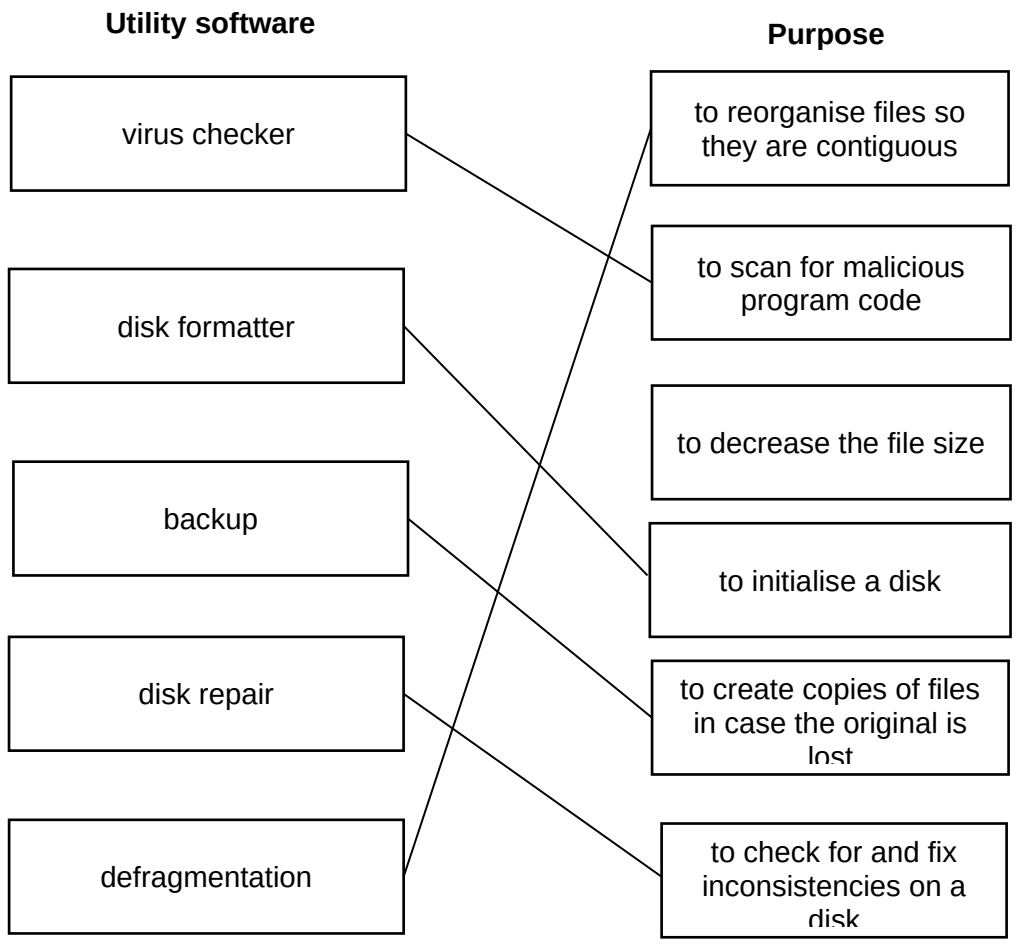
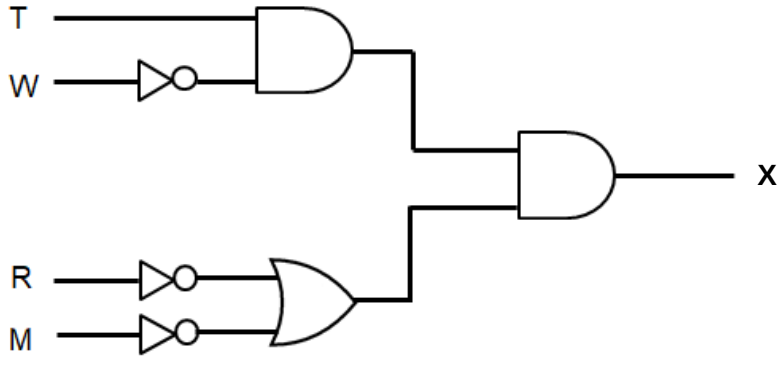
Question	Answer	Marks
1(a)	**1 mark** for each correct line.  	**5**
1(b)(i)	**1 mark** for each bullet point **(max 2)**: • larger amounts of source code take time to compile • slower to produce the object code than an interpreter • code cannot be changed without recompilation • the program will not run if there are any errors • errors cannot be corrected in real-time • one error may result in other false errors being reported • cannot easily test specific sections of the source code // cannot easily test unfinished source code	**2**
1(b)(ii)	**1 mark** for each bullet point **(max 2)**: • partially compiled programs can be used on different platforms as they are interpreted when run • code is optimised for the CPU as machine code is generated at run time	**2**

Question	Answer	Marks
2(a)(i)	–106	**1**
2(a)(ii)	96	**1**

Question	Answer	Marks
2(a)(iii)	**1 mark** for each bullet point: • 149 decimal • 0001 0100 1001	**2**
2(b)	1101 0010	**1**

Question	Answer	Marks
3(a)	**1 mark** for T AND NOT W **1 mark** for NOT R OR NOT M **1 mark** for final AND 	**3**
3(b)	**1 mark** for each set of rows as highlighted: **A** **B** **C** **X** 0 0 0 1 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 0 1 1 0 0 1 1 1 0	**2**
3(c)	**1 mark** for each bullet point: • to **store** data that does not change • data must be **stored** even when device is without power • to **store** boot up instructions / system software / firmware / BIOS	**2**

Question	Answer	Marks
4(a)	data verification is checking if input data is the same as the original whereas data validation is checking that the data is reasonable / sensible	**1**
4(b)	**1 mark** for each bullet point **(max 3)**: • checksum value is calculated **from the data** before transmission // correct description of a checksum algorithm • ... this calculated value is transmitted with the data • **receiving** computer recalculates the checksum from the received data • if the checksum **received** and **calculated** match, no error has occurred // if the checksum **received** and **calculated** do not match, an error has occurred	**3**
4(c)	**1 mark** for each bullet point **(max 2)**. For example: • to make sure data is in the required format // only expected characters allowed • to make sure the data is already present in the system • to make sure the data contains the correct number of characters • to ensure that non-numeric data is entered	**2**

Question	Answer	Marks
5(a)	**1 mark** for each bullet point **(max 3)**: Solution 1: • removing the many-to-many relationship between Owner and Tree • ... by removing TreeID and TreePosition from the Owner table • ... and creating a linking table between Owner and Tree • ... that contains OwnerID, TreeID and TreePosition • ... (composite) primary key of the linking table should be OwnerID and TreeID // insert a named new primary key in the linking table Solution 2: • removing the many-to-many relationship between Owner and Tree • move TreePosition into TREE table • ... put OwnerID into TREE table • create a new table with suitable name (for the species of tree) • ... containing ScientificName, MaxHeight and FastGrowing • ... with ScientificName as primary key // or another suitable primary key	**3**

Question	Answer	Marks

5(b)	**1 mark** for each bullet point:
	
	• INSERT INTO TREE
	• VALUES ( ) and correct values
	• Values in correct order
	
	Option 1:
	`INSERT INTO`
	`TREE(TreeID, ScientificName, MaxHeight, FastGrowing)`
	`VALUES('LOW_1276', 'Salix_Alba', 30.00, TRUE);`
	
	Option 2:
	`INSERT INTO`
	`TREE`
	`VALUES('LOW_1276', 'Salix_Alba', 30.00, TRUE);`
		3

5(c)	**1 mark** for: An attribute / field (or set of attributes / fields) that **could** be a primary key	**1**
5(d)(i)	**1 mark** for description • stores metadata about the database **1 mark** for a correct example For example: • field / attribute names • table name • validation rules • data types • primary keys // foreign keys • relationships	**2**
5(d)(ii)	**1 mark** for each bullet point **(max 2)**: • the overview of a database structure • models the problem / situation • ... by using methods such as an ER diagram • independent of any particular DBMS	**2**

Question	Answer	Marks
6(a)(i)	**1 mark** for each method of ensuring authenticity **(max 2)**: • (email) message put through hashing algorithm to produce a digest • Digest encrypted with <u>sender's private</u> key (to create the digital signature) • the (digital) signature can **only** be decrypted with matching <u>sender's public</u> key	**2**

Question	Answer	Marks
6(a)(ii)	**1 mark** for each bullet point: • **monitors** incoming and outgoing packets / traffic • **checks against** an allow list / deny list of IP addresses // **checks against** a set of rules for acceptable data / ports etc. • **blocks** transmissions that do not meet criteria / rules // **allows** through is satisfies the criteria /rules	**3**
6(b)(i)	**1 mark** for each bullet point **(max 2)**: • **improves** the accuracy of the sound file • ... because (digital) waveform more closely resembles the **analogue wave**form • quantization errors are reduced • increases the amount of detail stored	**2**
6(b)(ii)	**1 mark** for each bullet point: • decreases the file size of the sound file • ... because fewer bits are used to store **each sample**	**2**

Question	Answer	Marks
7(a)	**1 mark** for each set of highlighted rows.	**5**

Instruction address	ACC	IX	Memory address						
			100	101	102	103	110	111	112
			0	0	112	4	1	4	0
75		0							
76	1								
77									
78									
79									
80									
84	2								
85				2					
86	0								
87	1								
88			1						
89		1							
90									
76	4								
77									
78									
79									
80									
81	6								
82				6					
83									
86	1								
87	2								
88			2						
89		2							
90									

7(b)(i)	0100 1100	**1**

Question	Answer	Marks
7(b)(ii)	`0100 0001`	**1**
7(b)(iii)	`1001 1000`	**1**
7(b)(iv)	`1101 1111`	**1**
7(c)	**1 mark** for each correct row: **Description** / **Register transfer notation** Copy the address of the next instruction into the Memory Address Register. — MAR ← [PC] Increment the Program Counter. — PC ← [PC] + 1 Copy the contents of the Memory Data Register into the Current Instruction Register. — CIR ← [MDR]	**3**

Question	Answer	Marks
8(a)	**1 mark** one or two correct row(s). **2 marks** for all three correct rows. **Action** / **Increases the file size** / **Decreases the file size** / **No change to the file size** Change the colour depth of the image file to 16 bits per pixel. — ✓ (Decreases the file size) Change the screen resolution to 1366 × 768 pixels. — ✓ (No change to the file size) Change the colour of the rectangle from black to red. — ✓ (No change to the file size)	**2**
8(b)	**1 mark** for each bullet point **(max 2)**. For example: • can be enlarged without pixelation / loss of quality • individual components of the image can be edited • generally a smaller **file** size	**2**
8(c)(i)	**1 mark** for each correct underlined part: **Uncompressed sound** / **RLE compressed sound** EA F1 F1 F2 F2 F2 EA — 1EA 2F1 3F2 1EA **AB AB FF FF 1D 67** — 2AB 2FF 11D 167 32 32 80 81 81 — **232 180 281**	**2**

Question	Answer	Marks
8(c)(ii)	**1 mark** for each bullet point: • all the data is required // no data can be lost • ... otherwise text file will be corrupted / not make sense	**2**

Question	Answer	Marks
9	**1 mark** for each bullet point **(max 2)**. For example: • incorrect recognition of faces leads to mistakes such as • ... access to facilities / systems may be denied • privacy issues / people do not like data being stored • individuals will feel safer • ... there might be a reduction in crime • faster boarding • catching criminals	**2**

Question	Answer	Marks
10(a)	all four computers directly connected to the **switch** and no other connections.	**1**
10(b)(i)	**1 mark** for the device. **1 mark** for corresponding reason. • Device: Server • Reason: Server processes the requests and authorises traffic // firewall software on the server authorises traffic // server acts as the proxy • Device: Switch • Reason: Switch is connected to all the computers // to share access to the router on the network	**2**
10(b)(ii)	**1 mark** for each bullet point **(max 3)**: • receive packets from devices / internet • find destination of packets using the IP address • forward packets to **the destination** • assign **private** IP addresses to devices on LAN • store/update/maintain a routing table • find most efficient **path** to destination • maintain table of MAC and IP addresses • provides the LAN with a public IP address • acts as a gateway • performs protocol conversion • acts as a firewall	**3**