ~~by more device~~ Each device uses some bandwidth. ~~that~~ More devices ~~connected~~ connect to the network each device gets less bandwidth and cannot send as much data as is there was less devices. This candidate has identified that the bandwidth is split between the devices and then expanded this to identify that each device therefore has less bandwidth.
		ii	1 mark e.g. • Bandwidth • Interference / by example • Wired / wireless / transmission medium • Type/amount of data being transmitted • Central hardware performance / by example e.g. router/switch • Error rate • Distance between nodes • Topology / physical layout • Wireless repeaters	1	Do not award the number of users. Question is performance of network as a whole, not an individual device. **Examiner's Comments** This question was often answered well. The most common responses were the bandwidth or interference.
	b		1 mark for each completed term	7	Words are given so must match, however accept

			A website is hosted on a **web server**. The computers that access the websites are called **clients**. The user enters a **Uniform Resource Locator** into a web browser. The web browser sends a request to the **Domain Name Server** for the matching IP (Internet Protocol) address. If found the IP address is returned. A request is then sent to the IP address for the website. An IPv4 address is made of 4 groups of digits. Each group can be between **0** and **255**. The groups of digits are separated by a **full stop**		domain name system for domain name server, URL, DNS. Accept 0 and 255 in either order Do not allow server for web server because file server is another option and it will be ambiguous. **Examiner's Comments** Candidates were often able to accurately identify the first four missing terms. Some candidates confused the web server with the domain name server. Where terms are provided, candidates need to make sure they are using these. For example some candidates stated a website is hosted on a server – which was insufficient to identify a web server because file server was an alternative term they were provided. Few candidates were able to accurately identify the denary values that can be used in an IPv4 address. 256 was a common error for the highest number, and 1 was also often given as the lowest number. The answer for the final space was often given as a colon or a hyphen. Few candidates were able to accurately identify the full stop as being the separator.
	c		1 mark each to max 2	2	Accept description of a standard, and/or benefits of Ethernet (i.e. why has this become a standard).

			• Ethernet is used by (mostly) all manufacturers / Ethernet is used in many devices • To allow **compatibility** with other devices • Ethernet has a high bandwidth • Ethernet has inbuilt security • Ethernet is a proven/reliable connection • Ethernet is low cost for **purchase** / **installation** / **maintenance** (compared to other wired connections)		**Examiner's Comments** Many candidates found this question challenging and gave a description of what Ethernet is, or why it is a protocol. Some candidates explained what a standard is, and some candidates gave the features of Ethernet and why this makes is appropriate as a standard. For the latter the most common responses were that it was reliable and has a fast transmission speed. Some candidates were able to define a standard in terms of all devices using it, and some described it appropriately as a requirement for compatibility between these devices.
	d		1 mark each to max 3 e.g. • Receive packets • Forward/sending/transmitting packets • Maintain a routing table / by description • Identify the most efficient path to the destination / correct IP / correct location • Assign IP addresses to nodes/devices • Converts packets from one protocol to another.	3	Question is tasks carried out by a router, not the use of a router in a network. **Examiner's Comments** This question was challenging for many candidates. Some candidates described the purpose of the router, in other words- what its purpose is within a network – rather than identifying tasks that it carries out. The most common correct responses were that the router receives packets from devices and that it sends packets to devices. Some candidates also identified that

					it sends the packets towards the intended destination i.e. it looks at the destination and does not send to all connected devices. Exemplar 3  1 Provides a connection to the devices on the network to the internet. 2 provides (an IP (Internet protocol) address if requested. 3 Improves performance on devices. This response has given a generic purpose of a router in their first answer, providing a connection is the purpose and not a specific task it carries out. The second point was rarely given by candidates but is accurate that a router gives devices in its network an IP address.
	e		1 mark each to max 2 e.g. • Data cannot be **understood** if intercepted / The data will be meaningless • So that only authorised users can access the **confidential** material / protect **confidential** / **personal / user / library** data • To follow legislation/DPA	2	Question is transmission not storage Candidates might answer in terms of why encryption is good, or why the current system is not good. If the candidate has not clearly said which they are talking about (e.g. the current system …. or encryption means….) then the reverse of each mark point can be given. **Examiner's Comments** Some candidates were able to identify that encryption makes it impossible to understand the data. Some candidates stated the data could not be read. This was not precise enough. The data can still be intercepted and read but that this data will be meaningless.

					Some candidates also appropriate applied their answers to this scenario, identifying that it meant the data the library was transmitting, e.g. personal/sensitive data, could not be stolen or used inappropriately. **Misconception** A common misunderstanding was that encryption stops data being intercepted. The data can still be intercepted, but when opened it will be meaningless.
	f		1 mark each e.g. Send email: **SMTP** / simple mail transfer protocol Access website securely: **HTTPS** / hypertext transfer protocol secure	2	Mark first answer in each line. If abbreviation is inaccurate, check if written out (and vice-versa). **Examiner's Comments** This question was often answered well. Many candidates correctly identified HTTPs for the second protocol. However, some candidates did miss the required 's' to indicate it was being accessed securely. Many candidates also correctly identified SMTP for sending an email, although more candidates gave incorrect email protocols such as POP3.
			Total	**20**	
5	a		LAN / Local area network	1	
	b	i	1 mark per bullet Max 4 for similarities, max 4 for differences Similarities:	6	

			• They both connect devices • …they receive data from the devices • …they determine the correct destination for the data • …they transmit the data to its destination Differences: • A switch uses MAC addresses • A router uses IPs • A switch corrects nodes/computers • A router connects networks/Internet • A router stores the addresses of devices attached… • …a switch records the addresses as they are accessed / a switch has to look for correct address before sending		
		ii	1 mark per bullet • Clearly labelled switch • 2 laptops, 4 phones, 2 TVs • All devices connected to switch and nothing else	3	Connections can be wired or any identifiable wireless connection. Ignore any additional devices
			Total	**10**	
6		i	1 mark per bullet to max 3 e.g. • She can access the program from anywhere • … does not need to carry a storage device with her • Security/backup is (likely) managed for her • …does not need to manually backup his work	3	
		ii	1 mark per bullet to max 3 • If there is no Internet access he cannot access his work • Transmission may not be secure • …his work could be intercepted • Security is out of his control • …it may not be backed up/kept safe	3	

			Total	**6**	
7	a		• A set of rules for communication	1 (AO1 1a)	1 mark only to be awarded for a correct definition.
	b	i	• A division of network functionality	1 (AO1 1a)	Candidate's responses may differ from the given answer but must represent conceptually the same thing. e.g. "a layer is where jobs/processes are split up" would receive the mark.
		ii	• It is self-contained (1)… • …it allows different developers to concentrate on one aspect of the network (1) • A layer can be taken out and edited without affecting other layers (1)… • …it promotes interoperability between vendors and systems (1)	2 (AO1 1a)	1 mark to be awarded for the correct identification and 1 for a valid description up to a maximum of 2 marks.
	c		• It is easy to add a new node or device • Fewer data collisions can occur • If a node or device fails it does not affect the rest of the network • A signal does not need to be transmitted to all computers in the network	2 (AO2 1b)	1 mark to be awarded for each correct reason to a maximum of 2 marks. Any valid comparisons to other topologies can be awarded marks.
			Total	**6**	
8	a		• The computers are geographically remote/ distanced/ more than a mile apart • Communication medium is not owned by the law firm	1 (AO1 1a)	1 mark only to be awarded for a correct definition. Accept responses such as the company doesn't own the infrastructure. Do not accept 'Network over a wide area' or similar arrangement of wording.
	b		Two advantages from: • It would offer additional storage (1) so the company can take on more cases (1) • It is a very efficient method of backing up data (1) and so saves the firm time and money (1)	4 (AO2 1b)	1 mark to be awarded for each correct advantage, with a mark for a discussion of the advantage related to the law firm. To a maximum of 2 advantages.

			• It would allow their employees to work from anywhere (1) so they can take cases from other countries (1) • It is environmentally friendly (1) • Easy to increase availability of storage (1) • You don't need specialist network skills (1) so the firm don't need to employ more staff (1) • The third party provides security (1) so the company saves money on staff and software/hardware (1) • The third party provides backup (1) so the company saves money on staff and software/hardware (1) • Cheaper as don't need own infrastructure (1) Each advantage needs to be contextualised to gain 2 marks.		The total number of marks to be awarded for this task is 4 marks. Responses which are not contextualised will gain a maximum of 1 mark per advantage (to a maximum of 2 advantages).
	c		Two disadvantages from: • You need a constant internet connection (1) which lawyers who travel a lot may not always have (1) • Reliant on third party to carry out security procedures (1) but the firm are still legally responsible if things go wrong (1) • Reliant on third party for back up connection (1) • Data stored in the Cloud will be vulnerable to hacking and other threats (1) which the firm have no control over (1) • Issues regarding data ownership (1) • Implications of Data Protection Act (1) Each disadvantage needs to be contextualised to gain 2 marks	4 (AO2 1b)	1 mark to be awarded for each correct disadvantage with a mark for a discussion of the disadvantage related to the law firm. To a maximum of 2 disadvantages. The total number of marks to be awarded for this task is 4 marks. Responses which are not contextualised will gain a maximum of 1 mark per disadvantage (to a maximum of 2 disadvantages).
			Total	**9**	