(b)

description of stage	sequence number
the instruction is then copied from the memory location contained in the MAR (memory address register) and is placed in the MDR (memory data register)	**3**
the instruction is finally decoded and is then executed	**7**
the PC (program counter) contains the address of the next instruction to be fetched	*(1)*
the entire instruction is then copied from the MDR (memory data register) and placed in the CIR (current instruction register)	**4**
the address contained in the PC (program counter) is copied to the MAR (memory address register) via the address bus	**2**
the address part of the instruction is placed in the MAR (memory address register)	**6**
the value in the PC (program counter) is then incremented so that it points to the next instruction to be fetched	**5***

The incrementation of the program counter can appear at any stage after 2. All other stages must be in the correct given order. [6]

8 (a) hours: **18**

minutes: **53** [2]

(b)

hours (**"C"**)									minutes (**"D"**)							
0	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**:**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**0**

[2]

(c) Any **three** from:

– reads values in registers “C” and “D”

– and checks the values against those stored in registers “A” and “B”
(**NOTE**: the first two statements can be interchanged, i.e. “A” and “B” read first)

– If values in corresponding registers are the same

– the microprocessor sends a signal to sound alarm/ring [3]

(d) Any **three** from:

– uses a light sensor

– sends signal/data back to microprocessor

– signal/data converted to digital (using ADC)

– value compared by microprocessor with pre-set/stored value

– if value < stored value, signal sent by microprocessor …

– … to the voltage supply (unit)

– … “value” of signal determines voltage supplied/brightness of LED [3]

(e) Any **two** from:

– no need to warm up

– whiter tint/more vivid colours/brighter image

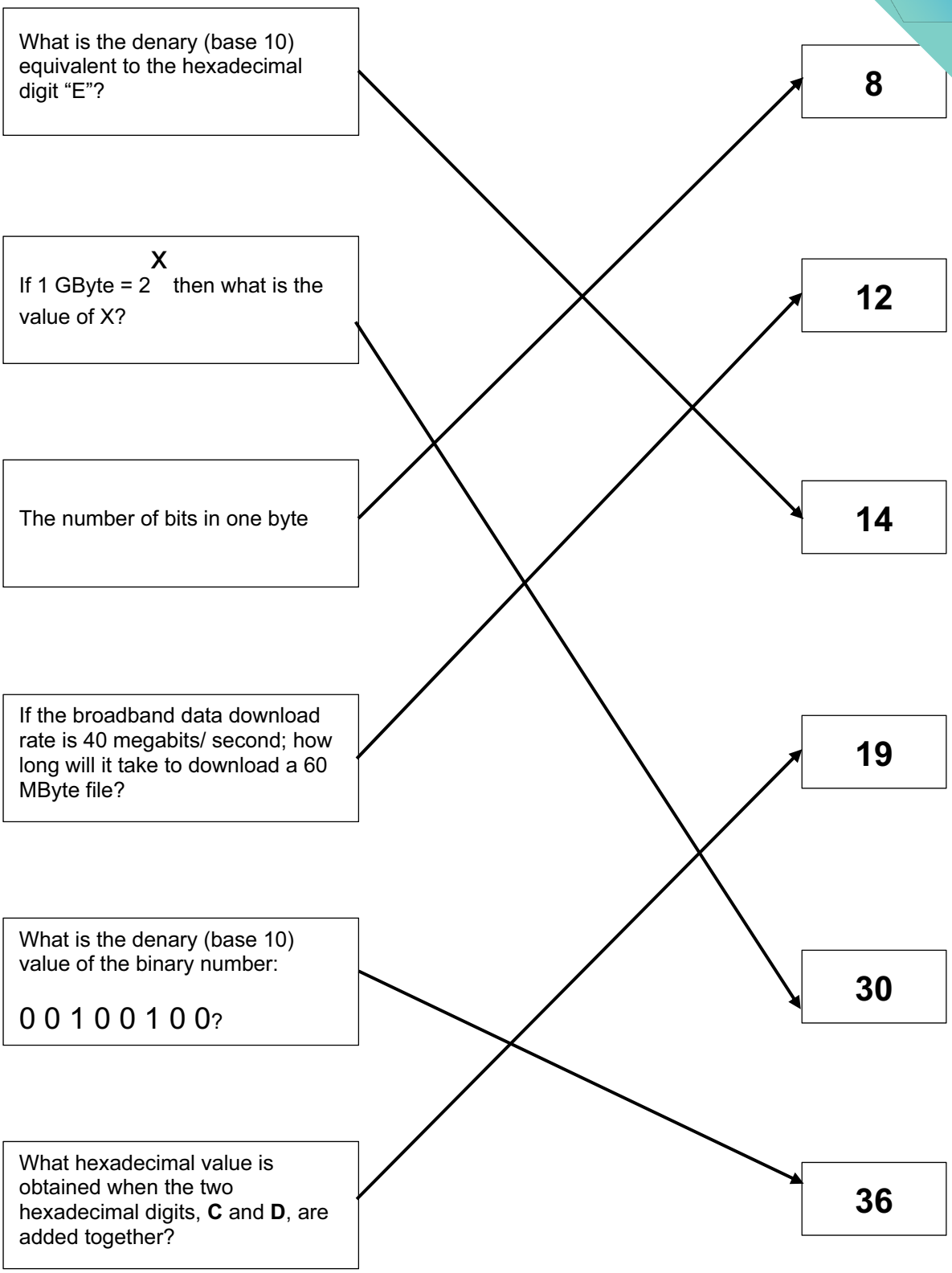
– higher resolution

– much thinner monitors possible/lighter weight

– more reliable technology/longer lasting

– uses much less power/more efficient [2]

9



5/6 matches – 5 marks
4 matches – 4 marks
3 matches – 3 marks
2 matches – 2 marks
1 match – 1 mark

[5]

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]

9 (a)

Binary number A:	**1**	**1**	**1**	**0**	**0**	**1**	**0**
Binary number B:	**1**	**0**	**0**	**1**	**1**	**1**	**0**

[2]

(b)

	Parity Bit
Binary number A	**1**
Binary number B	**1**

[2]

10 **1** mark for each correct storage device

ROM (not EPROM/PROM)
Blu-ray disc
RAM
DVD/ DVD-R(+R)/ DVD-RW(+RW)/ DVD-ROM (not CD or DVD-RAM)
SSD/example of a USB storage device
DVD-RAM

[6]

11 **1** mark for each correct point

- Presentation is used to format colour/style
- Structure is used to create layout
- In a HTML document structure and presentation are often kept separate
- By keeping the presentation separate it is easier to update colour/font
- Presentation is often stored in a file called a CSS …
- … the CSS in then linked to the HTML document to implement the presentation requirements
- (Mark-up) tags are used to define the structure of the document …
- … presentation and formatting can also be included within the tags [4]

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 5.

Question	Answer	Marks
7(c)(i)	Any **two** from: – Locked padlock – HTTPS – View the certificate	**2**
7(c)(ii)	Any **four** from: – requests web server to identify itself/view the (SSL) certificate – receives a copy of the (SSL) certificate, sent from the webserver – checks if (SSL) certificate is authentic/trustworthy – sends signal back to webserver that the certificate is authentic/trustworthy – starts to transmit data once connection is established as secure	**4**

Question	Answer	Marks
8		**6**

Statement	3D (✓)	Inkjet (✓)	Laser (✓)
Uses a moving print head	✓	✓	
Uses liquid ink		✓	
Produces output using materials such as plastic and resin	✓		
Uses piezoelectric or thermal technology	(✓)	✓	
Uses a rotating drum to transfer the image to the paper			✓
Uses layer upon layer of material to create the output	✓		

One mark per each correct row.

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**

5 (a) (i) Inkjet printer

Any **four** from**:**
- uses cartridges/liquid ink
- makes use of thermal bubble/piezoelectric technology
- sprays ink in droplets on the paper
- uses a moving print head
- suitable for low volume (high quality) output, e.g. a photo

[4]

(ii) Laser printer

Any **four** from**:**
- uses powdered ink/toner cartridges
- uses a (charged) printing drum
- makes use of static electricity charges
- uses a fuser to fix/melt ink onto the paper
- uses a discharge lamp to remove static charge from the drum
- useful for high volume (high quality) output, e.g. leaflets

[4]

(b) Any **three** from:
- produces solid, 3D objects/prototypes
- used in CAD/CAM
- makes use of tomography/slices of an object
- solid built up in thin layers
- uses resin, powdered metal, paper, plastic…

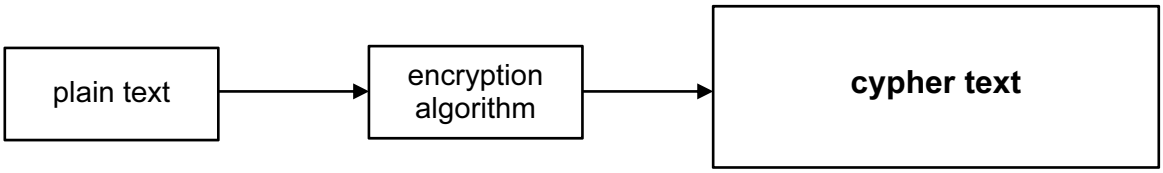
[3]

6 (a) Any **one** from:
- jumbling up/scrambling characters so that message makes no sense
- requires an encryption key to encrypt data
- need decryption key to decipher encrypted message

[1]

(b) Uses the same key to encrypt and decrypt message [1]

(c) 1 mark for correct name in box



[1]

(b) (i) 1 mark for each correct parity bit

parity bit

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

parity bit

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

[2]

(ii) Any **one** from:
- an even number of digits are changed
- a transposition error(s) has occurred

[1]

8 1 mark for each step in correct order. (NOTE: Marks can be awarded for a correct sequence.)

Steps in the printing process	Step order
As the printing drum rotates, a laser scans across it; this removes the positive charge in certain areas	**4**
The printing drum is coated in positively-charged toner; this then sticks to the negatively-charged parts of the printing drum	**6**
The paper goes through a fuser which melts the toner so it fixes permanently to the paper	**9**
The printer driver ensures that the data is in a format that the laser printer can understand	***(1)***
A negatively-charged sheet of paper is then rolled over the printing drum	**7**
Data is then sent to the laser printer and stored temporarily in the printer buffer	**2**
The toner on the printing drum is now transferred to the paper to reproduce the required text and images	**8**
The printing drum is given a positive charge	**3**
Negatively-charged areas are then produced on the printing drum; these match exactly with the text and images to be printed	**5**

[8]

(c) Register Z

(d) **(i)** (byte) 5

(ii) (column) 4 [1]

(iii) corrected byte is: **1 0 0 1 1 1 1 1** [1]

(iv) that gives the value: **1 5 9**
(follow through applies) [1]

(v) Any **two** from:

– The byte would be transmitted without having 5 consecutive 1's
– The fault condition would not be recognised [2]

6 Any **two** from:

High level language

– easier/faster to write code as uses English-like statements
– easier to modify as uses English-like statements
– easier to debug as uses English-like statements
– portable language code

Any **two** from:

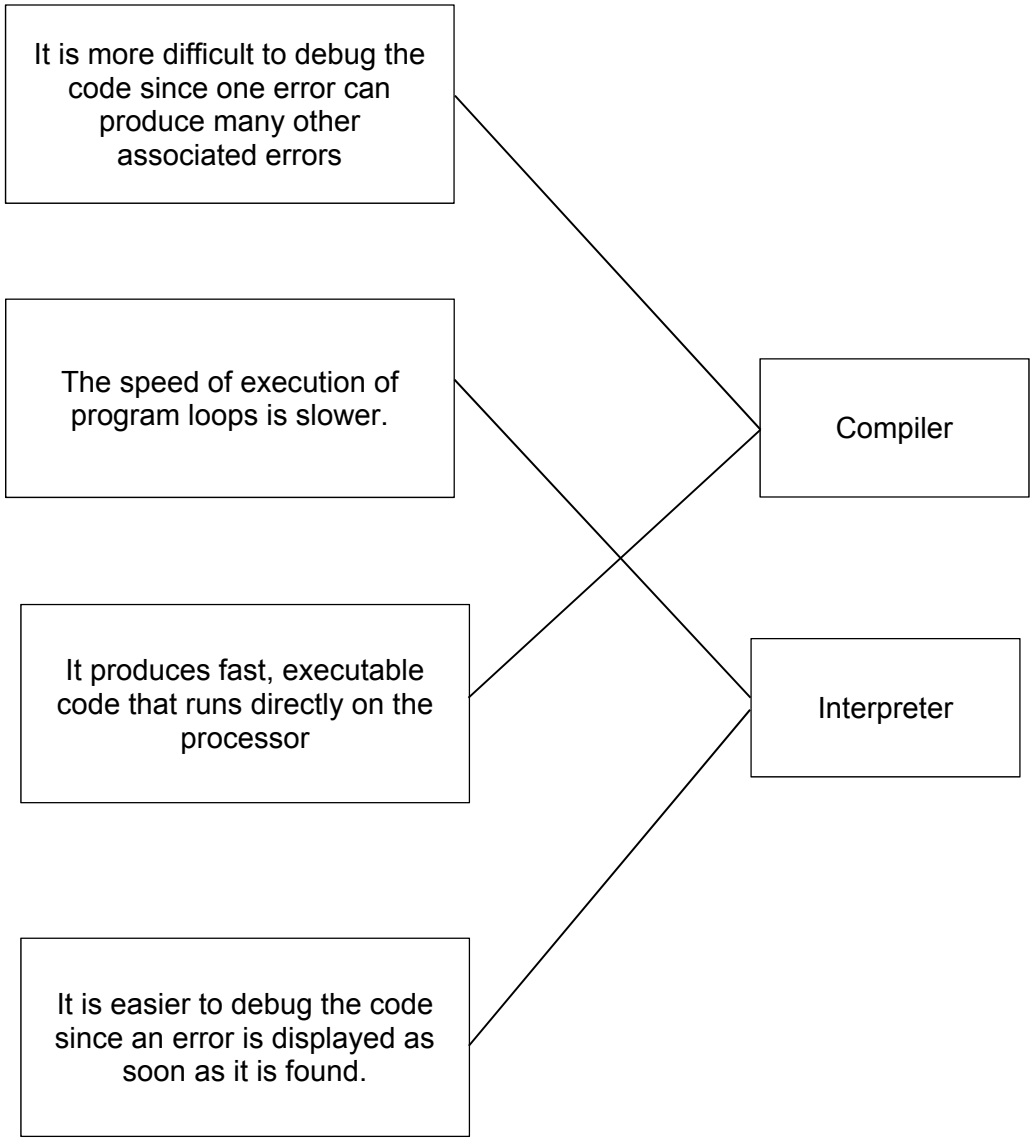
Low level language

– can work directly on memory locations
– can be executed faster
– translated program requires less memory [4]

7 Any **four** from:

– reaches maximum brightness quickly
– colours are vivid
– good colour definition/contrast can be achieved
– screens can be thinner/thin
– more reliable as LED's are long lasting
– consume very little/less energy [4]

8


It is more difficult to debug the code since one error can produce many other associated errors
The speed of execution of program loops is slower.
It produces fast, executable code that runs directly on the processor
It is easier to debug the code since an error is displayed as soon as it is found.
Compiler
Interpreter

[4]

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 9.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>1 mark for the correct ticks (✓) for each statement
<table>
<tr><th>Statement</th><th>3D printer (✓)</th><th>3D cutter (✓)</th></tr>
<tr><td>Outputs a physical 3D product</td><td>✓</td><td>✓</td></tr>
<tr><td>Uses a high powered laser to create the output</td><td></td><td>✓</td></tr>
<tr><td>Creates 3D prototypes</td><td>✓</td><td>✓</td></tr>
<tr><td>Uses layers of material to create the output</td><td>✓</td><td></td></tr>
</table></td><td>4</td></tr>
<tr><td>6(b)</td><td>Computer Aided Design/CAD</td><td>1</td></tr>
<tr><td>6(c)</td><td>Three from:
• Uses a large number of tiny mirrors
• Mirrors are laid out in a grid/matrix
• Each mirror creates a pixel in the image
• Mirrors can tilt toward or away from light source
• The mirrors reflect light toward a (projection) lens
• Colour is produced using a colour wheel // Light passes through colour wheel // filters light into red/green/blue
• Can be used to display an image on a wall/screen</td><td>3</td></tr>
</table>

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 10.

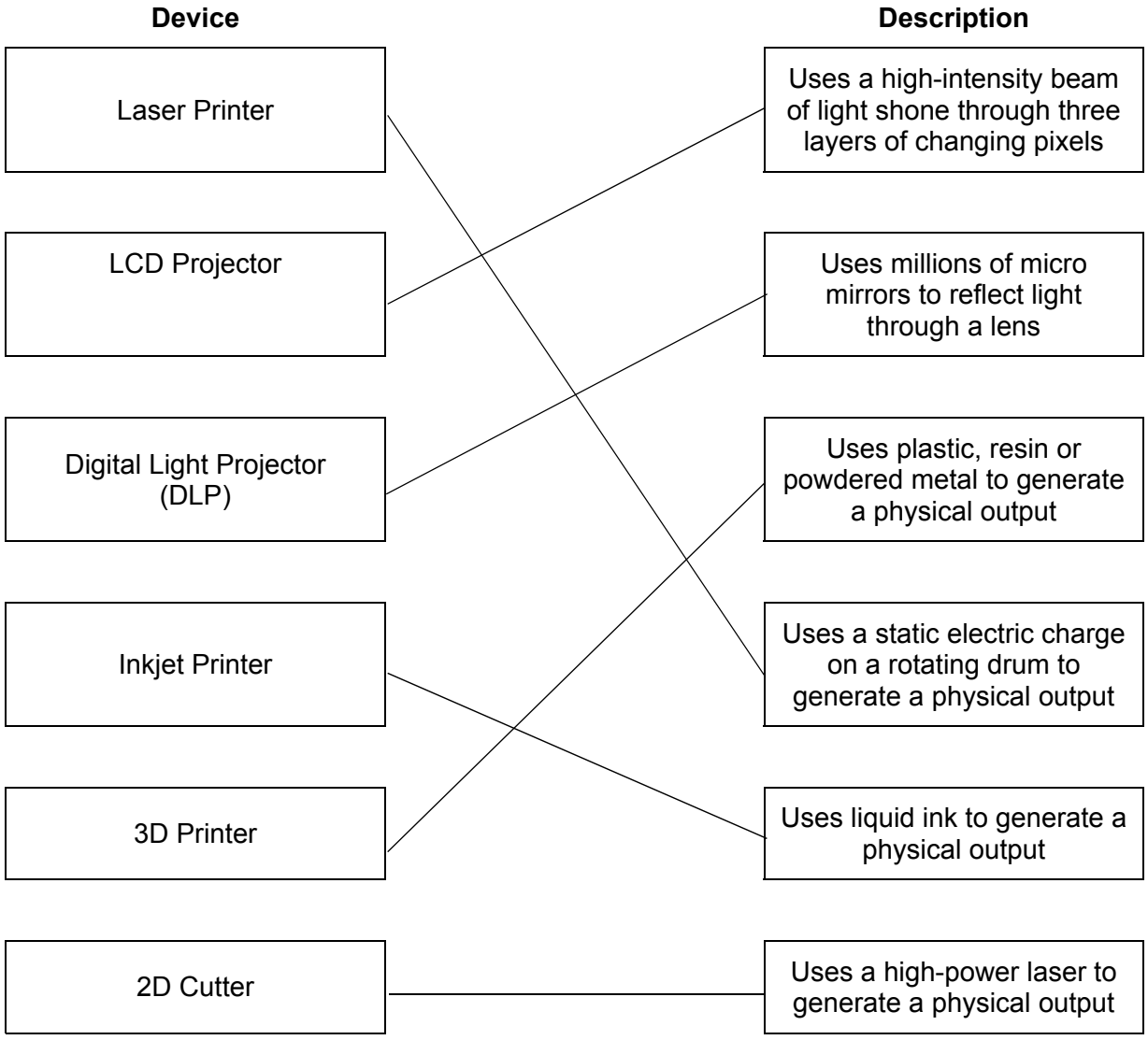
Question	Answer	Marks
4(a)	**Three** from: • Malware • Virus // No antivirus • Denial of service • Spyware // No antispyware • Phishing // opening unknown links/emails • Pharming // opening unknown links/emails (only award once for this alternative) • Hacking/cracking/unauthorised access // No/weak password // No/weak firewall • Downloading/Using unknown software • Not updating software • Physical issue e.g. computer/door left unlocked	**3**
4(b)	**Four** from: • It examines/monitors/filters traffic into **and** out of a computer • It allows a user to set criteria/rules for the traffic • It checks whether the traffic meets the criteria/rules • It blocks any traffic that does not meet the criteria/rules // Blocks unauthorised access • It warns a **user** of any unauthorised software/access/unauthorised outgoing traffic • It keeps a log of all traffic (that can be examined)	**4**

Question	Answer	Marks
5(a)(i)	2D/3D cutter	**1**
5(a)(ii)	Liquid crystal display // LCD	**1**
5(a)(iii)	Actuator	**1**
5(b)	1 mark for each correct missing word, in the given order: • interactive whiteboard • inkjet • thermal bubble • laser • rotating	**5**

Question	Answer	Marks
6(a)	• Compiler • Interpreter	**2**
6(b)	**Four** from: • Closer to human language/English … • … so it is easier/quicker to read/write/understand • … so it is easier/quicker to debug the program • … therefore, less likely to make errors • The program can be used on many different platforms … • … because it is written in source code • … because it is compiled into object code • They have built-in functions/libraries … • … this saves time when writing the program • Do not need to manipulate memory addresses directly … • … therefore, specialist knowledge of this is not required • Only need to learn a single language … • … as this can be used on many different computers	**4**

QUESTION 11.

Question	Answer	Marks
1	1 mark for each correct line, maximum 5 marks	5

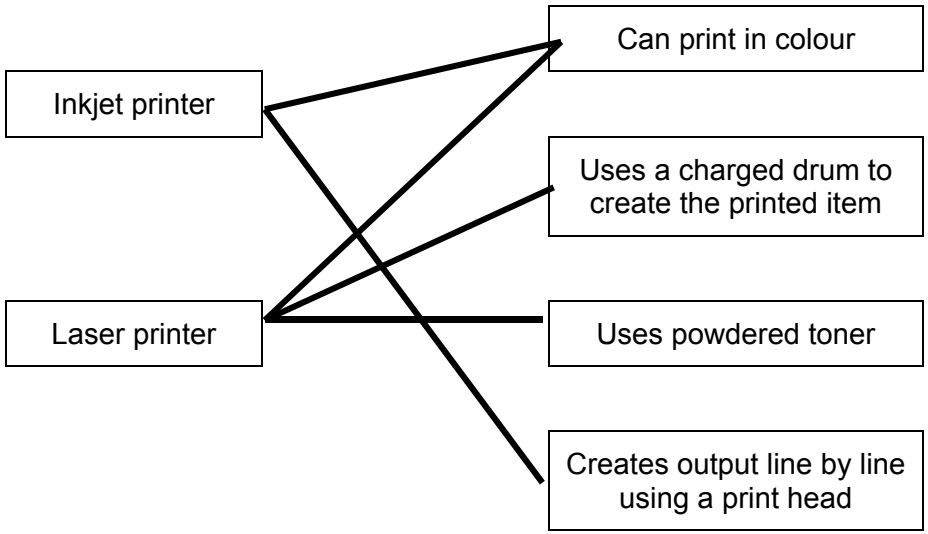


<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>2 marks for 3 correct bits, 1 mark for 2 correct bits

<table>
<tr><td>Parity Bit</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
</table></td><td>2</td></tr>
<tr><td>2(b)</td><td>Two from:
• Set of rules for controlling error checking/detection // it’s an error detection method // used to detect errors
• 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</td><td>2</td></tr>
<tr><td>2(c)</td><td>Checksum</td><td>1</td></tr>
</table>

Question	Answer	Marks
3	**Six** from: • A pressure sensor is used • The sensor sends data/signals to the microprocessor • Data is converted to digital format • Microprocessor compares data value against set **value** • If value <= 2400 Kg/under weight limit lift is permitted to operate • If value > 2400 Kg/over weight limit **signal is sent from the microprocessor** to deliver warning message to passengers • If value > 2400 Kg **signal is sent from the microprocessor** to lift mechanism to stop lift operating • Weight continuously monitored	**6**

QUESTION 12.

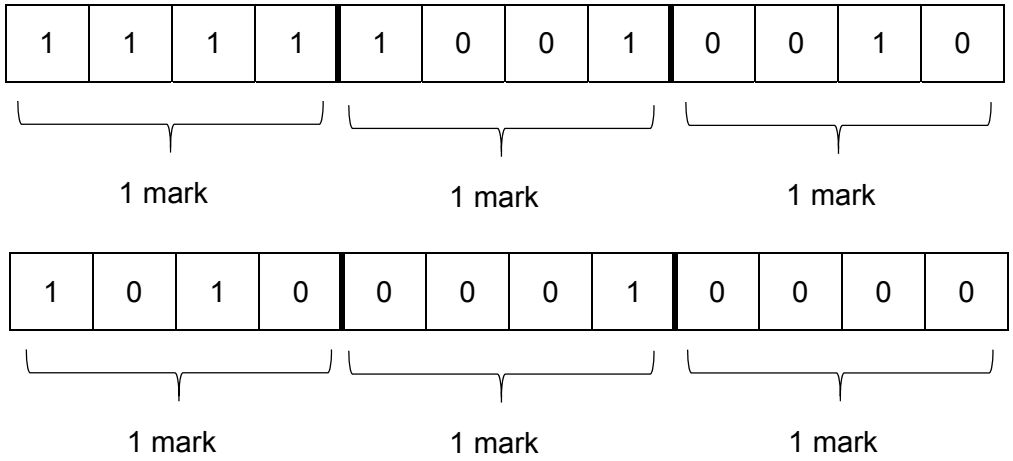
Question	Answer	Marks
1(a)	**Printer** **Statement**  **One** mark for correct lines from inkjet **One** mark for correct lines from laser	**2**
1(b)	• Laser	**1**
1(c)	**Two** from: • Design is created on the computer / software / CAD • Material is loaded to cutter • Different types of material can be used • Uses lasers to cut material … • … that use infra-red • … that produces extreme heat • … that is focussed using a special lens • Can work on both the *x*,*y* and *z* axis	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>One mark for each correct denary value

<table>
<tr><th>Binary</th><th>Denary</th></tr>
<tr><td>0001001110</td><td>78</td></tr>
<tr><td>0110110111</td><td>439</td></tr>
<tr><td>1000000001</td><td>513</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>2(b)</td><td>Two from:
• Uses fewer characters // shorter
• Easier to read / write / understand
• Less likely to make mistakes // less error prone
• Easier to debug</td><td>2</td></tr>
<tr><td>2(c)</td><td>One mark for each correct hexadecimal value in correct order
2 B 5</td><td>3</td></tr>
</table>

QUESTION 13.

Question	Answer	Marks
1(a)(i)	**Two** from: • 2D scanner • Touchscreen • Keypad/keyboard • Card reader • Mouse • Digital camera	**2**
1(a)(ii)	**Two** from: • HDD • SSD • USB flash memory drive • SD card • Any optical	**2**
1(a)(iii)	**Two** from: • Monitor/Touch screen • Speaker • Printer • LED // Light	**2**
1(b)(i)	• Increase the length of the key // make key 12-bit, etc.	**1**
1(b)(ii)	• Cypher text	**1**

Question	Answer	Marks
1(b)(iii)	**Six** from: • The system could use odd or even parity • A parity bit is added • The data is checked to see if it has incorrect/correct parity // by example • If parity is correct no error is found • An acknowledgement is sent that data is received correctly • The next packet of data is transmitted • If incorrect parity is found an error has occurred • A signal is sent back to request the data is resent • The data is resent until data is received correctly/timeout occurs	**6**
1(c)(i)		**6**

Question	Answer	Marks
1(c)(ii)	**One** mark for identification: • Compression **Three** from e.g.: • Best compression would be lossy • Use compression algorithm • This would remove all the unnecessary data from the file // removes detail/sound that the human eye/ear may not see/hear • Reduce colour palette … • … so each pixel requires fewer bits • Reduce resolution • Only store what changes between frames // temporal redundancy	**4**
1(d)	**Five** from: • The display is made up of pixels … • … that are arranged together as a matrix • Each pixel has three filters, red, blue and green • Shades of colour are achieved by mixing red, blue and green • The screen is backlit • Light is shone through the liquid crystals • The liquid crystals can be made to turn solid or transparent/on or off … • … by changing the shape of the crystal	**5**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>One mark for each correct row
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr>
<tr><td>High-level languages need to be translated into machine code to run on a computer</td><td>✓</td><td></td></tr>
<tr><td>High-level languages are written using mnemonic codes</td><td></td><td>✓</td></tr>
<tr><td>High-level languages are specific to the computer’s hardware</td><td></td><td>✓</td></tr>
<tr><td>High-level languages are portable languages</td><td>✓</td><td></td></tr>
</table></td><td>4</td></tr>
</table>