

5 Data is processed by the central processing unit (CPU) in a computer that has a Von Neumann architecture.

(a) Complete the table with the missing terms and definitions about processing data.

Term	Definition
current instruction register (CIR)	
	This is a processing unit within the CPU that can fetch, decode and execute instructions.
	This is a list of all the commands that can be processed by the CPU.
cache	
accumulator	

[5]

(b) Identify the component in the CPU that is responsible for decoding an instruction.

[1]

(c) Explain how the clock speed can affect the performance of a CPU.

5 An online company has a website that allows a user to buy products.

The user types in the uniform resource locator (URL) for the website and this is sent to a domain name server (DNS).

(a) Describe the role of the DNS.

[2]

(b) The website asks a user to input their username and password to log into their account.

The company want to make their login system more secure.

Tick (✓) **one** box to show **one** other security method that could be added to make the login system more secure.

- A

access levels

☐
- B

firewall

☐
- C

spyware

☐
- D

two-step verification

☐

[1]

(c) The company uses a proxy server to keep the web server safe from distributed denial of service (DDoS) attacks.

(i) Complete and annotate a diagram to show how a DDoS attack is carried out on the web server.



[5]

(ii) Identify **two** tasks that can be performed by a proxy server that are **not** performed by a firewall.

- 1

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.....
- 2

.....

.....

[2]

(d) The company uses cookies to allow users to keep items in a shopping cart. The items remain in the cart after the user closes their web browser.

(i) Tick (✓) **one** box to show the type of cookie that is used for this process.

- A

dynamic

☐
- B

persistent

☐
- C

session

☐
- D

static

☐

[1]

(ii) Give **three** other ways that the company can use cookies.

- 1
- 2
- 3

[3]

(iii) Cookies are stored by a web browser.

Give **two** other functions of a web browser.

- 1
- 2

[2]

4 A company decides to create a network for its devices.

All the company devices are within a single room.

The employees will need to use their devices to send data to each other and share files.

The company decides to send data across the network using packet switching.

(a) An employee sends an email to another employee. The email is broken down into packets.

Describe the structure of a packet of data for the email.

[4]

(b) The company decides to use parallel full-duplex data transmission to send the data across the network.

(i) Explain the reasons why the company have chosen this method of data transmission.

[4]

(ii) Give **two** drawbacks of the company using this method of data transmission.

1

2

[2]

(iii) Give **one** other method of data transmission the company could have chosen.

[1]

1 Data can be measured in bits.

(a) Give the name of the data storage measurement that is equal to 8 bits.

..... [1]

(b) State how many bits there are in a kibibyte (KiB).

..... [1]

(c) Give the name of the data storage measurement that is equal to 1024 gibibytes (GiB).

..... [1]

(d) A 16-bit colour image has a resolution of 512 pixels wide by 512 pixels high.

Calculate the file size of the image in kibibytes (KiB). Show all your working.

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.....
.....
.....
.....

Answer KiB

[3]

3 A programmer is creating a computer game. One character is **not** moving correctly.

The programmer needs to debug the program. To do this they need to look at addresses that are locations in memory.

The addresses are displayed as hexadecimal numbers.

(a) One address is A2F.

(i) Convert the address to binary.

..... [3]

(ii) Convert the address to denary.

..... [1]

Working space

.....
.....
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.....

(b) The binary number stored for another address is 000110011011.

(i) Convert the binary number to hexadecimal.

..... [3]

(ii) Convert the binary number to denary.

..... [1]

Working space

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.....

(c) Give **one** reason why the addresses are displayed in hexadecimal instead of binary.

.....
..... [1]

(d) Identify **two** other ways that hexadecimal is used in computer science.

- 1
- 2 [2]

(e) The health value for a character in the computer game can sometimes be a negative value. The negative values are stored as two’s complement 8-bit integers.

A character has a health value of −25.

Calculate the two’s complement 8-bit integer for −25. Show all your working.

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-
-
-
-
- [2]

5 A website allows users to purchase items.

Computer A sends a request for the homepage to the website’s server.

(a) The request is sent using packet switching.

The structure of a packet of data has three elements. One element is the packet header.

(i) Identify **two** items of data contained in a packet header.

- 1
- 2 [2]

(ii) Identify the **two** other elements of a packet.

- 1
- 2 [2]

- (b) Computer A needs to be directly connected to a router that is located in a different room.
- (i) Tick (✓) **one** box to identify whether serial data transmission or parallel data transmission is more suitable for this connection.

Explain the reasons for your choice.

Serial data transmission

Parallel data transmission

Reasons for your choice

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..... [3]

- (ii) The connection will also use full-duplex data transmission.

Define full-duplex data transmission.

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.....

..... [2]

- (c) The data transmission will use parity checks.
- (i) The bytes need to be sent using an even parity byte check.

Complete the parity bit for each byte.

	Parity bit						
Byte A		1	1	0	0	0	1 1
Byte B		0	0	0	0	0	0 0

[2]

- (ii) A parity block check can be used instead of a parity byte check.

Explain how a parity block check might detect an error in transmission that would **not** be detected by a parity byte check.

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.....

[2]

(iii) The data was sent using an even parity block check. One of the bits has been transmitted incorrectly.

	Parity bit	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Byte 0	1	1	1	0	1	0	0	0
Byte 1	0	0	1	0	0	1	0	0
Byte 2	1	0	1	1	0	0	0	1
Byte 3	1	1	0	0	1	1	1	1
Byte 4	1	0	1	0	0	0	1	0
Byte 5	0	0	0	0	0	0	0	0
Byte 6	0	1	1	1	1	0	0	0
Parity byte	0	1	1	0	1	0	1	0

Identify the bit number and the byte number of the incorrect bit.

Bit number

Byte number

[2]

- (d) The website allows the user to set up an account to log on and purchase items. The website is accessed and displayed using a web browser.
- (i) Two functions of the web browser are to render hypertext markup language (HTML) to display web pages and to store cookies.

Identify **two** other functions of a web browser.

- 1
- 2 [2]

- (ii) Identify **two** ways that cookies can be used to enhance the user’s experience of this website.

- 1 [2]
- 2