Y11 Computer Science (OCR - J277)

Unit 1 - Computer Systems

Sample Past Paper Questions

Topic 1

Systems Architecture

1(a) Ann wants to purchase a new computer and is looking at two models. The specification of the CPU in each computer is shown in **Fig. 1**.

Fig. 1

Computer 1	Computer 2
Clock Speed: 1 GHz	Clock Speed: 1.4 GHz
Cache size: 2 MB	Cache size: 2 MB
Number of Cores: 4	Number of Cores: 2

When running a 3D flight simulator, Computer 1 is likely to run faster than Computer 2.

Using the information in **Fig. 1**, identify **one** reason for this.

---

[1]

(b) Identify **two** internal components that are not in **Fig. 1**, which could improve the performance of the computers.

---

[2]

(c) Identify **four** events that take place during the fetch-execute cycle.

---

[4]

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2(a) Gareth's Sat Nav contains an embedded system. Define what is meant by an 'embedded system'.

---

[1]

(b) Identify **three** devices, other than a Sat Nav, that contain embedded systems.

---

[3]

3 Here are some statements about the CPU of a computer.

Tick **one** box in each row to show whether each of the following statements is true or false.

Statement	True	False
CPU stands for Central Processing Unit.		
The CPU fetches and decodes instructions.		
The speed of a CPU is usually measured in GigaHertz (GHz).		
If a CPU has many cores, this slows down the computer.		
The hard disk drive is part of the CPU.		

[5]

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4(a) Dipesh is thinking of buying a tablet computer to replace his old desktop computer.

Describe how the CPU and RAM work together to enable the tablet computer to operate.

[3]

(b) The tablet computer also uses cache memory. Describe the purpose of cache memory.

[2]

5 Alicia has designed a computer using Von Neumann architecture.

Describe the purpose of **two** registers that are used by Von Neumann architecture.

1

2

[4]

6(a) Computer A has a single core, 3.2 GHz processor.
Computer B has a single core, 1.2 GHz processor.

Explain why Computer A will usually run faster than Computer B.

---

[2]

(b)

(i) The table has **five** components of a computer, and **four** statements.

Tick **(✓) one or more** boxes in each row to identify which component(s) each statement describes.

Statement	MAR	MDR	Cache	Program Counter	RAM
It stores a single address					
It stores frequently used instructions					
It is a register					
It stores all currently running data **and** instructions					

[4]

(ii) Identify the name of **one** register **not** given in **part (i)** and describe its purpose.

Register ---

Purpose ---

[2]

7 A CPU has a clock speed of 3.8 GHz. etc.
Describe what is meant by a clock speed of 3.8 GHz.

[2]

8 Identify **two** events that take place during the fetch-execute cycle.

1

2

[2]

9 The following paragraph describes embedded systems.

Complete the paragraph by selecting terms from the list and writing them in the correct places. Not all terms are used.

actuator	applications	change	functions	laptop	larger
lights	microprocessor	processor	range	smaller	washing machine

Embedded systems have limited ..... They are often

built into a ..... machine. Two examples of embedded

systems are a ..... and automated

..... in a car.

[4]

10 Ali's tablet computer has an operating system.

Ali thinks his tablet is an embedded system.

State whether Ali is correct or incorrect, justifying your choice.

Choice ----------

Justification ----------

---

[3]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		It has more cores.	1	Although Computer 1 has a lower clock speed than the CPU in Computer 2 it has more cores, which means that it can be faster than Computer 2. Any answer relating to splitting a program into processes that be carried out consecutively will be accepted.
	b		RAM SSD HDD Graphics card (GPU)	2	Marks can be awarded for other appropriate responses: E.g. Motherboard Sound card
	c		• An instruction is fetched from memory • The instruction is then decoded • The decoded instruction is then executed so that the CPU performs continuously • The process is repeated • The program counter is incremented • The instruction is transferred to the MDR • The address of the instruction to be fetched is placed in the MAR	4	1 mark is to be awarded for each correct answer to a maximum of 4 marks.
			Total	**7**	
2	a		• A computer system that is built into another device	1	
	b		Three devices from: • Dishwasher • MP3 player • Washing machine • Mobile phone • Manufacturing equipment	3	1 mark to be awarded for each correct example identified to a maximum of 3 marks. There are many other examples of devices with embedded systems which may be acceptable.
			Total	**4**	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td></td><td></td><td>
<table>
<tr><th>Statement</th><th>True</th><th>False</th></tr>
<tr><td>CPU stands for Central Processing Unit</td><td>?</td><td></td></tr>
<tr><td>The CPU fetches and decodes instructions</td><td>?</td><td></td></tr>
<tr><td>The speed of a CPU is usually measured in GigaHertz (GHz)</td><td>?</td><td></td></tr>
<tr><td>If a CPU has many cores, this slows down the computer</td><td></td><td>?</td></tr>
<tr><td>The hard disk drive is part of the CPU</td><td></td><td>?</td></tr>
</table>
One mark per row
</td><td>5</td><td>?Examiner's Comments??

This question was generally well answered.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>4</td><td>a</td><td></td><td>• Instructions / programs(currently running) / data are stored in the RAM…
• these are fetched from the RAM by the CPU / Processor
• … where the instructions are executed / instructions are processed / data is processed</td><td>3</td><td>If the candidate has described the functions of RAM and the CPU separately, only award the 2nd bullet if it is clearly stated that instructions are fetched from RAM.

Mention of the fetch – execute cycle in the CPU is enough to award bullet 3.</td></tr>
<tr><td></td><td>b</td><td></td><td>• To store instructions / data that is frequently used / previously used / next to be used
• Data does not need to be fetched from RAM
• Speeds up access</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance

5			1 mark per bullet to max 2 per register
			
			• MAR // memory address register
			• Stores the address/location where data will be **read/written/accessed/fetched**
			// address/location of data/instruction being **processed**
			// address/location of data/instruction next to be **processed**
			
			• MDR // memory data register
			• Stores the data/instruction that is **fetched/read** from memory
			// stores the data that is to be written to memory
			// stores the data/instruction from the address in the MAR
			// data/instruction next to be **processed**
			
			• Program counter
			• Stores the address/location of the next instruction to be run
			// stores the address/location of the current instruction being run
			
			• Accumulator
			• Stores the result of manipulation/process/calculation
				4
				AO1 1a (2)
				AO1 1b (2)
					MAR stores address is not enough for description
					MDR stores the data is not enough for description
					
					Allow:
					
					• Current instruction register // IR
					• Stores the instruction currently being processed
					
					Accept MBR // Memory buffer register for MDR
					
					<u>Examiner's Comments</u>
					
					Many candidates were able to accurately name two registers. The more able were able to accurately describe the purpose of these registers. Some candidates were not specific enough in their responses to gain the descriptive marks, or repeated the name of a register without the purpose, e.g. 'The memory address register stores the address of the data'.

			Total	**4**	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>a</td><td></td><td>1 mark per bullet

• faster/higher clock speed
• 3.2GHz will run more Fetch-Execute (F-E) cycles per second
• …therefore the more instructions can be executed per second // by calculation</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td>i</td><td>1 mark for correct ticks and gaps on each row

<table>
<tr><th>Statement</th><th>MAR</th><th>MDR</th><th>Cache</th><th>Program Counter</th><th>RAM</th></tr>
<tr><td>It stores a single address</td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>It stores frequently used instructions</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>It is a register</td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td></tr>
<tr><td>It stores all currently running data and instructions</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table></td><td>4</td><td>If extra ticks on each row, 0 marks for that row</td></tr>
<tr><td></td><td></td><td>ii</td><td>1 mark for register e.g. accumulator
1 mark for description e.g. stores the result of arithmetic operations</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance
7			1 mark per bullet to max 2 • The number of FDE cycles run per given time/second // the frequency that the clock 'ticks' • 3.8 billion cycles/instructions … • …per second	2 AO1 1b (1) AO2 1a (1)	Do not award: how fast the computer is // speed of CPU 3.8 = 3,800,000,000 <u>Examiner's Comments</u> This question was answered well with many candidates able to demonstrate an understanding of the clock speed of a computer. Fewer candidates correctly translated the 3.8 GHz into the correct number of instructions/FDE cycles performed. Less able candidates did not identify an appropriate time frame, for example 'the number of instructions it can process' has a different meaning to 'the number of instructions it can process per second'. Another common misconception was it is the number of instructions it can perform at a time, a processor can only perform one instruction at a time.
			Total	2	
8			• An instruction is fetched from memory • The instruction is then decoded • The decoded instruction is then executed so that the CPU performs continuously • The process is repeated • The program counter is incremented • The instruction is transferred to the MDR • The address of the instruction to be fetched is placed in the MAR	2 (AO1 1a)	1 mark to be awarded for each correct answer to a maximum of 2 marks.
			Total	2	

Question			Answer/Indicative content	Marks	Guidance
9			1 mark for each completed term Embedded systems have limited **functions.** They are often built into a **larger** machine. Two examples of embedded systems are a **washing machine** and automated **lights** in a car.	4	
			Total	**4**	
10			1 mark per bullet to max 3 e.g. Incorrect: • Embedded system has one/few functions • …tablet has multiple functions // tablet is general purpose • Embedded system is single chip • …tablet has multiple chips combined • Embedded system is part of a larger system • … tablet is a self-contained system • You can update the software Correct: • Embedded system has one/few functions • ….the tablet may only be able to perform a small number of tasks • …tablet has a specific purpose • …tablet's hardware is fixed • …does not need/require/allow expansion • Embedded systems has firmware • ..you cannot update the OS in a tablet (usually) • Embedded system is part of a larger system • …tablet may have one microprocessor built into it	3	Max 2 if there is no application to the tablet
			Total	**3**	

Topic 2

Systems Architecture

1(a) Kofi uses his computer to record an audio file of himself playing his guitar.

Outline what happens when the computer converts the music into a file.

---

[2]

(b) Kofi increases the sample rate his computer is using to record his guitar.

Explain **two** effects this will have on Kofi's recording.

1

2

---

[4]

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2(a) Order the following units from smallest to largest:

GB bit PB byte nibble MB

---

[1]

(b) Convert the decimal number 191 into an 8 bit binary number.

---

[1]

(c) Convert the hexadecimal number 3E into a decimal number. You must show your working.

---

[2]

(d)

(i) Add together the following two 8 bit binary numbers. Express your response in an 8 bit binary form.

01101010

10010110

---

[2]

(ii) Identify the problem this addition has created.

---

[1]

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3 Complete a 2 place right shift on the binary number 11001011.

---

[1]

4(a) Vicky has been on holiday and has taken lots of photos. The memory in her camera is now full and she needs to transfer her photos to an external secondary storage device.

Define what is meant by 'secondary storage'.

---

[1]

(b) State **four** characteristics of secondary storage devices that Vicky should consider when choosing a device.

---

[4]

(c) Identify the **three** common storage technologies Vicky can choose from.

---

[3]

5 Gareth has a satellite navigation system (Sat Nav) in his car that uses RAM and ROM.

Fig. 2 lists some characteristics of computer memory. Tick (✓) **one** box in each row to show whether each of the statements is **true** for the RAM or ROM in Gareth's Sat Nav.

Fig. 2

	RAM	**ROM**
Stores the boot up sequence of the Sat Nav.		
The contents are lost when the Sat Nav is turned off.		
Holds copies of open maps and routes.		

[3]

6 A restaurant has a computer-based ordering system which is running slowly. A technician has said that the hard disc drive is fragmented. The technician has suggested using utility software to defragment the drive.

Explain how the restaurant's hard disc could have become fragmented.

---

[4]

7 Explain why data is stored in computers in a binary format.

---

[2]

8 Most computer systems use at least one storage device.

Explain **one** reason why a secondary storage device is needed in most computer systems.

---

[2]

9(a) Add the following bytes.

```
  1 1 0 1 1 0 0 0
+ 0 1 1 0 0 0 0 0
-----------------
```

[2]

(b) State the problem that will occur if a computer is to store the result as a byte.

---

[1]

10 Bob's computer has 512 kilobytes of ROM and 8 gigabytes of RAM.

(i) Describe the purpose of the ROM in Bob's computer.

(ii) Describe the purpose of the RAM in Bob's computer.

---

[4]

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11 Apu has a handheld e-book reader that allows him to store and read electronic books.

Types of secondary storage devices are magnetic, optical or solid state.

(i) State which type of storage is most suitable for storing the electronic books inside the e-book reader.

---

[1]

(ii) Explain **one** reason why this type of storage is the most suitable.

---

[2]

12(a) A computer has 1024 megabytes of RAM.

How many gigabytes of RAM does the computer have?

---

[1]

(b) The computer sometimes uses virtual memory.

Describe what is meant by virtual memory **and** state why it is needed.

---

[3]

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13 Alex is producing images and sound effects for a website.

Part of a bitmap image is shown in Fig. 2:

W	W	R	R	R	B	B
W	W	R	Y	R	B	B
B	B	R	R	R	B	B
B	B	B	LG	B	DG	B
B	DG	DG	LG	DG	B	B
B	B	DG	LG	B	B	B
B	B	B	LG	B	B	B

Fig. 2

The letters represent a colour, as shown in Fig. 3:

Letter	Colour
W	White
B	Blue
R	Red
Y	Yellow
DG	Dark Green
LG	Light Green

Fig. 3

Using the example in Fig. 2, explain how a bitmap image is stored on a computer.

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---

[3]

14 The character é is part of a computer's character set.

Describe what is meant by a character set.

[1]

15 William is creating a film for a school project using a digital video camera.

William transfers the videos to a computer for editing.

(i) The computer has 1GB of storage free.

Calculate the number of videos that could be stored on the computer if each video was 100MB in size.

Show your working.

---

[2]

(ii) A program needs to calculate the size of files in bytes. The program must:

- Ask the user to input a file size in megabytes
- calculate and output the number of bytes this represents in a user friendly format (e.g. "`There are 5242880 bytes in 5MB`").

Write an algorithm using pseudocode to calculate the number of bytes in a given number of megabytes.

---

[6]

16(a) The ASCII code for the character J is the denary number 74.

Write the 8-bit binary number for the ASCII character J in the following boxes:

[1]

(b) Give the hexadecimal number for the ASCII character K.
Show your working.

[2]

17 Layla is an artist. She draws images by hand. The image is then scanned and stored on a computer.

Layla uploads her images and videos to a website.

(i) Explain why Layla compresses the images and videos before uploading them.

---

[2]

(ii) Layla wants to reduce the file size of the images and videos by the largest amount possible.

Identify the method of compression that would be most appropriate. Justify your choice.

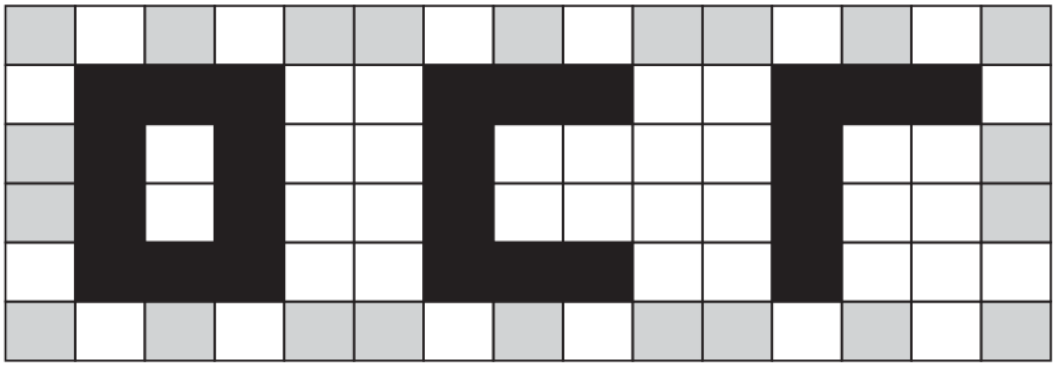
Compression method .....

Justification

---

[3]

18(a) The following logo is stored as a bitmap image. Each box represents one pixel, with three different colours being used in the image.



Calculate the fewest number of bits that could be used to store the logo as a bitmap image. You must show your working.

[4]

(b) Give **two** ways that the file size of the image could be reduced.

1

2

[2]

END OF QUESTION PAPER

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Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		• The height of the wave is measured / sampled (at regular / set intervals) • Turned into / stored as binary	2	1 mark for each bullet, to a maximum of 2.
	b		• The quality will improve … • … because the sound wave is more accurate to the original • The file size will increase … • … because there are more samples to store 4	4	1 mark for each bullet. (1 mark for identification of the effect, one mark for an explanation)
			Total	**6**	
2	a		bit, nibble, byte, MB, GB, PB 1	1	Correct Answer Only
	b		10111111	1	Correct Answer Only
	c		• Working; (3* 16) + 14 **OR** 00111110 • 62	2	1 mark for correct answer, 1 for valid method of working
	d	i	0000 0000	2	Correct Answer Only 1 mark per nibble
		ii	overflow	1	Correct Answer Only
			Total	**7**	
3			00110010	1	Correct Answer Only
			Total	**1**	
4	a		Long term/non-volatile storage of data/files External/auxiliary storage of data	1	1 mark only to be awarded for a correct definition.
	b		Four characteristics from: • Capacity/size • Speed • Portability • Durability • Reliability • Cost	4	1 mark is to be awarded for each correct characteristic to a maximum of 4 marks.
	c		• Optical • Magnetic • Solid state	3	1 mark only to be awarded for each correct definition.
			Total	**8**	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td></td><td></td><td>
<table>
<tr><th></th><th>RAM</th><th>ROM</th></tr>
<tr><td>Stores the boot up sequence of the Sat Nav.</td><td></td><td>✓</td></tr>
<tr><td>The contents are lost when the Sat Nav is turned off.</td><td>✓</td><td></td></tr>
<tr><td>Holds copies of open maps and routes.</td><td>✓</td><td></td></tr>
</table>
</td><td>3</td><td>Award 1 mark for each correct tick.

No marks should be awarded if ticks are in both boxes in a given row.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
<tr><td>6</td><td></td><td></td><td>• Orders have been saved onto the system as they order food and then deleted once processed (1)
• Once other orders have been made, new files are created (1) which may be bigger than the spaces left by the deleted files (1)
• The order files are split up (1)</td><td>4</td><td>Up to a maximum of 4 marks.
A maximum of three marks if there is no contextualisation Allow a mark if candidate's state that fragmentation increases access time (1)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>7</td><td></td><td></td><td>e.g.

• Circuit only needs to check for two states / uses switches…
• …electricity flowing or not flowing / on or off / 1 and 0
• …resulting in more reliable circuits.</td><td>2</td><td><u>Examiner's Comments</u>

A number of candidates were able to make the connection between the use of binary and the design of computer circuitry which is what was being addressed. Many other candidates made some relevant point which allowed them to gain one of the marks, but missed this crucial link.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
8			• To store the files / e.g. operating system • Even when the system is switched off / which must be non-volatile.	2	Examiner's Comments It was evident that a majority of the candidates did not understand the term “secondary storage” and we suspect that they guessed (rather than had been taught) that this was some kind of backup storage medium in case the hard drive failed, which is the answer that most gave.
			Total	**2**	
9	a		*Correct answer:* 1 1 0 1 1 0 0 0 + 0 1 1 0 0 0 0 0 (1) 0 0 1 1 1 0 0 0 *Award marks for:* • 1 1 1 0 0 0 for bits 5 to 0 • 0 0 for bits 7 and 6.	2	Examiner's Comments Most candidates had no difficulty with the portion of the binary addition where there was no carry, but weaker candidates were less sure about what to do about the carry with some even using the digit 2.
	b		• there is an overflow / a carry left over after the addition / does not fit into one byte.	1	Examiner's Comments It was unfortunate that a good number of candidates did not simply use the technical term (“overflow”) – however, those who did not use this term were still able to get the mark by giving an accurate description of an overflow error.
			Total	**3**	

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Question			Answer/Indicative content	Marks	Guidance
10		i	ROM • Stores the boot program / bootstrap loader / BIOS • Used to start the computer / Loads the operating system.	4	?Examiner's Comments?? Many candidates demonstrated a good knowledge of facts about the RAM and ROM, but some of these failed to score well by being less discerning about the facts that are relevant to answering the question. This part asked for the purpose of ROM and RAM, but several candidates listed the characteristics.
		ii	RAM • Stores the parts of the OS / programs that are running… • Stores the data currently in use • … for access by the CPU *(2 for each)*		
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
11		i	• Solid state	1	
		ii	• Fast access… • … less delays when turning the device on / turning pages etc… • No moveable parts / robust • … can be handled / manipulated / moved without damaging it • Small / light enough… • … to fit within a hand held device • low power • … to extend battery life of reader	2	No follow through from (i). Candidates need to identify a relevant characteristic of solid state storage for the first mark, and expand by explaining why this is an advantage in an e-book reader for the second mark. Note that portable / capacity are not acceptable answers here (as solid state storage is not particularly more portable / larger than other forms of storage for this application) Examiner's Comments ??In this part, most candidates demonstrated an awareness of the key characteristics of different types of secondary storage. The strongest candidates were able to clearly link the characteristics of solid state storage to the operational requirements of an e-book reader. Centres should encourage candidates to answer such questions positively, for example, by arguing why the characteristics of solid state storage make it most suitable, rather than why magnetic and optical storage are not suitable.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
12	a		• 1GB	1	Accept 1.024 The units are not necessary Examiner's Comments Was generally well answered.
	b		• Using the hard disk / secondary storage • Used as RAM / to store the contents of RAM / main memory • Needed when there isn't enough physical memory	3	Note that these points may be worded differently. E.g. “items are taken from memory and stored on the hard disk until needed” achieves the first two bullet points. Examiner's Comments Where candidates had explicitly studied the use of virtual memory, they were able to give a detailed description to gain 2 or 3 marks in this part. A number of candidates appeared to be guessing the answer, the most common wrong answers confusing virtual memory with cloud storage.
			Total	4	
13			max 2 for explanation max 1 for example / use of Figure 2 or 3 • An image is made up of / consists of pixels • A pixel can be one colour • Each colour has a unique / corresponding binary number • Each pixel / square is given the binary number of its colour • The binary numbers are stored in order in the file • E.g. White = 000, Red = 010, Blue= 110, top line would be 000000010010010110110	3	Accept answers that are annotated on Figures 1 and 2, or that use these to explain the storage of the image, that meet each bullet The example must be more than describing what the diagram shows, e.g. 'the squares with W in are white' is not enough. Examiner's Comments Very few candidates used the example in the figure as part of their response, there was the opportunity to annotate the diagram here, or to use it throughout their explanation, but this was very rarely done. The better candidates were able to use the correct terminology, whilst many wrote everything they knew about bitmap images, including how they are displayed on screen as opposed to how it is stored.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
14			• The characters / symbols a computer uses / understands / displays	1	This has to explain what the set is, not how they are stored. 0 marks for: • The characters for coding / programming • the amount / number of / quantity of characters Examiner's Comments Most candidates made a good attempt at defining a character set, but they needed to be explicit that it referred to the characters in a computer. A common error was that it was the characters that people use, or those that are on a keyboard, the latter of which is not accurate enough because a character set often has many more characters than those a keyboard displays.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
15		i	1 mark for working, 1 mark for answer • 1024(1000) / 100 // 10*100 = 1000 • = 10 (videos)	2 AO2 1a (1) AO2 1b (1)	Final answer must be 10, not 10.24 <u>Examiner's Comments</u> Most candidates were able to answer this question fully. They performed the correct calculation and gained the correct answer, rounding the number of videos appropriately. The most common error involved candidates multiplying 100 by 1000.

		ii	1 mark per bullet to max 6
			
			• Output asking for file size (in megabytes)
			• Taking number of MB as input
			• Multiplying by 1024 or 1000
			• Multiplying by 1024 or 1000 (may be same line as bullet 3, this must be the final value with no further changes)
			• Outputting the final bytes value…
			• …in an appropriate message
			
			`output "Please enter the file size in megabytes"`
			`input numberMB`
			`numberKB = numberMB * 1024 (or 1000)`
			`numberBytes = numberKB * 1024 (or 1000)`
			`output "There are " & numberBytes & " bytes in " & numberMB & "MB"`
				6
				AO3 2b
				(6)
					Award bullet 5 even if bullets 3 and 4 are wrong. Do not award if outputting the original input value.
					
					Bullet 4 must be the final calculation to get the mark. If there are any further calculations, or changes to the final bytes value then bullet 4 cannot be awarded.
					
					`Input = value` is incorrect, variable must be on left.
					
					Bullet 6 is dependent on bullet 5.
					
					Input must be stored e.g. `user input` – no mark
					
					Outputs must have "" around strings, variable identifiers must not have "".
					
					If bullet 5 is not given because the variable is in "", still award bullet 6 if correct.
					
					Bullet 3 and 4, could be multiplying by 1,000,000 or 1,048,576 (award both bullets).
					
					`numberMB = input("Enter the file size")` would get both bullets 1 and 2.

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Question	Answer/Indicative content	Marks	Guidance
			Concatenation is not required for the final bullet. `input("Filesize")` will get 1 mark for outputting File size, it will not get the input as there is no variable. <u>Examiner's Comments</u> This question covered the synoptic algorithm element of the examinations. Candidates were required to use their knowledge of binary numbers to write a pseudocode algorithm. Most candidates attempted to write a pseudocode algorithm. A small number of candidates drew a flowchart, which does not meet the criteria of pseudocode. Most candidates were able to gain at least some marks, most commonly for the output of a message, and then input of the required data. Common errors including inaccurate use of assignment, for example INPUT = FileSize is incorrect. This line of code states that the data within FileSize is stored in INPUT. The correct assignment is FileSize = INPUT. Candidates need to be aware of how to output strings and values within variables. These could have been output as individual statements, but when combined candidates need to differentiate between the variables and text. For example, OUTPUT (The new file size is & FileSize) makes use of concatenation, but the text is not identified as a string and requires speech marks e.g. OUTPUT (The new file size is & "FileSize"). Some candidates did not attempt to output a message to the user, asking them to input the file size. Candidates need to read all aspects of the question carefully to make sure they are meeting all of the criteria.

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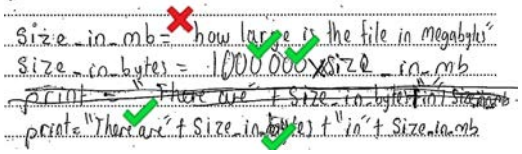
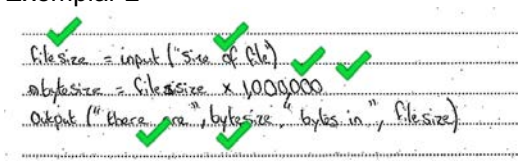
Question			Answer/Indicative content	Marks	Guidance
					Exemplar 1  This candidate has not identified that "how large is the file in megabytes" is an output, and has not explicitly asked for an input therefore cannot gain either of these marks. This first line of code is assigning a string to the variable size_in_mb. This error is not followed through, and the candidate has performed the correct calculation, and then output an appropriate message along with the new variable. Exemplar 2  This candidate has outputted an appropriate message and read the input into the variable filesize. They have performed the appropriate calculation (although * is preferable for multiplication, as an algorithm x is accepted). They have output an appropriate message and the correct variable.
			Total	8	
16	a		01001010	1	cao
	b		1 mark for adding 1 to J: binary 01001011 // converting J to hexadecimal and adding 1 1 mark for answer 4B	2	Allow 1 mark for converting J into 4A without adding 1
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
17		i	1 mark per bullet to max 2 • Reduces the file size… • …takes up less space on the server • Faster upload to server • Faster download for users	2	
		ii	1 mark for lossy 1 mark per bullet to max 2 • Lossy will most likely reduce the file size by a large amount than lossless • Lossy will remove data that is not noticeable // the changes will allow for further reduction without the user noticing	3	Award FT marks for justifying lossless appropriately to max 2
			Total	5	
18	a		• 90 (pixels in an image) // 15 x 6 (pixels in image) • Multiply pixels x bits per pixel • …2 bits required per pixel (because 3 colours) • 180 bits overall answer	4 AO1 1b(2) AO1 1b(2)	Must clearly show multiplication for 3rd BP
	b		• Reduce number of pixels / resolution • Reduce number of colours • Use lossy compression • Use lossless compression	2 AO2 1a(2)	Accept descriptive answers linked to given logo (e.g "change to black and white only") “Make image smaller” is NE Allow compression by itself for one answer.
			Total	6	

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Topic 3a

Computer Networks, Connections & Protocols - Networks and Topologies

1 A law firm currently use a Local Area Network (LAN) linked to a Wide Area Network (WAN). They want to upgrade their system to utilise cloud storage.

Define what is meant by a Wide Area Network.

---

[1]

2 A school has all of its computers in a local area network (LAN).

State **two** benefits of a LAN.

1

2

---

[2]

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3(a) A company, OCR Supermarkets, has supermarket stores throughout the country. The computers for each store connect to the central office using a Wide Area Network (WAN).

Identify **two** differences between a WAN and a LAN (Local Area Network).

Difference 1: _____

_____

Difference 2: _____

_____

_____

[2]

(b) OCR Supermarkets use a client-server network to connect the checkout computers to the store's server.

Describe **two** benefits to OCR Supermarkets of using a client-server network instead of a peer-to-peer network.

Benefit 1: _____

_____

_____

Benefit 2: _____

_____

_____

[4]

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4(a) A house has computers in each room and a central router. Every room allows both Ethernet and WiFi connections to the router.

(i) Describe the purpose of the router in the house's network.

---

[2]

(ii) Identify **two** additional items of network hardware, apart from cables and a router, that may be used within the house network.

1 ---

2 ---

[2]

(b) A user enters a uniform resource locator (URL) into a web browser on one of the computers in the house. A system is then used to find the IP address of the web server associated with the URL.

(i) Name the system which matches URLs to IP addresses on the web.

---

[1]

(ii) The following statements describe what happens after the IP address has been found and returned to the user's computer.

There are **five** missing statements in the table.

Write the letter of the missing statements from the table in the correct place to complete the description.

1 The request is put into packets

2 ---

3 The packets are sent across the network

4 ----------

5 ----------

6 If they have not arrived:

7 A timeout is sent to request the packets are resent

8 If they have arrived:

9 ----------

10 ----------

Letter	Statement
A	The server checks if all the packets have arrived
B	The packets are put in order
C	The request is processed by the web server
D	The packets are received by the host server
E	Each packet is given the address and a number

[5]

5(a) An office has a LAN (Local Area Network). The office has four employees who each have a laptop. The office also has one server and one networked printer.

The office is set up as a star network with a switch at the centre. All devices are connected to the network using cables.

(i) Draw the devices and connections in the office star network. All devices must be clearly labelled.

[3]

(ii) Describe the role of the switch in the office network.

---

[2]

(b) The office introduces a WAP (Wireless Access Point) to allow network access to wireless devices.

The office manager has noticed that the performance of the network has recently decreased.

(i) Describe how introducing wireless access could have slowed down the network.

[2]

(ii) Identify **two** other factors that can affect the performance of a network.

1

2

[2]

6 A law company currently use a Local Area Network (LAN) linked to a Wide Area Network (WAN).
They want to upgrade their system to utilise cloud storage.

Explain **two** disadvantages to the law company of storing their data in the Cloud.

1 _____

_____

_____

_____

2 _____

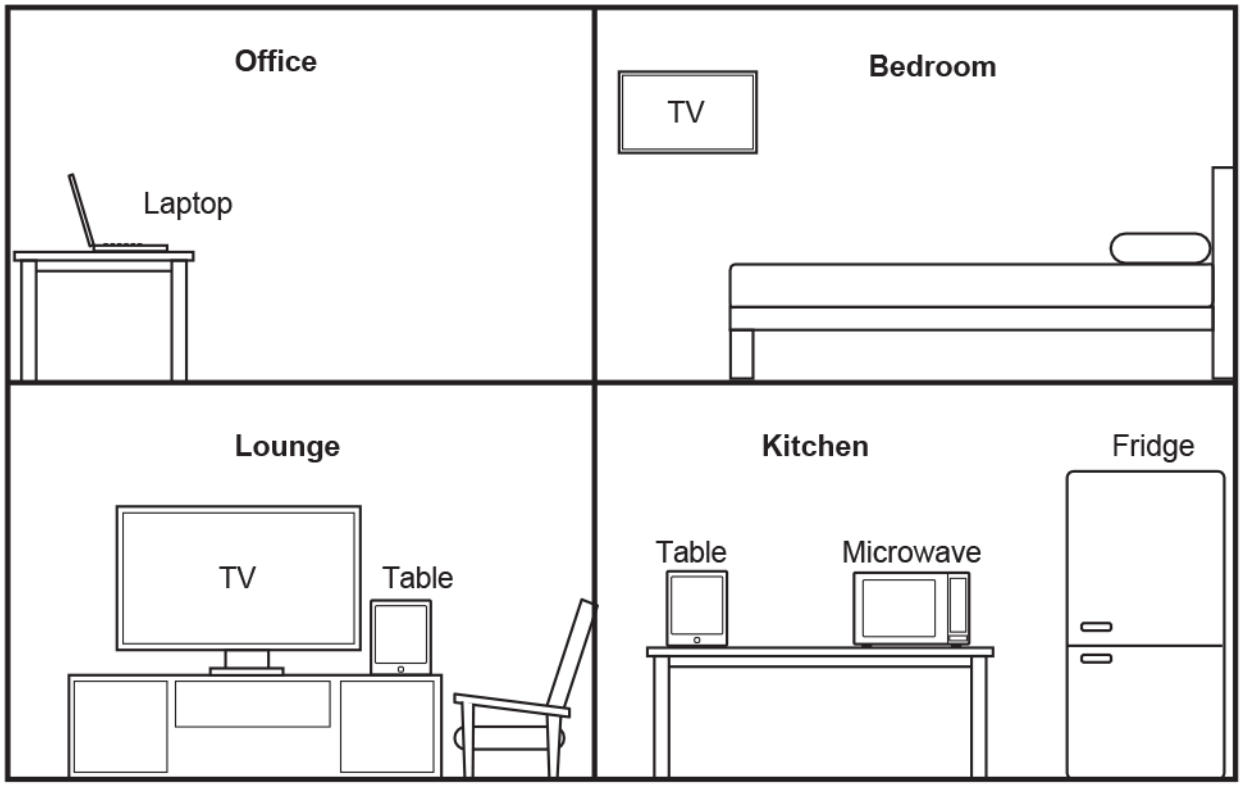
_____

_____

_____

[4]

7 Hope has a network in her house. The main devices are shown in the diagram.



State whether Hope's network is a LAN or a WAN. Justify your choice.

Choice _____

Justification _____

_____

_____

_____

[3]

END OF QUESTION PAPER

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Question			Answer/Indicative content	Marks	Guidance
1			• The computers are geographically remote/ distanced/ more than a mile apart • Communication medium is not owned by the law firm	1	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
			Total	1	
2			e.g. • Can share files / can work collaboratively on same files • Can share hardware resources / suitable example • Can access their files from any computer / classroom • Can work together from different computers using instant messaging • Centralised deployment of software to all computers	2	Examiner's Comments This question was intended to be fairly straightforward – standard answers for the advantages of having a network in a context in which most of them are familiar. Candidates who did not get full marks here either gave answers that were too vague such as "it allows the computers to communicate with each other" – which is just a definition of what a network does, not an advantage – or they compared a LAN to a WAN. The weakest candidates even tried their luck with very generic answers like "it's cheaper," demonstrating little understanding of the actual subject content being tested.
			Total	2	
3	a		• WAN is over a large geographical area / needs to transmit over a large distance // a LAN is over a small geographical area. • WAN uses external hardware / infrastructure / cables / network // LAN has its own infrastructure / cables / network / hardware due to distance / practicalities	2	NB Examples of infrastructure / hardware are allowed for WAN e.g. satellite, phone lines, Internet Allow LAN as Ethernet for second bullet NOT wide area for WAN Examiner's Comments Many candidates were able to correctly identify the difference in size between a WAN and a LAN. The better candidates also identified the difference in hardware, or ownership of the hardware used.

Question			Answer/Indicative content	Marks	Guidance
	b		2 marks per benefit E.g. • All files can be stored centrally • … so workers can access files from any computer • … all computers can update the central database / file • … Peer-to-peer files might be stored on their own computers / spread across many computers • Backups are central • … all data is backed up each time • … individual computers do not need to backup their own data • … Peer-to-peer may need to perform their own backups. • Monitor clients • …to ensure they are working correctly • Upgrade software centrally • …so you do not have to install on each computer individually • Central security (antivirus / firewall) • … do not need to install protection on all computers • …Peer-to-peer individual security may need to be installed on individual computers	4	Do not allow: -easy to share data -“more secure” **Examiner's Comments** This question was not answered well, with few candidate able to demonstrate an understanding of client-server and peer-to-peer networks. The most common response was the central storage of data, although this was often not expanded to explain why this is a benefit.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
4	a	i	1 mark per bullet to max 2 • Directs packets/data to destination // directs packets/data in a network • Receives packets/data from the network/Internet • Forwards packets/data to other computers on the network/Internet • Connects (different) networks together // e.g. joins home network to Interne • Has (public) IP address for LAN • Designates (private) IP addresses to network nodes	2 AO1 1a (1) AO1 1b (1)	Controls flow of data as BOD for bullet 1. Bullet 1 needs to refer to the router directing the destination e.g. it is making a decision/choice on where to send it. Bullet 4 - it has to be referring to the connection between the Internet and home network, or forwarding of data between them. Just referring to accessing Internet is not enough. Do not allow information for data/packets <u>Examiner's Comments</u> This question required candidates to demonstrate their understanding of a router and its purpose in a network. Candidates need to have an understanding of the purpose of the hardware in a network as to the roles is performs, and how it does this. Less able candidates gave generic descriptions such as 'it connects devices together', or 'lets a user go on the Internet'. These are not in-depth enough to explain the actual purpose of the router, i.e. to receive packets from a computer, read the address and forward the packet to its destination. Similarly, with access to the Internet, the router receives the package to go onto the Internet, packets it appropriately for the new type of network and then sends it onto the new network. The more able candidates were able to describe the purpose of directing packets to their destination, as opposed to sending it arbitrarily to other devices.

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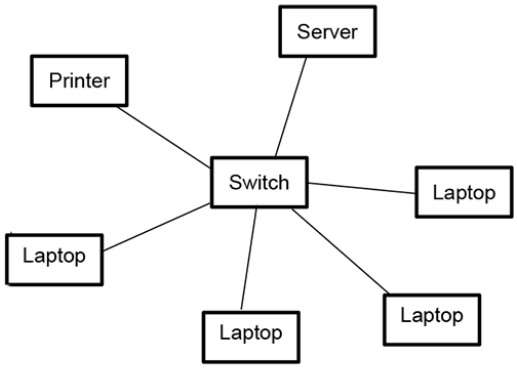
Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per item to max 2 e.g. • Network Interface card / NIC • Wireless access point / WAP • Wireless network interface card / WNIC / wi-fi card • Bridge • Switch • Hub • Repeater // wireless extender/booster • Server	2 AO1 1a (2)	Accept modem, power line adapter, Ethernet **jack** Must be an item of network hardware <u>Examiner's Comments</u> Many candidates were able to identify at least one device, most commonly switches and hubs.
	b	i	Domain Name Server // DNS.	1 AO1 1a (1)	Allow Server/service/system <u>Examiner's Comments</u> This question required an understanding of a Domain Name Server/System to convert URLs to IPs. Few candidates were able to identify this system, with many making guessing such as HTTP. Many candidates did not attempt to answer this question.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark for each letter in the correct place 1 The request is put into packets 2 **E** 3 The packets are sent across the network 4 **D** 5 **A** 6 If they have not arrived: 7 A timeout is sent to request the packets are resent 8 If they have arrived: 9 **B** 10 **C**	5 AO1 1b (5)	<u>Examiner's Comments</u> This question required an understanding of how packets of data are sent across a network. Candidates were required to read through the statements and order them logically. The more able were able to identify the appropriate sequence. Less able candidates confused some of the statements, such as identifying the request as being processed before the packets were received.
			Total	**10**	

Question			Answer/Indicative content	Marks	Guidance
5	a	i	1 mark per bullet • Four laptops/computers, a server and printer present and clearly identifiable (positions do not matter) • Switch as a device clearly identifiable… • …all devices directly connected to the switch and only the switch (FT from MP2) e.g.  	3 AO2 1a (3)	• Printer may be connected to the server or to the switch. • Accept PC for laptop • If the candidates has given server/switch or switch/server in the centre, mark the first one in their list. If they give server/switch, they do not get MP2, but allow access to MP3. <u>Examiner's Comments</u> Most candidates were able to gain at least 1 mark by drawing the required elements. Fewer candidates were able to correctly label the central device as the switch; many incorrectly labelled this as the server, or server/switch. This error demonstrates a misunderstanding that all devices connect centrally to a server, instead of a device such as a switch. Some candidates did not clearly label their devices or did not fully apply the scenario to the diagram i.e. labelling 'device' instead of the specific laptop, printer, server as required.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per bullet to max • To connect the devices together • Receives data/packets/traffic • Direct/send data/packets/traffic **only** to its **destination** • Creates/generates a list of devices connected to it as it receives signals • Uses MAC addresses of devices connected to it	2 AO1 1a (1) AO2 1a (1)	• Do not award information, penalise once. • Do not award packet switching out of context. • Accept MP3 by example <u>Examiner's Comments</u> This question required an understanding of the purpose and function of a switch in a network. A surprising number of candidates thought that the switch turns the network on and off. The better answers conveyed that signals were transmitted from the devices to the switch, and that the switch then transmitted the signals to the destination. A small number of candidates were able to demonstrate and understanding of how the switch records the MAC addresses of the devices attached to it and then uses these to forward data packets.
	b	i	1 mark per bullet to max 2 • Wireless transmission is slower **than cabled** • More devices/users could be connected e.g. mobile phones // increase in traffic • …reducing bandwidth available for each user // insufficient bandwidth for users/demand • Wireless can be limited by interference • …such as walls that disrupt the signal // from other wireless networks/users	2 AO1 1b (1) AO2 1b (1)	• Bod - wireless has less bandwidth <u>Examiner's Comments</u> This question required an understanding of the differences between wired and wireless transmission. Many candidates were able to correctly identify that wireless transmission is usually slower than wired transmission. Many candidates were also able to explain potential interference in wireless transmission and what can cause this interference.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per factor e.g. • Bandwidth available • Number of users (using the network at the same time) • (Number of) data collisions • Interference // by example e.g. walls • Distance data has to travel // signal strength • Amount of data being transferred • Applications being used • Server/CPU performance • Using a hub instead of a switch	2 AO1 1a (2)	• Do not accept wireless/wired connections • Bod answers such as cable length <u>Examiner's Comments</u> This question required candidates to consider what other else could affect the performance, other than a wireless versus wired network. There were some excellent responses demonstrating a range of knowledge such as differences in bandwidth, the number of users (and collisions), the type of hardware used and even the topology of the network.
			Total	9	
6			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	4	

Question			Answer/Indicative content	Marks	Guidance
7			1 mark for LAN 1 mark per bullet for justification to max 2 • Small geographic area • They will own the hardware // dedicated hardware // do not need to use outside hardware // controlled by Hope	3	
			Total	3	

Topic 3b

Computer Networks, Connections & Protocols - Wired and Wireless Networks, Protocols and Layers

1(a) The owners of a large bakery have a Local Area Network (LAN) with a star topology. They order their supplies over the Internet. When data is transmitted from the bakery to the supplier, network protocols are used.

Define what is meant by a 'network protocol'.

---

[1]

(b) TCP/IP is a set of protocols based on layers.

(i) With regards to network protocols, define what is meant by a 'layer'.

---

[1]

(ii) Describe **one** advantage of using layers to construct network protocols.

---

[2]

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2 A bank uses a local area network to connect all the computers in its head office.

Computers in the network can be identified using both IP addresses and MAC addresses.

Describe **two** differences between IP addresses and MAC addresses.

[4]

3 The following table has descriptions of Ethernet and WiFi.

Tick (✓) **one** box in each row to identify if the description is more appropriate for Ethernet or WiFi.

Description	Ethernet	Wifi
A wired connection		
More likely to be affected by interference		
Data can be transmitted at a faster speed		
Wireless transmission		
Shorter transmission range before data is lost		

[5]

4 For each of the scenarios below, identify the most appropriate protocol to be used and explain the function of the protocol.

(i) A user wants to transfer a file directly from his computer to his friend's computer.

---**[2]**

(ii) A customer wants to securely log into her bank's website to check her account balance.

---**[2]**

5 The IP address 192.149.119.226 is linked to the website with a URL of https://www.ocr.org.uk

When https://www.ocr.org.uk is entered into a browser, the website homepage is loaded.

Describe the relationship between the website URL (https://www.ocr.org.uk), the IP address and the webserver.

[5]

6 The owners of a large bakery have a Local Area Network (LAN) with a star topology. They order their supplies over the Internet. When data is transmitted from the bakery to the supplier, network protocols are used.

TCP/IP is a set of protocols based on layers.

(i) With regards to network protocols, define what is meant by a 'layer'.

---

[1]

(ii) Describe **one** advantage of using layers to construct network protocols.

---

[2]

7 Naomi's office has five computers connected into a Local Area Network (LAN). There is also one printer that all the devices can print to.

Ethernet cables are used within the office building.

Tick **one** box in each row to identify if the statement about Ethernet is True or False.

Statement	True	False
Ethernet is a protocol		
Ethernet uses wireless data transmission		
Ethernet can transmit data at speeds of up to 100 Gbits per second		
Ethernet is a protocol within the TCP/ IP stack		

[4]

END OF QUESTION PAPER

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Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		• A network protocol defines rules for data transmission • A network protocol defines standards for data transmission	1	1 mark only to be awarded for a correct definition.
	b	i	• A division of network functionality	1	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	1 mark to be awarded for the correct identification and 1 for a valid description up to a maximum of 2 marks.
			Total	4	
2			• IP addresses can be changed / are allocated as needed • MAC addresses can't be changed / every device has a fixed MC address • IP(v4) addresses are 4 bytes long • MAC addresses are 6 bytes long • IP(v4) addresses are normally written in denary • MAC addresses are normally written in Hex • IP addresses are configured by software • MAC addresses are configured in hardware • IP addresses are used for routing across a WAN / internet • MAC addresses are only used within the LAN [marks in pairs, maximum 2 pairs]	4	For bullets 3 and 4, accept answers where candidates refer to IPv6 being 16 bytes (128 bits). Award one mark if candidates state that IP addresses and MAC addresses are of different size.
			Total	4	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td></td><td></td><td>1 mark per row

<table><tr><th>Description</th><th>Ethernet</th><th>Wifi</th></tr><tr><td>A wired connection</td><td>✓</td><td></td></tr><tr><td>More likely to be affected by interference</td><td></td><td>✓</td></tr><tr><td>Data can be transmitted at a faster speed</td><td>✓</td><td></td></tr><tr><td>Wireless transmission</td><td></td><td>✓</td></tr><tr><td>Shorter transmission range before data is lost</td><td></td><td>✓</td></tr></table></td><td>5
AO1 1a
(5)</td><td>0 mark for row with > 1 tick

<u>Examiner’s Comments</u>

This question was answered well with the majority of candidates getting each answer correct.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
4		i	1 mark for protocol, 1 mark for description • FTP / file transfer protocol • Uses a client-server model // sends from client to server // sends from server to client	2 AO2 1b (2)	If protocol wrong, no mark for description Examiner's Comments Many candidates were able to identify the appropriate protocol of FTP. Few candidates were able to explain the function of this protocol. Common answers including redefining it as transferring a file, and not actually the function of it.
		ii	1 mark for protocol, 1 mark for description e.g. • HTTPS / hyper text transfer protocol secure • Encrypts the connection/data // Uses SSL/secure socket layer	2 AO2 1b (2)	If protocol wrong, no mark for description Examiner's Comments This protocol was often identified correctly and many candidates were able to describe its function in encrypting the data to ensure its security. Some candidates gave a description of it showing a padlock on the browser, but this does not explain the function of the protocol.
			Total	4	

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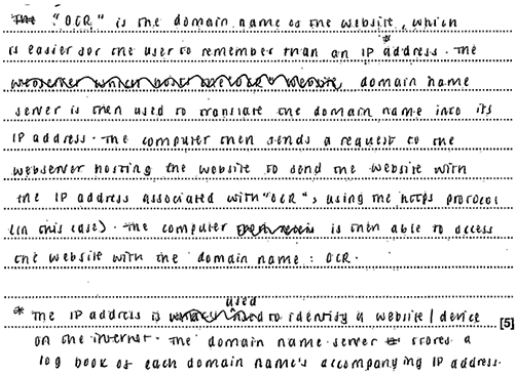
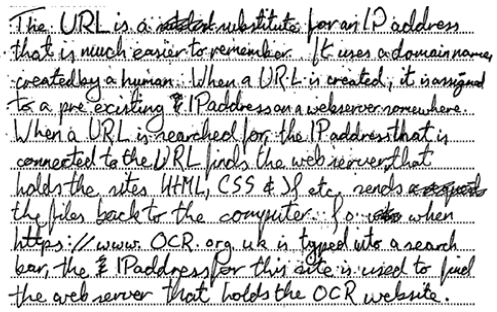
Question			Answer/Indicative content	Marks	Guidance
5			1 mark per bullet to max 5 • The website is hosted on a webserver • The website/webserver has an IP address • (Browser) sends URL to DNS • URL has a linked IP • DNS finds IP • If DNS cannot find the IP it passes request to higher DNS • …if not found return error • IP address sent back to the browser/computer • (Browser) sends request to IP/webserver • Webserver processes request for the website/webpage • …webserver sends the webpage/file/data to the user	5 AO1 1b (3) AO2 1b (2)	• Do not award 'the IP goes to the webserver' • Allow domain name in place of URL • 'DNS finds the IP of the URL it is given' gets 2 marks, 1 for URL has linked IP and 1 for DNS finds the IP • MP 11 do not accept webserver *loads* the webpage on the user's computer Examiner's Comments This question provided an opportunity for candidates to demonstrating their understanding of the links between URLs and IPs, and how websites are stored on web servers that have a URL and IP address. The better answers gave a detailed explanation of how a URL is converted into an IP address through a domain name server. Some candidates did not explain the relationship, instead giving the purpose of URLs as being user friendly, instead of detailed how it relates to the IP address and web server. Exemplar 5  The "OCR" is the domain name of the website, which is easier for the user to remember than an IP address. The webserver which hosts the website, domain name server is then used to translate the domain name into its IP address. The computer then sends a request to the webserver hosting the website to send the website with the IP address associated with "OCR", using the https protocol (in this case). The computer then is then able to access the website with the domain name : OCR. * The IP address is used to identify a website / device on the internet. The domain name server is stored a log book of each domain name's accompany ing IP address. [5] This candidate has given a good description of how a website is loaded, with the computer contacting the web server of

Question			Answer/Indicative content	Marks	Guidance
					the website. They have also included (briefly) details about a domain name server being used to convert the domain name into the IP address. Exemplar 6  The URL is a ~~addr~~ substitute for an IP address that is much easier to remember. It uses a domain name, created by a human. When a URL is created, it is assigned to a pre existing IP address on a webserver somewhere. When a URL is searched for, the IP address that is connected to the URL finds the web server that holds the sites HTML, CSS & JS etc, sends a request the files back to the computer. I.e. ~~when~~ when https://www.OCR.org.uk is typed into a search bar, the IP address for this site is used to find the web server that holds the OCR website. This candidate begins by describing why a URL is used instead of the relationship between the required parts. They do further down begin to detail how a web server stores the website and that this server sends the website back to the computer.
			Total	5	
6		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.
			Total	3	

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Mark Scheme

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td></td><td></td><td>1 mark for each row.

<table><tr><th>Statement</th><th>True</th><th>False</th></tr><tr><td>Ethernet is a protocol</td><td>✓</td><td></td></tr><tr><td>Ethernet uses wireless data transmission</td><td></td><td>✓</td></tr><tr><td>Ethernet can transmit data at speeds of up to 100 Gbits per second</td><td>✓</td><td></td></tr><tr><td>Ethernet is a protocol within the TCP/ IP stack</td><td>✓</td><td></td></tr></table></td><td>4</td><td>2 ticks in 1 row = 0 mark</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
</table>

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Topic 4

Network Security

1(a) A doctor's surgery stores hundreds of patients' details on its computer network. The surgery is concerned about the security of its patients' sensitive medical data.

Staff are already required to use strong passwords to protect systems. Explain, with reference to system security, **three** other ways that the surgery could protect the system.

[6]

(b) Identify **three** errors that the surgery's staff could make, that may endanger the security of the network and outline a procedure that could be put in place to prevent each error.

[6]

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2 A house has computers in each room and a central router. Every room allows both Ethernet and WiFi connections to the router.

The house owner is concerned about potential threats to the network from being connected to the Internet.

(i) Describe **three** possible threats to the computers connected to the network and give **one** way each threat can be reduced or prevented.

Threat 1 ----------

Prevention ----------

Threat 2 ----------

Prevention ----------

Threat 3 ----------

Prevention ----------

[9]

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3(a) Hamish stores confidential documents on his laptop.

Hamish needs his computer to be secure from unauthorised access when connected to a network.

(i) Describe the problems that can arise from unauthorised access to his laptop and confidential documents.

[3]

(ii) Describe **two** ways Hamish can help prevent unauthorised access to his laptop.

1

2

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[4]

(b) If unauthorised access does occur, Hamish would like to use encryption to add another layer of protection to his documents.

(i) Explain how encryption helps to protect Hamish's documents.

[2]

(ii) One encryption method is a Caesar cipher.

This Caesar cipher moves each letter of the alphabet **one** place to the right.

The following table shows the original letters in the first row, and the new letters in the second row.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A

For example, if the message read: `HELLO`

This would be stored as: `IFMMP`

The following pseudocode algorithm takes a string of uppercase letters as input and uses the Caesar cipher to encrypt them.

The functions used in the algorithm are described in the table:

Function	Description
`ASC(character)`	Returns the ASCII value for *character* e.g. `ASC("A")` returns 65
`CHR(ASCIIvalue)`	Returns the single character for *ASCIIvalue* e.g. `CHR(65)` returns "A"
`subString(Value, Number)`	Returns the *Number* of characters starting at position *Value* (where 0 is the first character)

Complete the pseudocode algorithm to perform a Caesar cipher.

```
01  message = input("Please enter your string")
02  newMessage = " "
03  messageLength = message.length
04  for count = 0 to ........................................
05      ASCIIValue = ASC(message.subString(.............,1))
06      ASCIIValue = ASCIIValue + ..........................
07      if ASCIIValue >90 then
08      ASCIIValue = ........................... – 26
09      endif
10      newMessage = ........................... + CHR(ASCIIValue)
11  next count
```

[5]

(iii) The algorithm needs adapting. An extra line (line 12) is needed to output the encrypted message.

Write line 12 to output the encrypted message in pseudocode or programming code.

---

[1]

---

4 A hospital stores patients' details on its computer network. The hospital is concerned about the security of its patients' details.

Identify **three** errors that the hospital staff could make that may endanger the security of the network. Outline a procedure that could be put in place to prevent each error.

Error 1 _____

Procedure 1 _____

_____

Error 2 _____

Procedure 2 _____

_____

Error 3 _____

Procedure 3 _____

_____

[6]

5 Amir has a home network that includes two laptop computers, four mobile phones, and two televisions.

Amir wants to protect the computers on his network from threats such as unauthorised access.

The following incomplete table contains a form of attack, description and method of preventing each attack.

Complete the table by writing the missing Forms of attack, Descriptions and Methods of prevention.

Form of attack	Description of attack	Method of prevention
	A program attempting all possible password combinations	
Data interception		
		Anti-virus

[6]

6(a) Data in computer systems is valuable and at risk of loss, damage or being stolen.

The table has four potential threats to data.

Write one prevention method for each threat in the table. Each prevention method must be different.

Threat	Prevention method
Unauthorised access to computer	
Virus	
Phishing	
Data interception	

[4]

(b) Name **two** other threats to the data in a computer system and give a method of preventing each.

Threat 1 ----------

Prevention 1 ----------

Threat 2 ----------

Prevention 2 ----------

---

[4]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		• Firewall (1 - AO2 1a) prevents unauthorised access (1 - AO2 1b) • Anti-malware (1- AO2 1a) removes viruses/spyware from infecting the system (1- AO2 1b) • Encryption (1- AO2 1a) any intercepted data is rendered useless (1- AO2 1b) • User access levels (1- AO2 1a) users have restricted access (1- AO2 1b) • Network policies (1- AO2 1a) rules that define acceptable use (1- AO2 1b)	6	1 mark to be awarded for each correct type to a maximum of 3 marks. (AO2 1a) 1 mark to be awarded for each correct explanation to a maximum of 3 marks. (AO2 1b)
	b		• Brings in files via any medium (1- AO2 1a)… • …not allowing/stopping external devices being used on the network (1-AO2 1b) • Downloading infected files from the internet (1 - AO2 1a)… • …blocking/restricting access tinsecure websites (1 - AO2 1b) • Allowing physical access to the surgery's network (1 - AO2 1a)… • …locking of doors/key cards/any physical security procedure (1 - AO2 1b) • Sending/sharing sensitive data with third parties (1- AO2 1a)… • … blocking/restricting access to USB ports/email/internet/printing (1 - AO2 1b)	6	1 mark to be awarded for each correct identification to a maximum of 3 marks. (AO2 1b) 1 mark to be awarded for each correct outlining of a procedure to a maximum of 3 marks. (AO2 1b) Allow any reasonable combination of error and reasonable procedure to mitigate the risk.
			Total	**12**	

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Question			Answer/Indicative content	Marks	Guidance
2			1 mark for naming threat, 1 for description, 1 for prevention. Max 3 per threat e.g. • Virus / trojan / worm / malware • Piece of software/code/a program that replicates itself // causes damage e.g. editing/deleting files • Running anti-virus/anti-malware software // don't download from unknown sources // don't click on unknown links • Spyware / malware / keylogger • Piece of software/code/a program that records actions/key presses and sends this data to a third party for analysis • Running anti-spyware/anti-malware software/firewall • Data interception / passive • Data is sent to another device and is intercepted by a third party • Encryption • Phishing • An e-mail has a link that when clicked directs the user to a fake website that collects personal data • Network policy // firewall • Pharming • A piece of code installed that redirects user to fake website that collects personal data • Anti-malware // firewall • Hacker • Person attempting to gain **unauthorised** access to the network/computers/ data/files // **unauthorised** access and then deleting/editing data/files • Firewall // strong password // biometrics // penetration testing • Brute force attack • Person/software using every	9 AO1 1b (3) AO2 1a (3) AO2 1b (3)	Must be relevant to home use i.e. not denial of service, SQL injection. Do not allow adware, spam. Do not allow backup as a prevention – it does not prevent the threat occurring. Do not allow encryption for stopping a hacker. Description must do more than repeat the threat. Read whole response to threat, identify threat first (may not be at the start and may be within description), then look for description. If no threat identified, then no mark for prevention. Allow any example of hacking for hacker e.g. cracking (password), active. But only once. Only award malware once, for virus or spyware e.g. virus identified, then malware identified both can be awarded. Virus, then malware, then spyware, would get a repeat for final spyware. Allow: • Ransomware • Prevents access to your files unless a ransom is paid • Anti-virus/firewall

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Question	Answer/Indicative content	Marks	Guidance
	combination of passwords to gain access • Firewall//strong passwords • Social engineering • Person being the weak point of the system // by example e.g. any example of deception • e.g. Strong passwords // check validity of sources		<u>Examiner's Comments</u> This question required candidates to consider the different threats to networks and computers that they have learnt about, and to identify which are appropriate in this situation. Most candidates were able to identify three threats, but at times these were not appropriate to the scenario, for example describing denial of service threats to a website, and SQL injection. This identifies the importance of candidates reading the questions carefully and identifying whether it is asking for a generic response i.e. a recall of knowledge (AO1), or an application of their knowledge (AO2). The most common threats identified included viruses and hackers, with candidates being able to describe the threats and identify appropriate measures to prevent them. Some candidates gave repeated answers, for example giving a virus as a threat, then a worm, then a Trojan – both of which are examples of viruses therefore already covered by their previous answer. Exemplar 5

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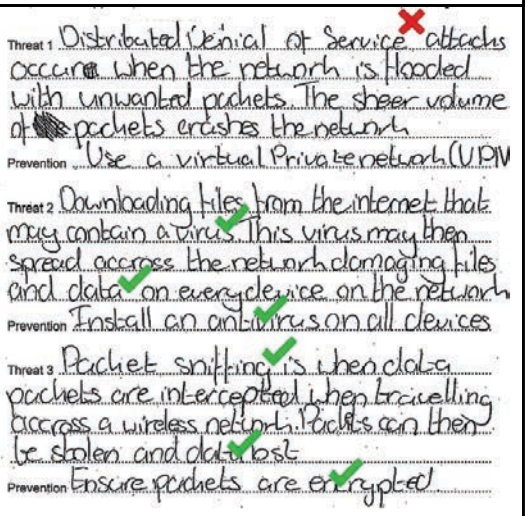
Question			Answer/Indicative content	Marks	Guidance
					 This candidate has given DDOS for the first answer which is not appropriate to the context; this is a threat to a webserver which is not part of the house owner's home network. They have given two further appropriate threats, described these appropriately and given reasonable preventions. It is important that candidates consider the context and give threats that are appropriate to the situation given in the question.
			Total	9	

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Question			Answer/Indicative content	Marks	Guidance
3	a	i	1 mark per bullet to max 3 e.g. • Malware could be put on the computer • Data protection legislation states personal data must be protected / breaks Data protection legislation • … breach of privacy • …he could lose his job • Delete files // change data • … so the important work is lost/changed • Steal files/data/information // copy data/files/information // keylogger transmits data/files/information to third party • … use for illegal activities • … e.g. profit from the data // gain private information // leak information to the public • Data could be locked	3 AO2 1b (3)	<u>Examiner's Comments</u> This question required candidates to consider the consequences of unauthorised access to the laptop and documents. Candidates tackled this question well, with many candidates identifying potential problems such as deletion/modification of files, installation of files etc. Some candidates gave appropriate consequences to Hamish such as loss of job or breaking of data protection act and the consequences of this.

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Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark for naming, 1 for description to max 2 per method e.g. • Password • No access without the password // **description** of strong password // limit attempts to guess // changing it regularly • Limited attempts to get into laptop • before laptop is locked • Firewall • Monitor incoming and outgoing transmissions // Stop unauthorised/unwanted incoming/outgoing transmissions/packets. • Biometrics • Need fingerprint/retina scan • Do not leave laptop logged on/unattended • So that other people cannot physical access it • Physical security // keep in locked room • So that people cannot physically access the laptop • Do not connect laptop to network // standalone computer • So that there are no network threats • Two-step verification // two-factor authentication • For example sending code to mobile phone	4 AO1 1a (2) AO2 1a (2)	• Do not accept encryption/anti-malware, this will not prevent unauthorised access. • Do not accept penetration testing - it's a laptop, not a network. • Login is NE for password • Do not accept access rights - it's access to the laptop <u>Examiner's Comments</u> This question required candidates to apply their knowledge of computer security to the protection of a laptop against unauthorised access. Some candidates incorrectly identified features to stop unauthorised users accessing the data once they were on the laptop. The question required responses on how to prevent them accessing the laptop to begin with. The most common answers included use of firewalls and passwords. Few candidates were able to describe the actions performed by a firewall, instead repeating the question in that it stops unauthorised access. More common were good descriptions of strong passwords or locking the laptop once a set number of incorrect passwords was entered.

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Question			Answer/Indicative content	Marks	Guidance
	b	i	1 mark per bullet to max 2 • Uses an algorithm to • … jumble/scramble/mix up the data // turns it into cypher text // by example • If it is accessed it cannot be **understood** // it is **unintelligible** • Use of keys to encrypt/decrypt data	2 AO1 1a (1) AO2 1b (1)	• 'Need the key to understand the data' can get both MP2 and 3 • Cannot read the data // data is unreadable is NBOD <u>Examiner's Comments</u> This question was answered well by many candidates who were able to identify that encryption scrambles data and that a key is required to read it.

		ii	1 mark for each completed piece of code
			
			`message = input("Please enter your string")`
			`newMessage = ""`
			`messageLength = message.length`
			`for count = 0 to` **`messageLength - 1`**`//` **`message.length - 1`**
			`  ASCIIValue = ASC(message.subString` **`count`**`,1))`
			`  ASCIIValue = ASCIIValue +` **`1`**
			`if ASCIIValue > 90 then`
			`  ASCIIValue =` **`ASCIIValue`** `- 26`
			`  endif`
			`  newMessage =` **`newMessage`** `& CHR(ASCIIValue)`
			`next count`
				5
				AO3 2b (5)
					• For `messageLength - 1` in loop accept `messageLength` or `message.length`
					
					• Spelling must be exact, do not penalise case.
					
					<u>Examiner's Comments</u>
					
					This question tested candidates' understanding of algorithms and the use of strings in programming.
					
					A noticeable number of candidates did not attempt the question.
					
					The most common correct response was the first space to identify the number of iterations. The final space was also often answered correctly, identifying that the string is concatenated with the rest of the message.
					
					Fewer candidates were able to identify the character being selected, or the value to add to ASCIIValue within the loop.

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Question			Answer/Indicative content	Marks	Guidance

		iii	1 mark for suitable output
			e.g.
			
			`output(newMessage) //`
			`print(newMessage)`
				1
				AO3 2b
				(1)
					• Must logically work. Do not accept "" around `newMessage`.
					
					• Parentheses not required.
					
					• Do not accept:
					• `newMessage = output(newMessage)` or similar
					
					• Accept any output method
					
					• Bod - if the candidate outputs something extra it must be valid i.e. a variable from the program, or additional text in a string with suitable concatenation e.g. `print(newMessage + asciiValue)` is ok but `print(newMessage is the new message)` is not.
					
					Examiner's Comments
					
					This question required candidates to identify the variable from part bii that stores the final encrypted message and to output it using any identifiable output keyword.
					
					A common error was putting speech marks around new message i.e. 'newmessage' which would mean the words 'newmessage' would be output instead of the contents of the variable.

			Total	15	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td></td><td></td><td>• Brings in files via any medium (1 – AO2 1a)…
• …not allowing/stopping external devices being used on the network (1 – AO2 1b)
• Downloading infected files from the internet (1 – AO2 1a)…
• …blocking/restricting access to insecure websites (1 – AO2 1b)
• Allowing physical access to the surgery's network (1 – AO2 1a)…
• …locking of doors/key cards/any physical security procedure (1 – AO2 1b)
• Sending/sharing sensitive data with third parties (1 – AO2 1a)…
• … blocking/restricting access to USB ports/email/internet/printing (1 – AO2 1b)</td><td>6
AO2 1a (3)
AO2 1b (3)</td><td>1 mark to be awarded for each correct identification to a maximum of 3 marks. (AO2 1b)

1 mark to be awarded for each correct outlining of a procedure to a maximum of 3 marks. (AO2 1b)

Allow any reasonable combination of error and reasonable procedure to mitigate the risk.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td>1 mark for each completed box

<table><tr><th>Form of attack</th><th>Description of attack</th><th>Method of prevention</th></tr><tr><td>Brute-force attack</td><td>A program attempting all possible password combinations</td><td>Strong password // set number of password attempts // firewall</td></tr><tr><td>Data interception</td><td>Data transmission being read by unauthorised user/program</td><td>Encryption</td></tr><tr><td>Malware//Virus//Trojan etc.</td><td>Software that damages/deletes data</td><td>Anti-virus</td></tr></table></td><td>6</td><td>Enter text here.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>a</td><td></td><td>1 mark for a suitable prevention

<table><tr><th>Threat</th><th>Prevention</th></tr><tr><td>Unauthorised access</td><td>Firewall // (strong) password // physical security // access rights // security questions // two-step authentication</td></tr><tr><td>Virus</td><td>Anti-virus/malware // firewall // network restrictions e.g. no downloads // do not plug in unknown storage devices</td></tr><tr><td>Phishing</td><td>Firewall // do not click on unknown links // spam filter // education about what to do/not do // check sender/website to see if real/fake</td></tr><tr><td>Data interception</td><td>Encryption</td></tr></table></td><td>4</td><td>Mark first in box
Do not mark repeat</td></tr>
<tr><td></td><td>b</td><td></td><td>1 mark for each suitable threat, and 1 mark for suitable prevention
e.g.
Spyware (1) anti-spyware (1)
Pharming (1) Check web address is valid(1)
DOS/DDOS (1) Use of proxy server/firewall (1)
Ransomware (1) Use of antimalware (1)
SQL injection (1) Network forensics/suitable form validation (1)
Social engineering // people as a weak point (1) training (1)
Poor network policy (1) education/setting rules (1)
Hardware failure/loss (1) Backup (1)</td><td>4</td><td>Award different types of virus e.g. worm, trojan separately.

Do not award hacking, brute-force - both covered in unauthorised access.

BOD malware</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

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Topic 5

Systems Software

1(a) Amin buys a new computer with an operating system and some utilities.

State **two** functions of the operating system.

1

2

---

[2]

(b) The table below shows some of the utilities in Amin's computer.

Tick **one** box in each row to show whether the utility is used for security or disk organisation.

Utility	Used for security	Used for disk organisation
Antivirus		
Defragmenter		
File transfer		
Firewall		

[4]

2(a) Security on a computer can be provided directly by the operating system or by using utility programs.

Utility programs include antivirus, file transfer, firewall and system cleanup.

State which **two** of these utilities can be used for security.

1

2

---

[2]

(b) Identify and describe **two** methods by which the operating system can provide additional security directly.

1

2

---

[4]

3 Xander's tablet computer comes with system software, including an operating system and utility system software.

The operating system provides file management.

Identify **three** ways that Xander can make use of the file management facility.

1 _____

_____

2 _____

_____

3 _____

_____

[3]

4 A restaurant has a computer-based ordering system which is running slowly. A technician has said that the hard disc drive is fragmented. The technician has suggested using utility software to defragment the drive.

Explain how the restaurant's hard disc could have become fragmented.

[4]

5 Eve's computer has system software including an Operating System and Utility Software.

Tick (✓) **one** box in each row to identify which function of the Operating System deals with each action.

Action	Memory management	Peripheral management	File management	User management
Creating a new folder to store documents in				
Moving data from Virtual Memory to RAM				
Renaming a file				
Reading data from a scanner				
Changing the password required to log on to the computer				

[5]

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6 Ali's tablet computer has an operating system.

Ali runs defragmentation analysis on his magnetic hard disk. Parts of the results are shown.

	File 1
	File 2
	File 3
	Free space

(i) Explain how defragmentation will change how the files and free space are arranged on Ali's hard disk.

[3]

(ii) After defragmentation, Ali's computer is able to access files faster.

Explain why Ali's computer can access the files faster after defragmentation.

[2]

(iii) Give **three** additional examples of utility programs.

1 ----------

2 ----------

3 ----------

[3]

END OF QUESTION PAPER

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>e.g.

• Provides interfaces between user and computer / Determines look and feel of the computer
• Provides a platform for software to run
• Manages peripherals used by the system
• Manages memory</td><td>2</td><td><u>Examiner's Comments</u>

This question was fairly well answered.</td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><th>Utility</th><th>Used for security</th><th>Used for disk organisation</th></tr><tr><td>Antivirus</td><td>?</td><td></td></tr><tr><td>Defragmenter</td><td></td><td>?</td></tr><tr><td>File transfer</td><td></td><td>?</td></tr><tr><td>Firewall</td><td>?</td><td></td></tr></table></td><td>4</td><td><u>Examiner's Comments</u>

This question was answered correctly by almost all candidates.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>2</td><td>a</td><td></td><td>• antivirus
• firewall</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>e.g.

• (User name and) password
• Only allows you to use the system if you are authorised

• Encryption
• Prevents hackers from understanding any data if accessed (e.g. passwords)

• Access rights
• To prevent files from being modified / deleted

• User access control
• Prevents users from making changes to the system

Marks in pairs</td><td>4</td><td>Accept any security measure that is provided by the operating system itself but not by standard utility programs (even if the utility program is normally bundled with operating systems).
The first bullet is for identifying or a brief description of a measure.
The second bullet is for a further more detailed description or a description of how the measure ensures security.

Any reasonable biometrics is acceptable.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
3			1 mark per bullet to max 3 e.g. • He can place his files into folders/directories • He can (re)name files/folders • He can move his files/folders • He can copy/transfer/export files/folders • He can delete his files/folders • He can set permissions/access rights • He can search for files • He can view file details/extensions/file size/type • He can create files/folders • He can sort files/folders // he can put files into a specific order // by example • He can open files/folders	3 AO2 1a (3)	• Answers must be clear as to what the answer is applied to i.e. 'you can open it' - what is it? • Mark first answer on each section. • Do not award: ◦ defragment ◦ view files ◦ download ◦ compression ◦ preview ◦ edit/read/write files • 'Organise files' without what into - is not enough. Examiner's Comments Candidates found this question challenging. Many candidates identified incorrect features such as compression and encryption. Some candidates were able to identify one or two ways; commonly deleting files or transferring files. Only a few candidates were able to identify three correct ways.
			Total	3	
4			• Orders have been saved onto the system as they order food and then deleted once processed (1) • Once other orders have been made, new files are created (1) which may be bigger than the spaces left by the deleted files (1) • The order files are split up (1)	4 (AO2 1b)	Up to a maximum of 4 marks. A maximum of three marks if there is no contextualisation. Allow a mark if candidates state that fragmentation increases access time. (1)
			Total	4	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td></td><td></td><td>1 mark per row

<table><tr><th>Action</th><th>Memory management</th><th>Peripheral management</th><th>File management</th><th>User management</th></tr><tr><td>Creating a new folder to store documents in</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>Moving data from Virtual Memory to RAM</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Renaming a file</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>Reading data from a scanner</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>Changing the password required to log on to the computer</td><td></td><td></td><td></td><td>✓</td></tr></table></td><td>5</td><td>No mark awarded if 2+ ticks on each row</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
6		i	1 mark for: • Collate free space together Max 2 from • Collate file fragments together/contiguously • All of **file 1** will be stored **consecutively** • All of **file 2** will be stored **consecutively** • All of **file 3** will be stored **consecutively**	3	Allow diagram Do not award gives more free storage space. Do not award 'similar' files are grouped together.
		ii	1 mark per bullet to max 2 • When one page is read it does not have to search for second page // does not have to search through all the pages // does not need to reassemble the individual pages • Does not have to physically move as far to get the next part of the file • Less physical movement saves time • Multiple locations do not need accessing // fewer individual accesses	2	Answer must relate to why it is faster.
		iii	1 mark for each example e.g. • Backup • Encryption • Compression • Firewall • Anti-virus // anti-malware • Anti-spyware // anti-malware	3	Only award anti-malware once.
			Total	**8**	

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Topic 6

Ethical, Legal, Cultural and Environmental Impacts of Digital Technology

1 A law firm currently use a Local Area Network (LAN) linked to a Wide Area Network (WAN).

Fig. 3 lists some actions that may take place in the law firm's office. Tick (✓) one box in each row to show which legislation applies to each action.

Fig. 3

Action	Data Protection Act 1998	Computer Misuse Act 1990	Copyright Designs and Patents Act 1988
Using a picture for the law firm's new logo without the original creators permission.			
A secretary accessing a lawyer's personal email account without permission.			
Making a copy of the latest Hollywood blockbuster movie and sharing it with a client.			
Storing customer data insecurely.			
A lawyer installing a key logger on the secretary's computer.			
Selling clients personal legal data to a marketing company without their permission.			

[6]

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2 Even though the computer devices they own still work, people often want to buy the most up-to-date models, such as the latest smartphone.

Discuss the impact of people wanting to upgrade to the latest smartphone.

In your answer you might consider the impact on:

- stakeholders
- technology
- ethical issues
- environmental issues

[8]

3 Amin buys a new computer with an operating system and some utilities.

Some of the software in Amin's computer is open source.

Describe what is meant by open source software.

---

[2]

4 William is creating a film for a school project using a digital video camera.

William wants to upload his videos on the Internet and is considering releasing them under a Creative Commons license.

Explain how a Creative Commons license will impact the use of William’s videos by other people.

---

[3]

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5 Fiona is a software engineer. She is creating a new version of a computer game she released three years ago.

Fiona is considering selling the game online and not making it available physically in shops.

Describe the environmental impact of Fiona's decision.

[2]

6 A law company currently use a Local Area Network (LAN) linked to a Wide Area Network (WAN). They want to upgrade their system to utilise cloud storage.

Fig. 2 lists some actions that may take place in the law company's office.
Tick (✓) **one** box in each row to show which legislation applies to each action.

Action	Data Protection Act 2018	Computer Misuse Act 1990	Copyright Designs and Patents Act 1988
Using a picture for the law company's new logo without the original creator's permission.			
A secretary accessing a lawyer's personal email account without permission.			
Making a copy of the latest Hollywood blockbuster movie and sharing it with a client.			
Storing customer data insecurely.			
A lawyer installing a key logger on the secretary's computer.			
Selling client's personal legal data			

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to a marketing company without their permission.			

Fig. 2

[6]

7 * People often want to buy the most up-to-date smartphones, even though the smartphone they own still works.

Discuss the impact of people wanting to upgrade to the latest smartphone.

In your answer, you might consider the impact on:

- smartphone users
- cultural issues
- ethical issues
- environmental issues.

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[8]

8 Layla is an artist. She draws images by hand. The image is then scanned and stored on a computer.

Layla wants to protect her images so they cannot be copied by other people.

Identify which legislation can help protect Layla's images.

[1]

9 Eve's computer has system software including an Operating System and Utility Software.

Eve uses a computer to write a computer game. She wants people to be able to download her program online.

Eve is choosing between an open source and proprietary licence.

(i) Give **two** benefits to the customers of Eve choosing an open source licence.

1 _____

_____

2 _____

_____

[2]

(ii) Give **two** benefits to Eve of choosing a proprietary licence.

1 _____

_____

2 _____

_____

[2]

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10 Daniel is a medical researcher trying to find a cure for a disease. He has a team of hundreds of people carrying out medical testing.

Recent developments in Artificial Intelligence (AI) mean that a computer program could do the work of dozens of researchers in a much shorter time. Daniel decides to increase his use of Artificial Intelligence.

Discuss the issues surrounding this decision. Consider the following in your answer:

- ethical issues
- legal issues
- cultural issues

---

[8]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1				6	1 mark for each tick in the correct box. 0 marks for a row with more than one tick.

Action	Data Protection Act 1998	Computer Misuse Act 1990	Copyright Designs and Patents Act 1988
Using a picture for the law firm's new logo without the original creator's permission			✓
A secretary accessing a lawyer's personal email account without permission		✓	
Making a copy of the latest Hollywood blockbuster movie and sharing it with a client			✓
Storing customer data insecurely	✓		
A lawyer installing a key logger on the secretary's		✓	

Question			Answer/Indicative content				Marks	Guidance
			computer					
			Selling client's personal data to a marketing company without their permission	✓				
			Total				6	

Question			Answer/Indicative content	Marks	Guidance
2				Enter text here.	

			Mark Band 3-High Level
			(6-8 marks)
			The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; 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 discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors.
			
			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
			(3-5 marks)
			The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; 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 discuss the impact on most areas, showing reasonable recognition of influencing factors.
			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
			(1-2 marks)
				8	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:
					
					Indicative Content:
					
					Stakeholders
					
					• Can adversely affect people in this country and abroad:
					  ◦ health issues
					  ◦ financially
					  ◦ socially
					  ◦ culturally
					• The phone manufacturers
					• The phone shops/networks
					
					Technology
					
					• The type of devices that are disposed of
					• Modern phones poorly designed for durability
					• Phones hardware not upgradeable/replaceable
					• Proprietary technology used by some manufacturers
					
					Environmental
					
					• Reference to e-waste (people dispose of their devices in landfill even if they are in good working order)
					• Some equipment is also sent abroad to be disposed of
					• Leads to excessive landfill (in this country and/or abroad, e.g. Africa and Asia)
					• Toxic waste released into land, ground water, air (in this country and/or abroad, e.g. Africa and Asia)
					• Waste of resources Precious metals in phones

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Question			Answer/Indicative content	Marks	Guidance
			The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit.		Ethical Issues • Contributes to ill health • Contributes to the digital divide • Contributes to social divide • Problem of confidential data stored on the devices • Puts social pressure on parents to pay for their children to upgrade • Puts social pressure on the public to upgrade • Can lead to bullying of those who cannot afford the latest technology • Phone manufacturers intentionally designing fragile phones so they need to be replaced more often • High cost of new devices.
			Total	**6**	
3			• The source code is distributed with the software • The customer can modify the source code • The customer can redistribute the source code (with the same licence / restrictions)	2	Examiner's Comments It was pleasing to see a reduction in the common misapprehension that being free of charge is an essential or defining characteristic of open source software. This shows, to some extent, that centres have taken note of the feedback provided from previous sessions.
			Total	**2**	

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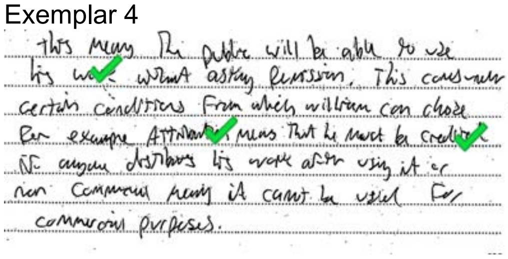
Question			Answer/Indicative content	Marks	Guidance
4			1 mark per bullet to max • Allows free distribution // other people can use/edit his work • **Other people** can redistribute his work • Can **choose** to restrict other people to be able to use/edit/share the videos • Work is still copyrighted // others cannot claim it as their own • No-derivative • …William can set that if others edit it they cannot redistribute it with the edits • attribution • …Can insist e.g. on having his name on it if re-used // referencing // must be credited • Can insist on non-commercial use // others cannot sell/profit from his work // personal use only	3 AO1 1b (1) AO2 1a (1) AO2 1b (1)	"People need to ask to use it" is not enough. <u>**Examiner's Comments**</u> This question required candidates to demonstrate their understanding of a Creative Commons license to the context of the use of someone else's work. Some candidates did not make full use of the context and answered the question by defining the licence. Most candidates were able to explain how other people would be able to use or edit the videos themselves and then redistribute it. More able candidates were able to describe the different Creative Commons licenses available and how each of these would impact the use of the videos. A common misconception was that Creative Commons automatically copyrighted all material so that no one else could use, edit or distribute the videos. Exemplar 4  this means the public will be able to use his work without asking permission. This consumer certain conditions from which william can chose For example Attribution means that he must be credited if anyone distributes his work after using it or non commercial meaning it cannot be used for commercial purposes.

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Question			Answer/Indicative content	Marks	Guidance
					This good response shows a clear understanding of Creative Commons licensing and its different forms. They have identified that the public are able to use William's work and then given the examples of Attribution and the implication that William must be credited if his work is used. This has already gained the 3 marks, but they continue to describe the need for the work to be used non-commercially.
			Total	3	
5			1 mark per bullet Benefits of not providing physical copies e.g. • Less/no plastic/paper/raw materials used in manufacture // no need for packaging // less waste • Less electrical power needed to manufacture • No petrol used to distribute/collect • …smaller carbon footprint • Fewer disks need to be manufactured • Fewer factory emissions // less pollution • Old versions will be thrown away Drawbacks of still creating a physical copy (sold online) e.g. • Plastic/paper are used in manufacture • Increase in waste • Old versions will be thrown away • Uses petrol / creates emissions to distribute	2 AO2 1b (2)	• Could be read as still physically creating but not putting in shops. • Do not accept more use of computers/electricity to download. <u>Examiner's Comments</u> This question required an understanding of environmental impacts of selling software physically. Many candidates were able to give detailed explanations as to the positive impact of not releasing a game physically, such as the reduction of materials for packaging. Some candidates need not read the question fully and gave explanations as to how it would benefit Fiona to release it online and not in shops. This led to answers about the number of people it would reach and the income she would make, as opposed to the environmental impact.
			Total	2	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td></td><td></td><td>
<table>
<tr><th>Action</th><th>Data Protection Act 2018</th><th>Computer Misuse Act 1990</th><th>Copyright Designs and Patents Act 1988</th></tr>
<tr><td>Using a picture for the law company's new logo without the original creator's permission.</td><td></td><td></td><td>✓</td></tr>
<tr><td>A secretary accessing a lawyer's personal email account without permission.</td><td></td><td>✓</td><td></td></tr>
<tr><td>Making a copy of the latest Hollywood blockbuster movie and sharing it with a client.</td><td></td><td></td><td>✓</td></tr>
<tr><td>Storing customer data insecurely.</td><td>✓</td><td></td><td></td></tr>
<tr><td>A lawyer installing a key logger on the secretary'</td><td></td><td>✓</td><td></td></tr>
</table>
</td><td>6
(AO1 1b)</td><td>1 mark for each tick in the correct box.

0 marks for a row with more than one tick.</td></tr>
</table>

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Question			Answer/Indicative content				Marks	Guidance
			s computer.					
			Selling client's personal legal data to a marketing company without their permission.	✓				
			Total				6	

Question			Answer/Indicative content	Marks	Guidance
7			**Mark Band 3 – High Level** **(6–8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; 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 discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *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** **(3–5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; 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 discuss the impact on most areas, showing reasonable recognition of influencing factors. *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** **(1–2 marks)** The candidate demonstrates a basic	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Smartphone users</u> • Can adversely affect people in this country and abroad: ◦ health issues ◦ financially ◦ socially ◦ culturally <u>Cultural issues</u> • Desire/need to own newest device • …to fit in with peers • May have new features that users require for work/leisure <u>Environmental issues</u> • The type of devices that are disposed of • Modern phones poorly designed for durability • Phones' hardware not upgradeable/replaceable • Reference to e-waste (people dispose of their devices in landfill even if they are in good working order) • Some equipment is also sent abroad to be disposed of • Leads to excessive landfill (in this country and/or abroad, e.g. Africa and Asia) • Toxic waste released into land, ground water, air (in this country and/or abroad, e.g. Africa and Asia) • Waste of resources • Precious metals in phones <u>Ethical issues</u> • Contributes to ill health • Contributes to the digital divide • Contributes to social divide

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Question			Answer/Indicative content	Marks	Guidance
			knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* 0 marks No attempt to answer the question or response is not worthy of credit.		• Problem of confidential data stored on the devices • Puts social pressure on parents to pay for their children to upgrade • Puts social pressure on the public to upgrade • Can lead to bullying of those who cannot afford the latest technology • Phone manufacturers intentionally designing fragile phones so they need to be replaced more often • High cost of new devices.
			Total	8	
8			Copyright designs and patents act	1	
			Total	1	
9		i	1 mark per bullet to max 2 • Free of charge • They can adapt it / add features	2	
		ii	1 mark per bullet to max 2 • She can charge customers // She can earn a profit • She can restrict what users can do /// users can't edit it	2	
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
10			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; 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 discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *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** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; 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 discuss the impact on most areas, showing reasonable recognition of influencing factors. *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** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Ethical</u> • Replacing people with machines • Loss of jobs • Community will suffer • Work will be completed faster • May find a cure faster • More reliable calculations • Save more lives <u>Legal</u> • More secure than people seeing personal data • May be at risk if not backed up • May be at risk of threats e.g. hackers • Who is responsible if there is an error <u>Cultural</u> • Removal of people from workforce • Change in demand for skills • Need people to manage the hardware/software instead of medical expertise • Skills may be lost

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Question			Answer/Indicative content	Marks	Guidance
			acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		
			Total	8	