

COMPUTER SCIENCE
NOVEMBER 2022 SESSION

6023/01

Disclaimer: These are just suggested solutions. It is not the official marking guide from ZIMSEC.

1. (a) (i) State any one difference and one similarity between ASCII and Unicode.

[2]

Difference

- ASCII encodes symbols, digits, letters, whereas Unicode encodes special texts from different languages, letters, symbols.
- ASCII uses a 7-bit range to encode just **128** distinct characters. Unicode on the other hand encodes **154** written scripts.

Similarity

- The first 128 Unicode characters of ASCII characters are the same with Unicode

1 (a) (ii) State the number of bits used by an EBCDIC character.

[1]

- 8 bits

1 (b) Perform the following binary arithmetic operations in 8 bit systems. Show workings clearly.

(i) 01001001 + 00101111

[2]

(ii) 01101001 ÷ 00000101

[2]

$$\begin{array}{r}
 01001001 \\
 + 00101111 \\
 \hline
 01111000
 \end{array}$$

$$\begin{array}{r}
 10101 \\
 \begin{array}{r}
 101 \overline{) 1101001} \\
 \underline{- 101} \\
 110 \\
 \underline{- 101} \\
 101 \\
 \underline{101} \\
 0
 \end{array}
 \end{array}$$

1 (c) In the same b bit system, a student attempts to perform the following arithmetic operation

$$01100100 \times 00000011$$

(i) Perform the operation giving the result in 8 bits.

[3]

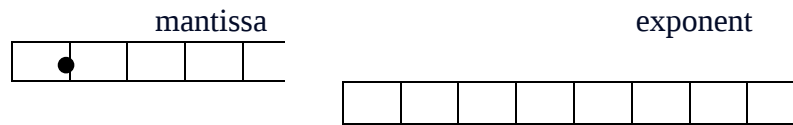
(ii) State the type of error that is ion the result.

[1]

$$\begin{array}{r}
 01100100 \\
 11 \\
 \hline
 100101100
 \end{array}$$

This is an **overflow**.

(d) A digital system uses 16 bits for its Normalised floating point representation.



Copy and complete the binary pattern for the:

- (i) the smallest positive value; [2]
- (ii) highest magnitude negative value. [2]

Smallest positive value: 01000000 10000001

Highest magnitude negative number: 10000001 01111111

2 (a) Define the term *IP address*. [2]

Unique characters that identifies each computer on the internet of local network.

2 (b) Explain the purpose of an IP address. [2]

- Identification of a device.
- Locating a device on a network.
- Can be used in troubleshooting a network.

2 (c) Distinguish between public and private IP addresses. [4]

- A public IP address is assigned to your network router by your network service provider and can be accessed directly over the internet.
- A private IP address is assigned by a local router to your device. This address is only visible within your network.
- The addresses assigned by your router (private) have local scope whereas public IP addresses have global scope.
- When using private IP address all data transfers stay within the network and are unaffected by external factors. On the other hand, the data transfers on public IP address can be shared and be affected by external factors.

2 (d) Describe the two components that make up the IP address. [4]

- **The network ID**- comprising the first three numbers of the address. - Host ID

3 (a) Define the term *protocol*. [2]

- Established set of rules that govern the transmission of data between different devices in a network.

(b) Describe the SMTP. [4]

Simple Mail Transfer Protocol is used to send and receive emails.

(c) State any **two** functions of the data link layer.

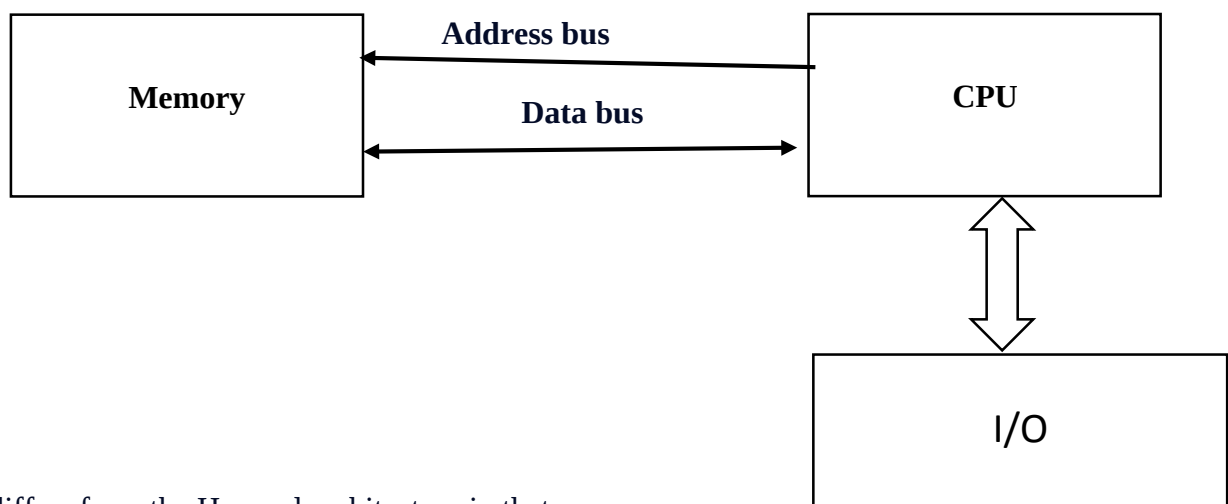
- Framing: Receives the stream of bits and divides them into manageable data units called frames.
- Error control: Handles problems that occurs as a result of bit transmission.
- Flow Control: Ensures data flows at a pace that does not overwhelm sending and receiving devices.
- Permits the transmission of data to the network layer.

4 (a) Explain any two types of interrupts and give an example of how each may be generated.

[6]

- **Hardware interrupts**- occurs when a signal for the processor is from a hardware device eg instruction from keyboard or mouse.
- **Software interrupts**- a particular instruction can be inserted into the desired location in the program.
- **Internal interrupts**- arise from an erroneous use of an instruction, eg division by zero, permanent termination of an instruction
- **External interrupts**- come from I/O devices, from a circuit monitoring the power supply or from any external source.

4(b) Draw a diagram representing a Von Neumann architecture and explain how it differs from the Harvard architecture.



It differs from the Harvard architecture in that:

- both data and instructions are stored in the same memory.
- Both data and instructions share the same buses.

5. A power station has a safety system based on three inputs to a logic network. A warning system signal ($S=1$) is produced when certain conditions occur based on these 3 inputs.

Input	Binary Value	Plant Status
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T	1	Temperature >120°C
	0	Temperature ≤120°C
P	1	Pressure > 10 bar
	0	Pressure ≤ 10 bar
W	1	Cooling water > 100l/hr
	0	Cooling water ≤100l/hr

A warning signal ($S=1$) will be generated if

either (a) Temperature > 120°C and cooling water ≤100l/hr

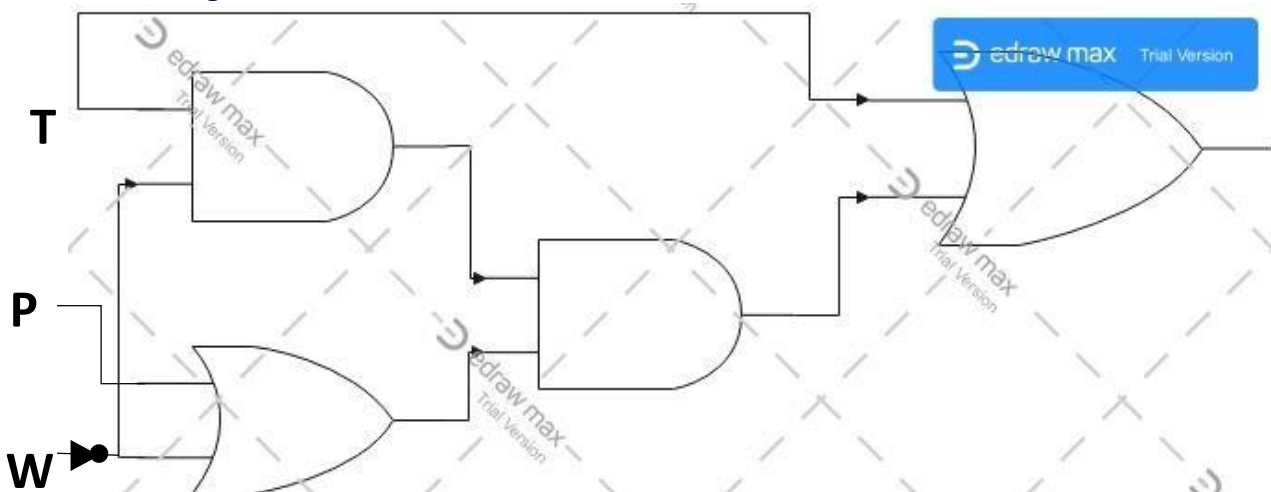
or (b) Temperature ≤120°C and (Pressure > 10 bar or cooling water ≤100l/hr)

Draw a logic network and truth table to show all the possible situations when the signal could be received. [8]

Boolean Expression

$$TW' + T'(P + W')$$

Circuit diagram



Truth Table

T	P	W	W'	TW'	P+W'	T'	T'(P+W)	S
0	0	0	0	0	1	1	1	1
0	0	1	1	0	0	1	0	1
0	1	0	0	0	1	1	1	1
0	1	1	1	0	1	1	1	1
1	0	0	0	1	1	0	0	0
1	0	1	1	0	0	0	0	0
1	1	0	0	1	1	0	0	0
1	1	1	1	0	1	0	0	0

6 Manga Electronics is a start up company which intends to expand into e-waste management industry.

(a) Define the term *e-waste*.

[2]

All types of discarded electronic gadgets.

(b) Discuss the social and economic impact of e-waste business to the immediate community. [5]

Social

- reduce air pollution since materials that would have been burnt are managed properly.
- reduce water pollution since toxins from gadgets are managed.
- Reduction of land pollution.

Economic

- raising of funding through recycling materials

(c) (i) Define the term *data privacy*. [1]

- Discipline intended to keep data safe against improper access, theft or loss.

(iii) State any **two** business ethics the company should follow. [2] - Data protection.

- Environmental awareness
- Corporate and social responsibility
- Customer prioritization
- Community outreach
- Fairness to employees.

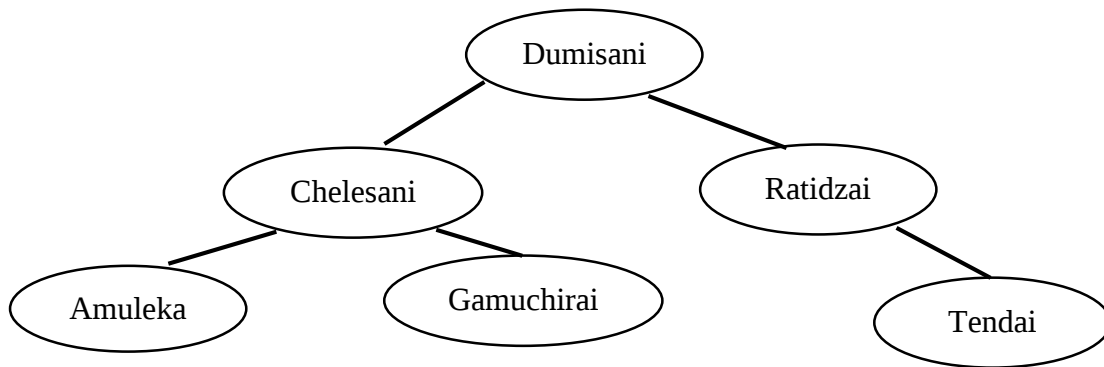
7. Names are stored in a binary tree according to the algorithm below.

```

Repeat
    If Name > Node Then
        take right pointer
    Else
        Take left pointer
    End If
Until empty Node
Insert Name
    
```

(a) Given that the root node is Dumisani, create a binary tree resulting from inserting the following in the order given:

Chelsesani Ratidzai Amuleka Tendai Gamuchirai [3]



(b) Describe an algorithm for using the tree to read the names in alphabetic order. [2] In order traversal

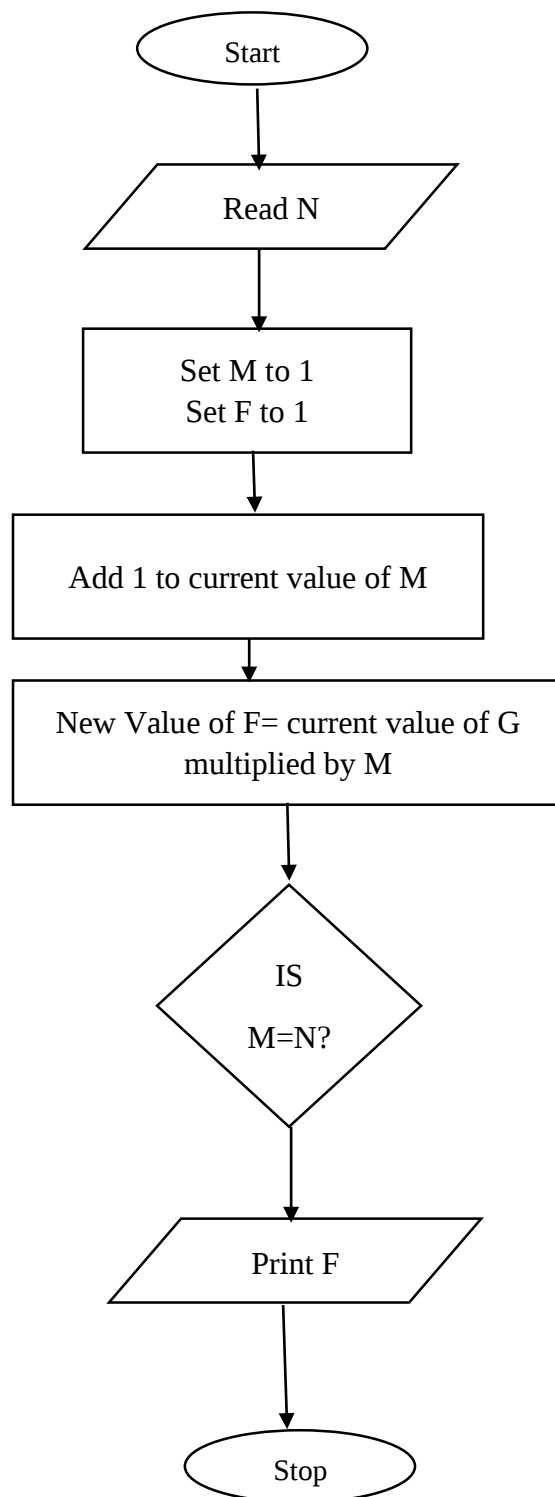
- Traverse the Left sub-tree
- Visit the Node
- Traverse the Right sub-tree.

8. (a) Write an algorithm, in pseudocode, of a program that accepts any 200 positive numbers and displays their sum. [5]

```

STOP
Set num(200) TYPE integer
Set sum, i TYPE integer =0
  While i<200
    INPUT num
    Sum=sum + num
  END WHILE
PRINT sum
STOP
  
```

(c) Study the flowchart below and answer the questions that follow.



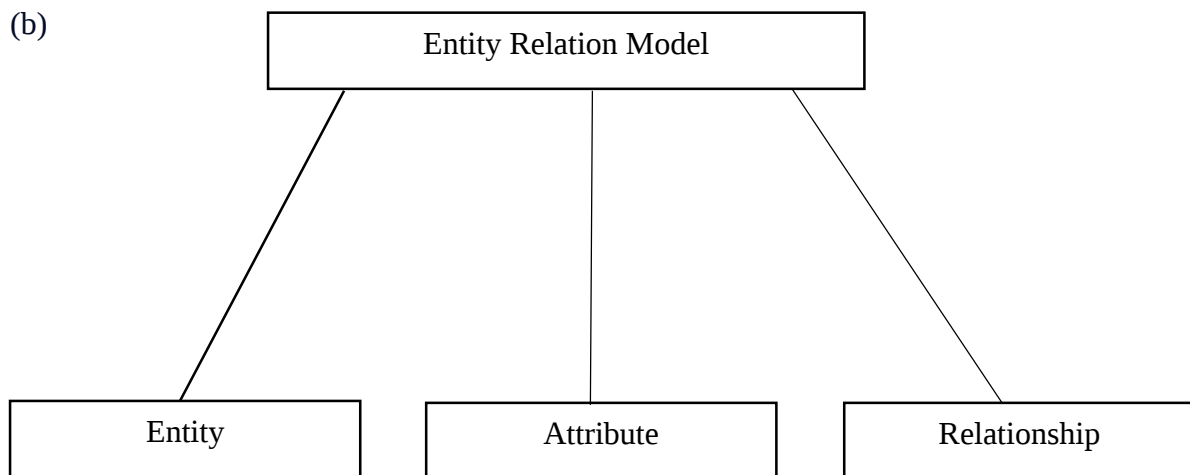
- (i) Dry run the algorithm given that the value of N is 5 Use the trace table template below.

N	M	F	M=N?	Output
5	2	2	No	
5	3	6	No	
5	4	24	No	

5	5	120	Yes	120
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- (ii) Outline the function or task that is performed by the flow chart above. [1] - Calculating the factorial of a number.

9. (a) Explain why database design is important. [4]
- To ensure the integrity of data.
 - Improving query performance
 - A well designed database can be scalable.
 - Cost-effective.



The diagram above shows components of an Entity Relationship Diagram. Describe the three components, giving examples. [6]

Entity

- Any distinguishable object or thing that is independent of another. Examples include person, place, student etc.

Attribute

- A characteristic or trait of an entity type that describes the entity for example Full Name, D.O.B,

Relationship

- A situation that exists between two relational database tables. For example between two entities viz Student and Lecturer relationship is “teaches”.

10. (a) Define the term *patent*. [1]
- a license conferring a right or title for a set period.

- (b) Justify why patents are necessary in systems development. [3]
- they promote innovation.
 - Protects intellectual property.

- Gives incentives to inventors.

(c) Explain how the use of e-commerce could be beneficial for a small company. [2]

- Reduced overhead costs.
- No need for a physical establishment.
- Ability to reach a broader audience.
- scalability

(d) Explain any **two** ICT global changes in e-learning.

[4]

- game based learning.
- Online learning
- Webinars
- Online meetings
- Artificial intelligence - Virtual reality - Mobile applications.