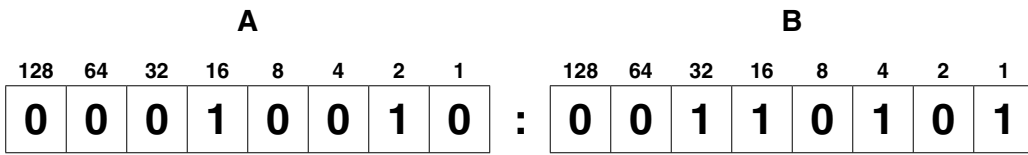# QUESTION 1.

8 An alarm clock is controlled by a microprocessor. It uses the 24 hour clock. The hou̶...
by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit reg...

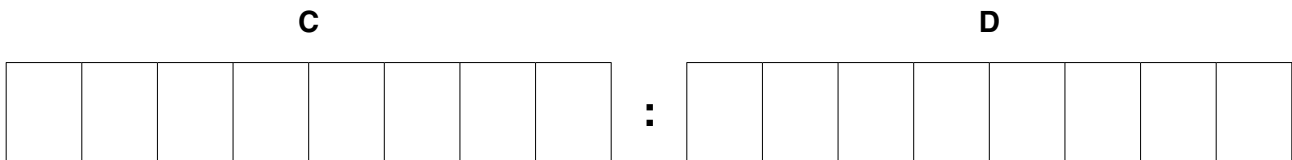**(a)** Identify what time is represented by the following two 8-bit registers.

A

128	64	32	16	8	4	2	1
0	0	0	1	0	0	1	0

B

128	64	32	16	8	4	2	1
0	0	1	1	0	1	0	1

Hours .... Minutes ....

[2]

(b) An alarm has been set for 07:30. Two 8-bit registers, **C** and **D**, are used to represent the hours and minutes of the alarm time.

Show how 07:30 would be represented by these two registers:

C

Hours

D

Minutes

[2]

(c) Describe how the microprocessor can determine when to sound the clock alarm.

....

....

....

....

....

....[3]

(d) The LCD (liquid crystal display) on the clock face is back-lit using blue LEDs (light emitting diodes). The brightness of the clock face is determined by the level of light in the room. The amount of light given out by the LEDs is controlled by a control circuit.

Describe how the sensor, microprocessor and LEDs are used to maintain the correct brightness of the clock face.

....

....

....

....

....

....

....

....[3]

(e) Modern LCD monitors and televisions use LED back-lit technology.

Give **two** advantages of using this new technology compared to the older cold cathode fluorescent lamp (CCFL) method.

1 ....

....

....

2 ....

....

....
[2]

QUESTION 2.

7 Each seat on a flight is uniquely identified on an LCD above the seat. For examp
shown as:
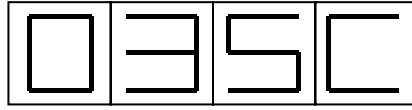
The first three characters are digits that represent the row.
The fourth character is the seat position in that row. This is a single letter, A to F, that is stored as a hexadecimal value.

Each of the four display characters can be stored in a 4-bit register. For example, 0 and C would be represented as:

	8	4	2	1
0:	0	0	0	0
C:	1	1	0	0

(a) Show how the 4-bit registers would store the remaining two characters, 3 and 5.

3

5

[2]

(b) Identify which seat is stored in the following 4-bit registers.

0	0	0	1	→ ....
1	0	0	1	→ ....
0	1	0	0	→ ....
1	1	1	0	→ ....

[2]

QUESTION 3.

3 **(a)** Convert the following hexadecimal number into 12-bit binary:

4 A F

[3]

(b) The 2016 Olympic Games will be held in Rio de Janeiro. A timer that counts down to the opening of the Games is shown on a microprocessor-controlled display.

The number of hours, minutes and seconds until the Games open are held in three 8-bit registers.

The present register values are:

0	1	1	0	1	0	0	1

105 hours

0	0	1	0	0	0	0	0

32 minutes

0	0	0	1	0	1	0	0

20 seconds

The timer will count **down** in seconds.

(i) Show the values in each 8-bit register **30 seconds** after the time shown above:

hours

minutes

seconds

[3]

(ii) Write the hexadecimal value of the **minutes** register from **part (b)(i)**.

....[1]

QUESTION 4.

6 Signals are sent to and from the components of a processor using buses.

Identify and describe the purpose of **two** different buses.

Bus 1 ....

Purpose ....

....

....

....

....

Bus 2 ....

Purpose ....

....

....

....

....

[6]

QUESTION 5.

5 **(a)** The denary number 57 is to be stored in two different computer registers.

Convert 57 from denary to binary and show your working.

....

....

....

....[2]

(b) Show the binary number from **part (a)** as it would be stored in the following registers.

Register 1

Register 2

[2]

(c) A binary number stored in a register can have many different uses, for example an address in main memory.

Give **two** other uses for a binary number stored in a register.

Use 1 ....

Use 2 ....

[2]

(d) A register in a computer contains binary digits.

0	0	1	1	1	0	1	0

The contents of the register represent a binary integer.

Convert the binary integer to hexadecimal.

....

....[1]

QUESTION 6.

10 Alexandra has a new mobile device.

It has a touch screen that uses capacitive technology.

(a) Describe how a capacitive touch screen registers Alexandra's touch.

....

....

....

....

....

....

....

.... [4]

(b) Alexandra is wearing gloves because it is cold.

She presses an icon on her touch screen but her action is not registered.

(i) Explain why the touch screen will not register her touch.

....

....

....

.... [2]

(ii) Alexandra does not want to remove her gloves.

Explain how Alexandra could use her mobile device whilst still wearing gloves.

....

....

....

.... [2]

QUESTION 7.

10 Explain how an instruction is fetched in a computer based on the Von Neumann

....

....

....

....

....

....

....

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....

....

.... [6]

11 Identify **three** similarities between CDs and DVDs.

1 ....

....

2 ....

....

3 ....

....

[3]

QUESTION 8.

6 **Six** statements are given about touch screen technology.

Tick (✓) to show if the statement applies to **Capacitive** or **Resistive** touch screen tech

Statement	Capacitive (✓)	Resis... (✓)
Needs pressure to be applied to create a circuit		
May not register a touch if the user is wearing gloves		
More commonly used in smartphones		
More responsive to a touch		
Needs an electrical field to be changed to register a touch		
Cheaper to manufacture		

[6]

QUESTION 9.

5 (a) A clothing shop uses a barcode reader at the checkout.

The checkout is linked to a stock control system. The system monitors stock automatically keeps them above a minimum level.

Explain how the stock control system automatically keeps the stock levels above a minim. level.

....

....

....

....

....

....

....

.... [4]

(b) The software for the stock control system is stored on a central computer. The computer uses random access memory (RAM), read only memory (ROM) and a hard disk drive (HDD).

The computer is a Von Neumann model computer system with a central processing unit (CPU).

(i) State the purpose of the RAM, ROM and HDD in the central computer.

RAM ....

....

ROM ....

....

HDD ....

....
[3]

(ii) Identify **four** components that are part of the CPU.

Component 1 ....

Component 2 ....

Component 3 ....

Component 4 ....
[4]

3 **(a)** Three statements about cookies are shown below.

Study each statement.

Tick (✓) to show whether the statement is true or false.

Statement	True	False
Cookies can destroy or modify data in a computer without the user's knowledge		
Cookies generate website pop-ups		
Cookies allow a website to detect whether a viewer has viewed specific web pages		

[3]

(b) Two features of Von Neumann architecture are the use of registers and the use of buses.

Give the names of **two** registers and **two** buses.

Registers

1 ....

....

2 ....

....

Buses

1 ....

....

2 ....

....

[4]

QUESTION 11.

5   Three switches, A, B and C, each send values of 0 or 1 to a logic circuit. Value X is output from the logic circuit.

Switch A ──────────▶ ┌─────────────────┐
Switch B ──────────▶ │ Logic circuit │ ──────▶ Output X
Switch C ──────────▶ └─────────────────┘
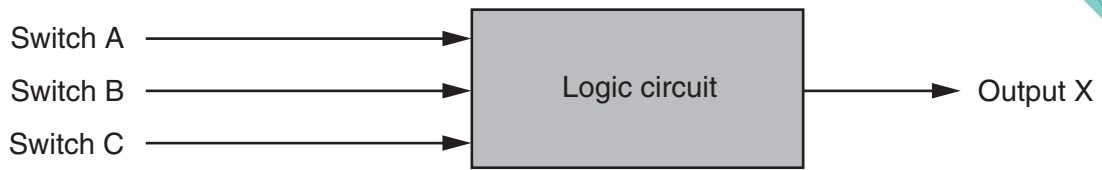
Output X has a value of 1 depending on the following conditions:

Switch A sends value 1 AND Switch B sends value 0

OR

Switch B sends value 1 AND Switch C sends value 0

(a)   Draw a logic circuit to represent the conditions above.

A ──

B ──   ── X

C ──
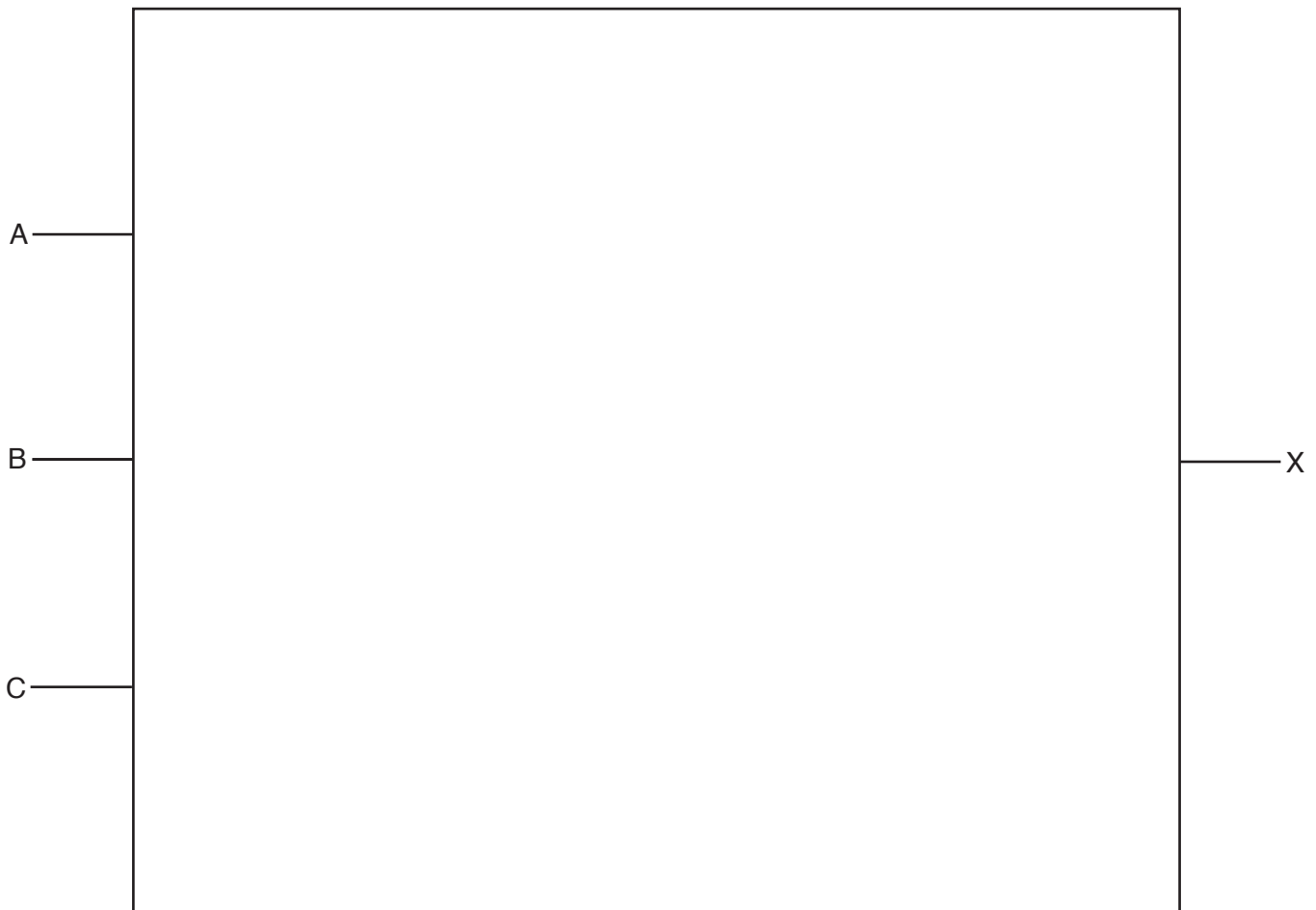
[5]

(b) Complete the truth table for the conditions given at the start of question 5.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) A microprocessor regularly samples the output, X. Each sample value is stored in an 8-bit register as shown below. One bit of this register is reserved as a parity bit.

Five consecutive output values of 1 indicate a fault condition.

Identify which of the following registers shows a fault condition.

Parity bit

| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | **Register Y** |

| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **Register Z** |

Register ....[1]

(d) When eight bytes of data have been collected, they are transmitted to a c̶ away. Parity checks are carried out to identify if the data has been transmitted system uses **even parity** and column 1 is the parity bit.

The eight bytes of data are sent together with a ninth parity byte:

	parity bit	column 2	column 3	column 4	column 5	column 6	column 7	column 8
byte 1	1	0	0	0	0	1	0	0
byte 2	1	1	1	1	0	0	1	1
byte 3	0	1	0	0	1	0	0	0
byte 4	0	1	1	1	0	0	0	1
byte 5	1	0	0	0	1	1	1	1
byte 6	0	0	0	0	0	0	0	0
byte 7	1	1	1	0	1	0	0	0
byte 8	1	0	0	0	1	1	1	0
parity byte	1	0	1	1	0	1	1	1

(i) Identify which of the eight bytes contains an error.

byte ....[1]

(ii) Identify which column contains an error.

column ....[1]

(iii) The incorrect bit is indicated where the byte number and column cross.

Give the corrected byte.

[1]

(iv) Calculate the denary value of the corrected byte.

....

....[1]

(v) Considering the fault condition given in **part (c)**, explain why it is very important that the incorrect bit is located and corrected.

....

....

....

....[2]

QUESTION 12.

(b) Draw a logic circuit corresponding to the logic statement:

X = 1 if ((A is 1 AND B is 1) AND (A is 1 OR C is NOT 1)) OR (B is 1 AND C is NOT

A ———

B ——— X

C ———

[6]

11 The fetch-execute cycle make use of registers.

(a) Describe the role of the Program Counter (PC).

....

....

....

....[2]

(b) Describe the role of the Memory Data Register (MDR).

....

....

....

....[2]

(d) Give **two** benefits of using sensors to monitor the manufacture of plastic pipe

1 ....

....

2 ....

....

[2]

8 Explain how an instruction is fetched in a Von Neumann model computer.

....

....

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.... [6]

9 HTML can be used to create the structure and the presentation of web pages.

(a) Describe what is meant by HTML structure.

....

....

....

....

.... [2]

4 An 8-bit binary register contains the value:

0	0	1	1	0	1	0	0

(a) Convert the binary value to denary.

....

.... [1]

(b) The contents of the register shifted one place to the right would give the result:

0	0	0	1	1	0	1	0

The contents of the register shown at the start of question 4 are shifted two places to the left.

Show the contents of the register after this shift has taken place.

[1]

(c) State the effect this shift has on the denary value in **part (a)**.

....

.... [1]

5 Audrey wants to send a sound file to Nico using email.

The file is too large to attach to an email so Audrey decides to compress the file.

She uses lossy compression to reduce the size of the sound file.

(a) Describe how lossy compression reduces the size of the sound file.

....

....

....

....

....

....

....

.... [4]

(d) For the fourth question, he writes the answer:

"This is when a person copies another person's computer program and tries to cla[...] own."

State what Jesse is describing.

.... [1]

(e) For the fifth question, he writes the answer:

"This is the legal protection that a person can obtain, to provide protection against his work being stolen."

State what Jesse is describing.

.... [1]

7 The Von Neumann model for a computer system has several components that are used in the fetch-execute cycle.

(a) One component is main memory.

(i) Describe what is meant by main memory and how it is used in the Von Neumann model for a computer system.

....

....

....

....

....

.... [3]

(ii) State **two** other components in the Von Neumann model for a computer system.

1 ....

2 ....
[2]

(b) Computer systems often use interrupts.

Five statements are given about interrupts.

Tick (✓) to show if each statement is **True** or **False**.

Statement	True (✓)	False (✓)
Interrupts can be hardware based or software based		
Interrupts are handled by the operating system		
Interrupts allow a computer to multitask		
Interrupts work out which program to give priority to		
Interrupts are vital to a computer and it cannot function without them		