4 **(a)** Any **one** from:

- secure sockets layer
- encrypts data being transmitted
- use of http**s**
- use public and private keys

[1]

(b) 1 mark for each number in the correct order, next to the correct stage.

Stage	Sequence number
the encrypted data is then shared securely between the web browser and the web server	**6**
the web browser attempts to connect to a web site which is secured by SSL	***(1)***
the web server sends the web browser a copy of its SSL certificate	**3**
the web browser requests the web server to identify itself	**2**
the web server will then send back some form of acknowledgement to allow the SSL encrypted session to begin	**5**
the web browser checks whether the SSL certificate is trustworthy; if it is then the web browser sends a message back to the web server	**4**

[5]

5 **(a)** 1 mark per correctly placed tick

Received byte	Byte transmitted correctly	Byte transmitted incorrectly
1 1 0 0 1 0 0 0		✓
0 1 1 1 1 1 0 0		✓
0 1 1 0 1 0 0 1	✓	

[3]

(b) **(i)** byte number: **7**

column number: **6**

[2]

(ii) Any **two** from:

- letter “A”(byte 7) transmitted as odd parity (three 1s)
- column 6 has odd parity (seven 1s)
- intersection of byte 7 and column 6 indicates incorrect bit value

[2]

(c) **190**

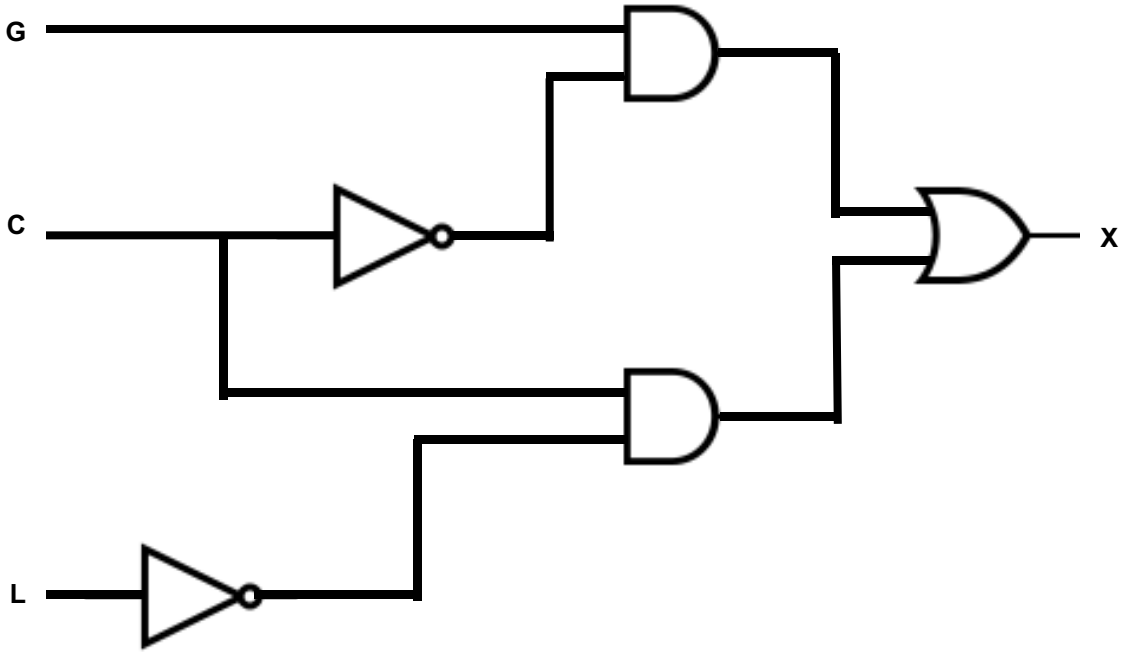
[1]

(d) Any **one** from:

- 2 bits interchanged (e.g. 1 → 0 and 0 → 1) that won’t change parity value
- even number of bits/digits are transposed
- If there are multiple errors in the same byte/column, that still produce the same parity bit, the error will not be detected

[1]

6 (a) 1 mark per correct logic gate, correctly connected



[5]

(b)

G	C	L	Workspace	X	
0	0	0		0	
0	0	1		0	1 mark
0	1	0		1	
0	1	1		0	1 mark
1	0	0		1	
1	0	1		1	1 mark
1	1	0		1	
1	1	1		0	1 mark

[4]

4 (a) (i) serial

(ii) Any **three** from:
- automatically detects the hardware/installs drivers
- plug only goes in one way/can't connect incorrectly
- supports different data transmission speeds/a range of data transmission speeds
- has become the industry standard/universally used
- backwards compatible (with earlier versions of USB ports) [3]

(iii) interrupt [1]

(b) **1** mark each use of printer, max 1 mark per printer.

inkjet printer	– (small quantities of) documents – photographs
3D printer	– (physical) prototype (from CAD) – (physical) model (from a blueprint) [2]

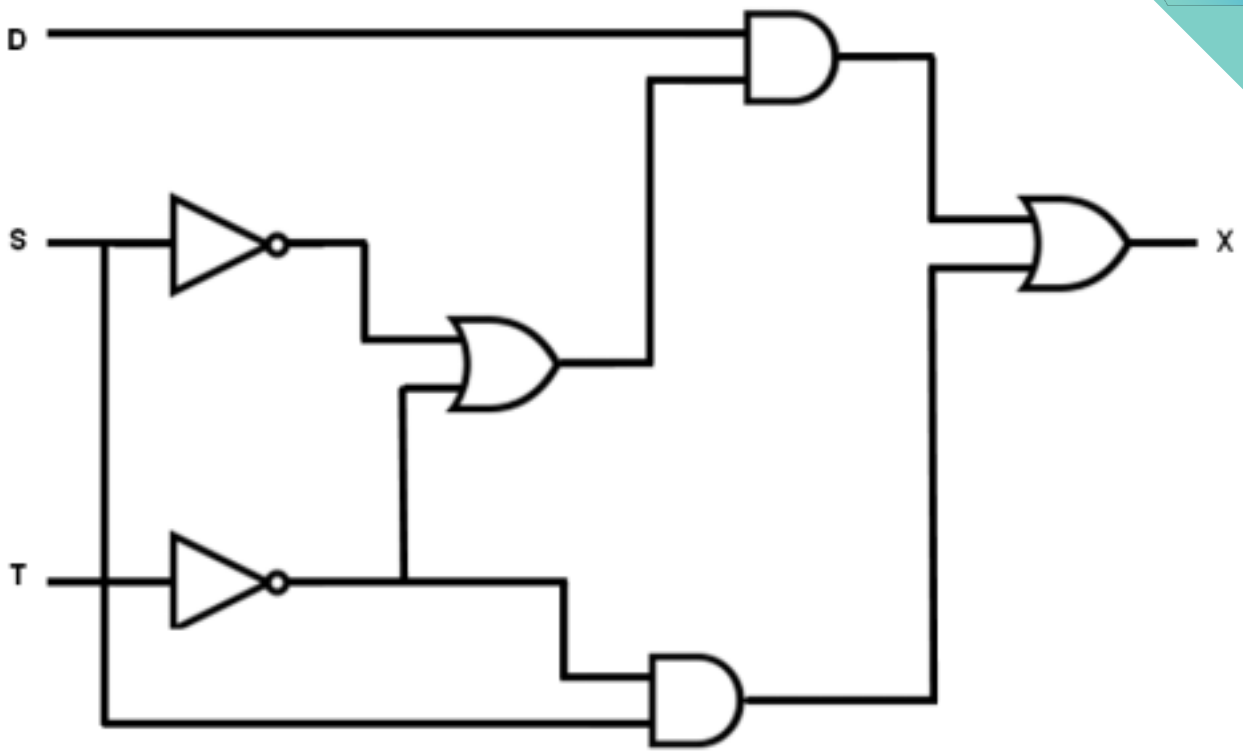
(c) **1** mark for naming printer + **1** mark for description + **1** mark for application

Laser printer

- uses toner/powder ink
- uses (positive and negative) charged drums // rotating drum
- uses static charge
- no moving head
- faster at printing
- high volume output/high speed
- producing flyers/leaflets/magazines [3]

This is an example, other types of printers can be credited.

5 (a) **1** mark for each correct gate, with correct source of input(s)



[6]

(b)

D	S	T	Working Space	X
0	*0*	*0*		**0**
0	*0*	*1*		**0**
0	*1*	*0*		**1**
0	*1*	*1*		**0**
1	*0*	*0*		**1**
1	*0*	*1*		**1**
1	*1*	*0*		**1**
1	*1*	*1*		**0**

4 marks for 8 correct X bits
3 marks for 6 correct X bits
2 marks for 4 correct X bits
1 mark for 2 correct X bits

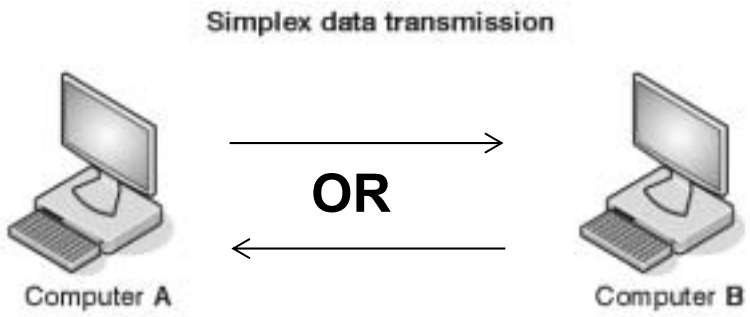
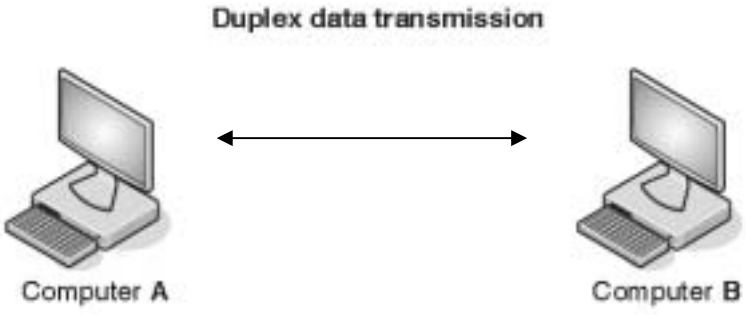
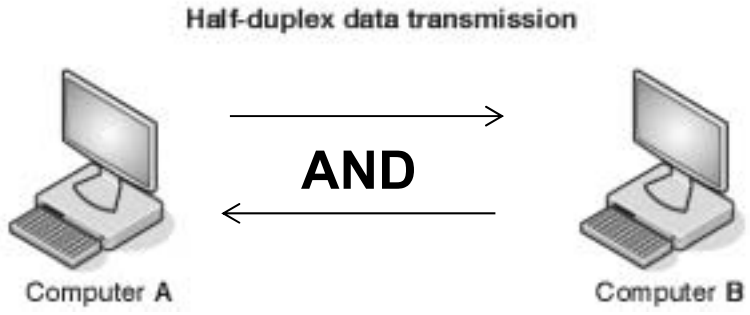
[4]

QUESTION 3.

<table>
<tr><th>Question</th><th>Answer</th></tr>
<tr><td>5(a)</td><td>1 mark per correct tick

<table>
<tr><th>Received byte</th><th>corrupted during transmission (✓)</th><th>not corrupted during transmission (✓)</th></tr>
<tr><td>10110100</td><td>✓</td><td></td></tr>
<tr><td>01101101</td><td></td><td>✓</td></tr>
<tr><td>10000001</td><td>✓</td><td></td></tr>
</table>
</td></tr>
<tr><td>5(b)</td><td>Four from:
• Uses acknowledgement and time out
• Check performed on received data // error is detected by e.g. parity check, check sum
• If error detected, request sent to resend data // negative acknowledgment is used
• If no acknowledgement is sent that data is received // positive acknowledgement is used
• Data is resent / Resend request repeated, till data is resent correctly …
• … or request times out // limit is reached</td><td>4</td></tr>
</table>

Question	Answer	Marks
6	1 mark for correct bus name and up to 2 further marks for appropriate purpose. **Address (bus)** **Two** from: • Carries / transports an address / location … • … of the next item to be fetched • Data travels one way (unidirectional) **Data (bus)** **Two** from: • Carries / transports data / example of data ... • … that is currently being processed // that will be / has been processed • Data can travel in both directions (bidirectional) **Control (bus)** **Two** from: • Carries / transports signals • Control / directs the actions of the CPU / processor • Can be either Unidirectional or Bidirectional	**6**

Question	Answer	
7(a)	1 mark for correct arrow(s), one mark for correct description  (Direction of data is) one way only // unidirectional  (Direction of data is both ways) <u>at same time</u> / <u>simultaneously</u> / <u>concurrently</u>  (Direction of data is both ways) but at different times / <u>not at the same time</u> / <u>not simultaneously</u> / <u>not concurrently</u>	

Question	Answer	
7(b)	1 mark each use, must be different. **Simplex** e.g.: Microphone to computer Sensor to computer Computer to printer Computer to speaker Computer to monitor Webcam to computer Sending data to a device // sending data from a device **Duplex** e.g.: Telephone call Voice over IP Computer to printer (only award once) Instant messaging Broadband connections Video conferencing Sending data to and from devices e.g wireless technology Computer to modem	
7(c)	2 marks for IC, 2 marks for USB **IC** • parallel transmission // description of parallel • for sending data internally **USB** • serial transmission // description of serial • for sending data externally (to and from peripherals / between devices)	**4**

Question	Answer	Marks
8(a)	2 marks for SSL, 2 marks for Firewall **SSL protocol** **Two** from: • uses encryption • encryption is asymmetric / symmetric / both • makes use of (public and private) keys • data is meaningless (without decryption key / if intercepted) **Firewall** **Two** from: • helps prevent unauthorised access // helps prevent hacking • checks that data meets criteria // identifies when data does not meet criteria • acts as a filter for (incoming and outgoing) data // blocks any unacceptable data //allows acceptable data through	**4**

QUESTION 5.

Question	Answer	Marks
10(a)	Any **four** from: – Structure **and** presentation are defined using (mark-up) tags – Structure **and** presentation dictate the appearance of the website – Structure is used for layout – Example of structure – Presentation is used for formatting / style – Example of formatting – Separate file / CSS can be used for presentation content	**4**
10(b)(i)	1 mark for each correct part – domain (name) – file name/webpage name	**2**
10(b)(ii)	Any **two** from: – Hypertext Transfer Protocol Secure // it is the access protocol // It is a protocol – It means the website uses SSL/TLS – It means data sent (to and from the webserver) is encrypted	**2**
10(c)	Any **two** from e.g. : – To store items that a customer has added to an online shopping basket – To store a customer's credit card details – To store log-in details – To track what product a customer browses // Track music preferences – Targeted advertising // making recommendations – Personalises/customises the experience – Shows who are new and returning customers – To speed up log-in times – To speed up/allow single click purchases – Improves the experience	**2**

Question	Answer	Marks
10(d)	Any **four** from: – Prevents direct access to the **webserver** // Sits between **user** and **webserver** – If an attack is launched it hits the proxy server instead // can be used to help prevent DDOS // help prevent hacking of **webserver** – Used to direct invalid traffic away from the webserver – Traffic is examined by the proxy server // Filters traffic – If traffic is valid the data from the webserver will be obtained by the user – If traffic is invalid the request to obtain data is declined – Can block requests from certain IP addresses	**4**

QUESTION 6.

Question	Answer	Marks
3	2 marks per issue from: Phishing – Legitimate looking emails sent to use – When user clicks on attachment / link sent to fraudulent website – Asked to reveal/designed to steal sensitive information Pharming – Malicious code loaded on user hard drive – Will redirect URL requests to fraudulent website – Asked to reveal/designed to steal sensitive information Spam – Junk / unwanted email – Sent to large numbers of people – Used for advertising / spreading malware – Fills up mail boxes	**6**

Question	Answer	Marks
4(a)(i)	<table><tr><th>Received Byte</th><th>Transmitted correctly (✓)</th><th>Transmitted incorrectly (✓)</th></tr><tr><td>10001011</td><td></td><td>✓</td></tr><tr><td>10101110</td><td>✓</td><td></td></tr><tr><td>01011101</td><td>✓</td><td></td></tr><tr><td>00100101</td><td>✓</td><td></td></tr></table>	**4**
4(a)(ii)	**One** from: – ARQ – Check Sum	**1**

Question	Answer	Marks
4(b)(i)	– Multiple bits / byte(s) sent at the same time – Using multiple wires	**2**
4(b)(ii)	Any **one** from e.g.: – Integrated Circuits – Any appropriate CPU buses – Any suitable device connection that uses parallel	**1**
4(b)(iii)	Two from: – Bits remain synchronised … – … reducing data errors – Only single wire is required … – … more cost effective to install/manufacture	**2**
4(c)(i)	– Encrypted text is meaningless – Need the key to decrypt the text	**2**
4(c)(ii)	– Increase length / more bits used for key … – … will generate more possibilities for key / less chance of decryption by brute force method	**2**

Question	Answer	Marks
5(a)	(0)1101011	**1**
5(b)	000 100101100 1 mark for three leading zeros, 1 mark for correct binary number	**2**
5(c)	B3 1 mark for each correct character	**2**
6(a)	Any **two** from: – A signal sent from a device / software – Requests processor time // Processor stops to service interrupt – Interrupts have different priorities	**2**

QUESTION 7.

Question	Answer	Marks
7(a)(i)	– 12 (ignore leading zeros)	1
7(a)(ii)	– 198 (ignore leading zeros)	1
7(a)(iii)	– 1217	1
7(b)	**One** mark per each correct hex value in correct order – 0E9	3

Question	Answer	Marks
8(a)	Any **three** from: – It is a universal standard – It can't be inserted the wrong way around – Supports different transmission speeds – Automatically detects if correct driver installed	3
8(b)	**Two** marks for benefits, **one** mark for drawback Benefits: – Faster speed of printing – Can print duplex / on both sides – Many letters can be printed from one toner cartridge – Can print in high volumes Drawback – Toner cartridge more expensive to buy – More time to warm-up – Larger footprint	3

Question	Answer	Marks
8(c)(i)	Any **two** from: – Paper jam – Out of paper – Out of toner/ink – Buffer full – Awaiting input – Print complete – Printer ready Award any other valid example	**2**
8(c)(ii)	Any **one** from: – Operating system – Interrupt handler – Interrupt service routine	**1**

Question	Answer	Marks
9(a)		**6**

Statement	**HDD (✓)**	**SSD (✓)**
It has a limited number of read/write cycles		✓
It uses magnetic properties to store data	✓	
It has moving parts	✓	
It is non-volatile storage	✓	✓
It can be used as an external storage device to back-up data	✓	✓
It uses flash memory to store data		✓

QUESTION 8.

Question	Answer	Marks
9	– 1 – 0 – 1 – 1	**4**

Question	Answer	Marks
10(a)	Any **four** from: – Example of spyware e.g. Keylogger is used – Spyware is downloaded without knowledge (by example) – Spyware records key presses / screen clicks / screen activity – Data is relayed back to third party – Data is analysed // Patterns in data could reveal log-in details … – … details can then be used to log into the laptop (remotely)	**4**
10(b)	– Biometric device – Two step authentication	**1**

9 Any **six** from:

– infrared / motion / pressure (sensor) // sensor detects movement/pressure
– signals/data sent (continuously) to microprocessor
– converted from analogue to digital (using ADC)
– microprocessor compares value with those stored in memory
– if sensor value does not match the stored value(s) …
– … signal sent to switch on the light
– … signal sent to keep the light on
– … light remains on for a period of time (30 seconds)
– if sensor value matches the stored value(s) …
– … light will remain off
– … will turn off after period of time (30 seconds)
– works in a continues loop [6]

10 **(a)** **(i)** 2 marks for 3 correct binary conversions, 1 mark for 2 correct binary conversions [2]

0	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**1**

(ii) 1 mark for each correct hex value converted

1 A F [3]

(b) 2 marks for working + 1 mark for correct answer

Working
– $1200 \times 8 = 9600$ (bytes)
– 9600/1024 or 9600/1000

Answer
– 9.4 or 9.6 kilobytes [3]

(c) Any **one** from:

MAC address

– Media Access Control (address)
– unique number that identifies a device (connected to the Internet)
– address is made up of manufacturer id + serial number of device
– address is allocated by the manufacturer

Any **one** from:

IP address

– Internet Protocol (address)
– location/address of a device on the Internet
– address is unique for given Internet session
– address is supplied when a device connects to the Internet
– address is allocated by the network [2]

QUESTION 10.

Question	Answer	Marks
3(b)	**Five** from: • Correct column headings / place holders by example • Correctly place a 1 or a 0 for each column • Identify the columns to be added • Add together the (denary) values identified … • … this will give a total which is the denary number/answer • Answer is 10	**5**

Question	Answer	Marks
4(a)(i)	<table><tr><th>Method 1</th><th>Tick (✓)</th><th>Method 2</th><th>Tick (✓)</th></tr><tr><td>Serial</td><td>✓</td><td>Simplex</td><td></td></tr><tr><td>Parallel</td><td></td><td>Half-duplex</td><td></td></tr><tr><td></td><td></td><td>Duplex</td><td>✓</td></tr></table>	**2**
4(a)(ii)	Any **four** from (**Max 3** for serial): • Serial has <u>less/lower</u> interference • Serial is (more) reliable/accurate <u>over distances</u> • In serial the bits won't be skewed • In serial it is easier to collate the bits together again after transmission • Duplex transmits data in both directions <u>at the same time</u> • simplex/half-duplex/remaining methods won't allow read and write at same time	**4**

Question	Answer	Marks
4(b)	1 mark for error checking method, 2 marks for description: Checksum • A value is calculated from the data // Description of calculation • Value is transmitted with data • Value is recalculated after transmission • If the values match the data is (more likely to be) accurate Parity check • A parity bit is transmitted with each byte of data • Odd or even (parity can be used) • Counts / checks number of 1's // counts / checks to see if 1's are even // counts / checks to see if 1's are odd • (Each byte is) checked after transmission to see if it matches the odd/even parity used Automatic Repeat Request (ARQ) • Uses acknowledgement and timeout • When a device detects an error in data transmission it asks for the packet to be resent / no error detected, positive acknowledgment sent • The sending device resends the packet after the request to resend/ timeout received • This process is continuous until the packet received is correct/until the ARQ limit is reached Echo (check) • Copy of data is sent back to sender • Data is compared to see if it matches • If it does not match error detected	**6**

Question	Answer	Marks
5(a)	Any **four** from: • Data / files • Stored in a text file • Downloaded to a user's computer when a website is visited // webserver sends to web browser • Stored on a user's computer • Stored by a browser • Detected by the website when it is visited again	**4**
5(b)	Any **two** from: e.g. • To store personal information/data • To store login details • To save items in an online shopping basket • To track/save internet surfing habits // to track website traffic • To carry out targeted advertising • To store payment details • To customise a webpage // to store user preferences • Store progress in online games/quizzes	**2**

Question	Answer	Marks
6	1 mark for each correct term, in this order: • Interrupt • Compiler • ALU/Arithmetic and Logic Unit • ARQ/Automatic repeat request	**4**

QUESTION 11.

Question	Answer	Marks
7(a)	1 mark for each correct answer: • uses several/multiple wires • transmits multiple bits at a time	**2**
7(b)	Benefit 1 mark for: • quicker/faster data transfer Drawback **One** from: • More chance of data being skewed due to bits being sent simultaneously/out of order // less safe transmission as bits are sent simultaneously/out of order • More expensive as requires more/several/multiple wires • More chance of interference as more/several/multiple wires are used (than can create crosstalk)	**2**
7(c)	**One** from: • Used in integrated circuits • Used in RAM • Used in connections to peripheral devices (e.g. printer)	**1**

Question	Answer	Marks
8	1 mark for each correct answer, in the given order: • browser • webpages • Internet Service Provider (ISP) • Internet • protocol • IP address	**6**

Question	Answer	Marks
9	**Five** from: • The data is sent to the microprocessor • The analogue data is converted to digital (using ADC) • The microprocessor compares the data to a stored value of 5 kg … – … If the value is greater than 5 kg … – … a counter is added to/incremented • The process is continuous	**5**

Question	Answer	Marks
10	**Four** from: • It performs a number of basic tasks, including controlling hardware/file handling (any other suitable examples) • It allows the user to communicate with the computer using hardware // without it the user would not be able to communicate with the computer using hardware • It provides the user with a user interface // without it the user would not have a user interface to use • PC's are often used to perform many complex tasks at a time … – … the OS is needed to handle this multitasking – … therefore, it provides the ability to handle interrupts	**4**

QUESTION 12.

Question	Answer	Marks
8	**Four** from: • Used to attend to certain tasks/issues • Used to make sure that **vital** tasks are dealt with **immediately** • The interrupt/signal tells the CPU/processor (that its attention is required) • A signal that can be sent from a device (attached to the computer) • A signal that can be sent from software (installed on the computer) • The interrupt will cause the OS/current process to pause • The OS/CPU/ISR will service/handle the interrupt • They have different levels of priority • After the interrupt is serviced, the (previous) process is continued • It enables multi-tasking to be carried out on a computer • A valid example of an interrupt e.g. 'out of paper' message for a printer	**4**

Question	Answer	Marks
9(a)(i)	**Two** from: • Data is transmitted one bit at a time • Data is transmitted using a single wire • Bits arrive in order/sequence	**2**
9(a)(ii)	**Two** from: • Data is transmitted multiple bits at a time/simultaneously • Data is transmitted using multiple wires • Bits may arrive out of sequence/skewed (and are reordered)	**2**
9(a)(iii)	1 mark for each: • Data is transmitted in both directions • … at the same time/simultaneously	**2**

Question	Answer	Marks
9(b)	Maximum of three marks per error detection method. 1 mark for naming the method, 2 marks for describing it. **Parity (check)** • Odd or even parity can be used • Bits are added together // 1 bits are counted • Parity bit added (depending on parity set) • Parity checked on receipt • If parity bit is incorrect an error is detected **Checksum** • Calculation performed on data (to get the checksum) • Checksum sent with data • Checksum recalculated after transmission • Comparison made between checksum before and checksum after transmission • Error detected if checksums are different **Automatic repeat request (ARQ)** • Uses acknowledgement and timeout • Request is sent (with data) requiring acknowledgement • If no response/acknowledgment within certain time frame data package is resent • When data received contains an error a request is sent (automatically) to resend the data • The resend request is repeatedly sent until packet is received error free/limit is reached/acknowledgement received	**9**

Question	Answer	Marks
10	**Five** from: • The sensor sends data to the microprocessor • The analogue data is **converted to digital** (using ADC) • The microprocessor compares the reading to the set range/stored values/stored data (6 to 8) … – … If the reading is >8 or <6 / outside range … ○ … the **microprocessor** sends a signal to output the alert • The **process** is continuous/repeated	**5**

QUESTION 13.

Question	Answer	Marks
4(a)	1 mark for each correct conversion *01101010* | **11111111** | **00001000** | **10010011**	**3**
4(b)	• Computers use switches / logic gates • Only uses 2 states / On or Off / 1 or 0	**2**

Question	Answer	Marks
5(a)	• Bits sent one at a time • Uses a single wire	**2**
5(b)	USB / SATA / Wifi /PCI Express / Any appropriate serial device	**1**
5(c)	• Data is transferred in two directions • Data is sent in only one direction **at a time**	**2**

Question	Answer	Marks
6	1 mark for method name, 1 mark for description e.g. **Backups** • Make a copy of the data • Copy stored away from main computer • Data can be restored from backup **Anti-virus** • Scans computer for viruses • Software to detect/remove viruses • Can prevent data being corrupted by viruses **Firewall** • Hardware or software that monitors network traffic • To help prevent hackers gaining access / deleting data **Password/Biometrics** • To help protect files / computer from unauthorised access **Restricted access** • To stop users downloading/installing software that could harm **Verification** • Message e.g. to ask if definitely want to delete **Physical methods** • Locks/alarms/CCTV to alert/deter unauthorised access	**6**

QUESTION 14.

Question	Answer	Marks
5(a)	• Data is sent down a single wire … • … one bit at a time • Data is sent in both directions … • … but only one direction at a time	4
5(b)	**One** mark for correct byte (Byte) 2 // 01010100 **Three** from: • Added up / counted the 1s / 0s • Even parity used // 3 bytes are even • Byte 2 uses odd parity // 1 byte is odd	4

Question	Answer	Marks
6(a)(i)	**One** from: • Code will run without the need of an interpreter • (Object) Code is platform independent • Source code not available / cannot be modified	**1**
6(a)(ii)	**One** from: • Source code not available / cannot be modified • Comments, etc. not visible • Future changes will require code to be recompiled	**1**
6(b)(i)	**One** from: • Protocol is HTTPS • Padlock icon is locked • Can view website certificate	**1**
6(b)(ii)	**Five** from: • Browser / client sends request to webserver to request identification • Web server sends its digital / security certificate • Browser authenticates certificate … • … if authentic connection, is established • Any data sent is encrypted … • … using public and private keys	**5**
6(c)	**Four** from: • A type of software licence • Free of charge • Normally distributed without the source code • Can legally share / copy • Cannot legally modify code • Cannot resell	**4**

QUESTION 15.

Question	Answer	Marks
10(a)	**Four** from: • Validation method • Used to check data entry • Digit is calculated from data // by example • Digit is appended / added to data • Digit is recalculated when data has been input • Digits are compared • If digits are different, error is detected // If digits match, no error is detected	**4**
10(b)	**Six** from (maximum three marks per security method): • Firewall … • … Monitors the traffic • … **Blocks** any traffic that doesn't meet the **criteria** / **rules** • (Strong) password // biometric … • … Data cannot be accessed without the use of the password / bio data • … Prevent brute force attacks • Encryption … • … Data will be scrambled • … **Key** is required to decrypt the data • … If data is stolen it will be meaningless • Physical security methods … • … The physical security will need to be overcome • … This can help deter theft of the data • Antispyware … • … will remove any spyware from system • … will prevent data being relayed to a third party	**6**

Question	Answer	Marks
11(a)	**RAM** • To store the data / instructions / parts of OS that are currently in use **ROM** • To store the firmware / bootup instructions / BIOS **SSD** • To store files / software // by example	**3**
11(b)	**Two** from: • It is more durable // it has no moving parts • It has a faster read / write / access speed • It is more compact / light weight / smaller / portable • It uses less energy // battery will last longer • It is quieter • Not affected by magnetic forces • It runs at a cooler temperature • Less latency // takes less time to warm up	**2**

QUESTION 16.

Question	Answer	Marks
5	**One** mark for each correct parity bit	**3**

	Parity bit							
Register A	**0**	0	1	0	0	0	1	1
Register B	**0**	0	0	0	0	1	1	1
Register C	**0**	0	0	0	0	0	1	1

Question	Answer	Marks
6(a)	• Free software	**1**
6(b)	• Freeware	**1**
6(c)	• Shareware	**1**
6(d)	• Plagiarism // Intellectual property theft	**1**
6(e)	• Copyright	**1**