ZIMSEC
For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

COMPUTER SCIENCE 6023/1

PAPER 1

NOVEMBER 2022 SESSION 3 hours

Additional materials:
Answer paper

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

You are reminded of the need for good English and clear presentation in your answers.

This question paper consists of 5 printed pages and 3 blank pages.

1 **(a)** **(i)** State any **one** difference and any **one** similarity between ASCII and Unicode. [2]

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

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

(i) 01001001 + 00101111 [2]

(ii) 01101001 ÷ 00000101 [2]

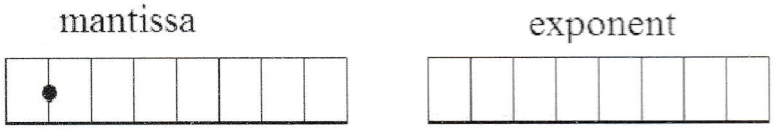
(c) In the same 8 bit system, a student attempts to perform the following arithmetic operation

01100100 × 00000011

(i) Perform the operation giving the result in 8 bits. [3]

(ii) State the type of error that is in this result. [1]

(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]

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

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

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

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

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

(b) Describe the SMTP. [4]

(c) State any **two** functions of the data link layer. [2]

4 **(a)** Explain any **two** types of interrupts and give an example of how each may be generated. [6]

(b) Draw a diagram representing a Von Neumann Architecture and explain how it differs from the Harvard Architecture. [6]

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

Input	Binary value	Plant status
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 ≤ 100 l/hr

A warning signal **(S = I)** 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 ≤ 100 l/hr)

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

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

(a) Define the term *e-waste*. [2]

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

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

(ii) State any **two** business ethics the company should follow. [2]

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
```

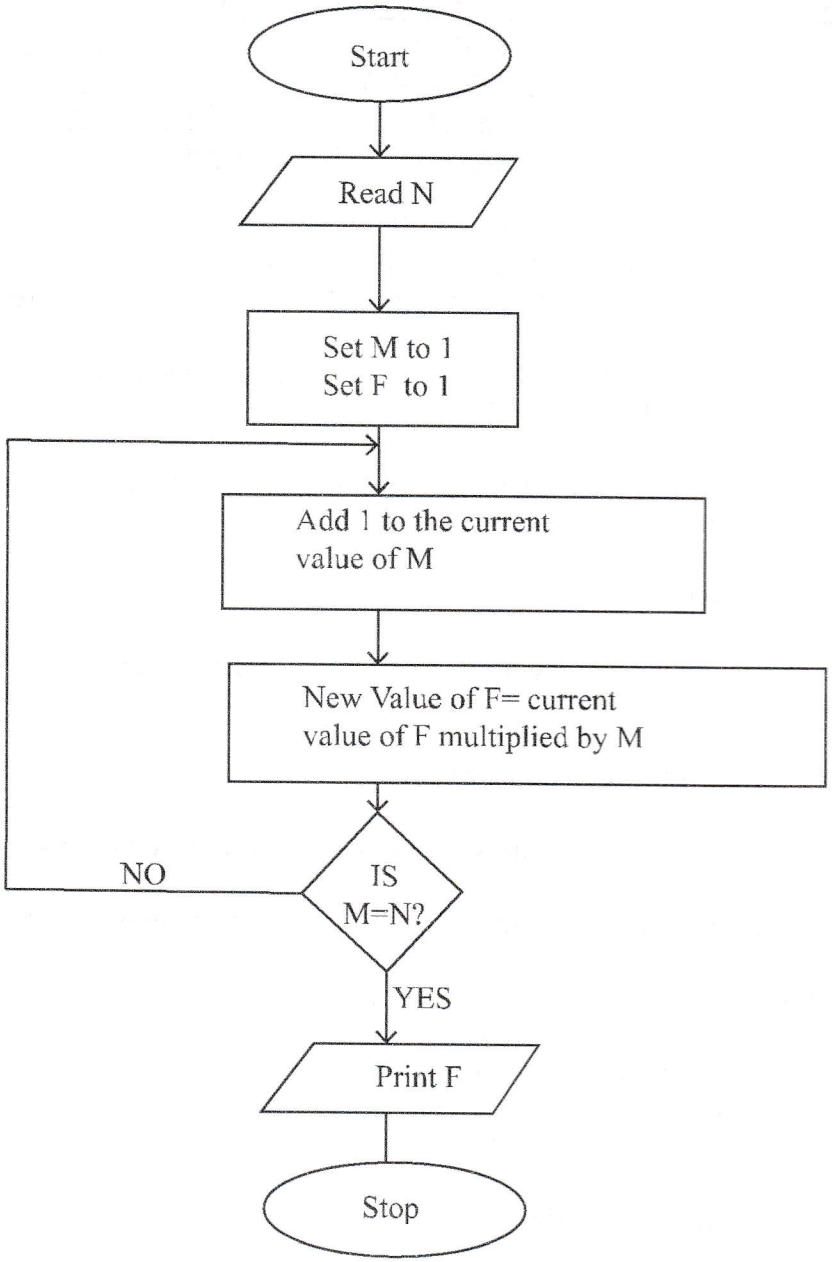
(a) Given that the root node is Dumisani, create a binary tree resulting from inserting the following in the order given:

Chelesani Ratidzai Amuleka Tendai Gamuchirai. [3]

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

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

(b) 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.

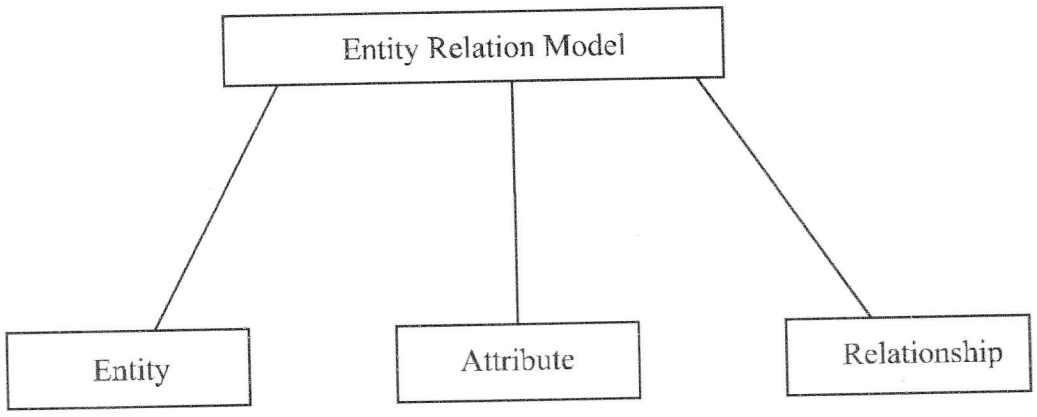
N	M	F	M = N?	Output

[4]

(ii) Outline the function or task that is performed by the flow chart above. [1]

9 **(a)** Explain why database design is important. [4]

(b)



The diagram above shows components of an Entity Relationship Diagram.

Describe the **three** components, giving examples. [6]

10. **(a)** Define the term *patent*. [1]

(b) Justify why patents are necessary in systems development. [3]

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

(d) Explain any **two** ICT global changes in e-learning. [4]

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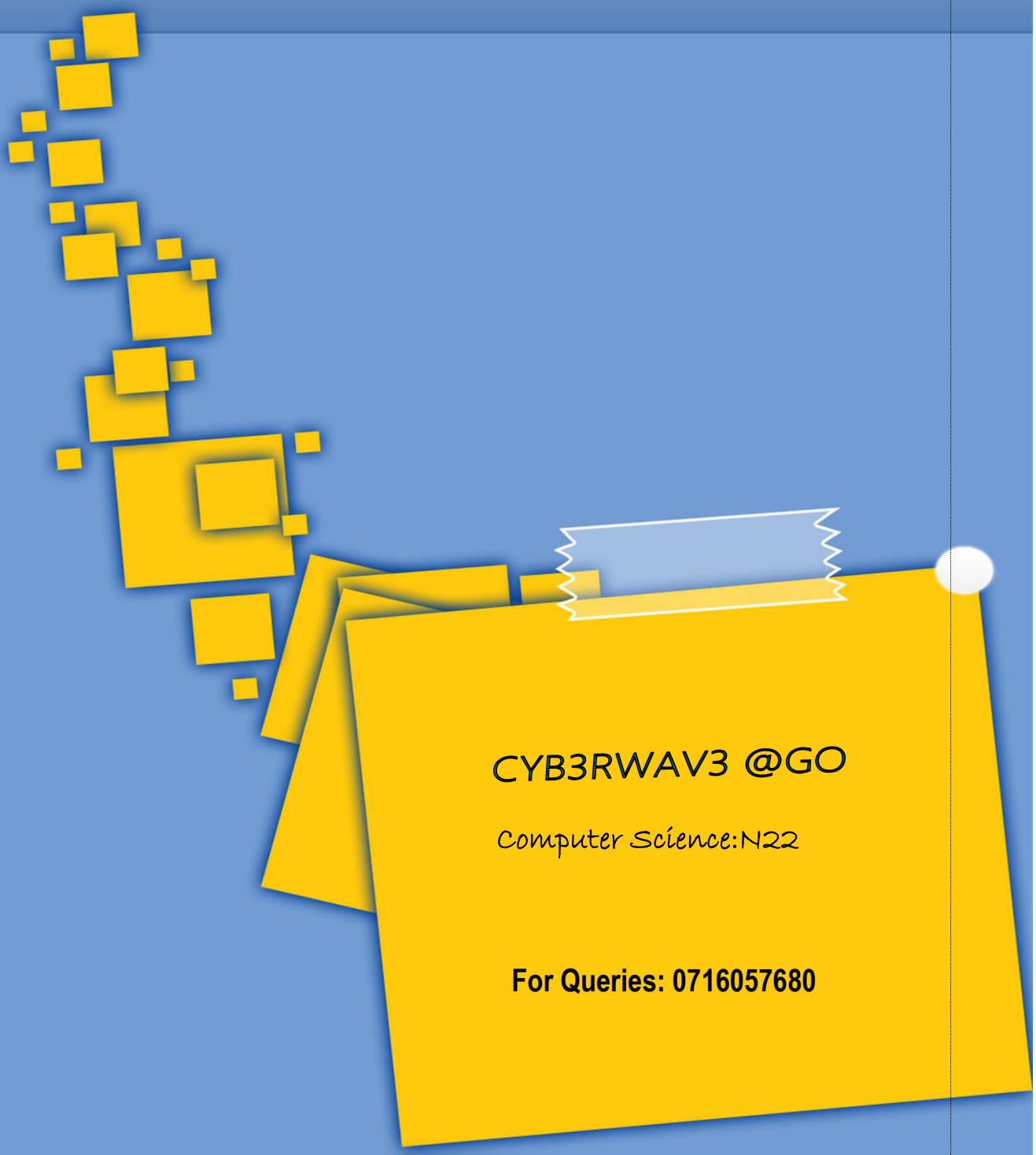

CYB3RWAV3 @GO

Computer Science:N22

For Queries: 0716057680

ccyberwavee@gmail.com tinashechenyika8@gmail.com

1 (a) (i) State any **one** difference and any **one** similarity between ASCII and Unicode. [2]

- ASCII (American standard Code for information Interchange) is used to represent text in form of symbols,numbers,and character, whereas UNICODE is used to exchange process, and store text data in any language format

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

- EBDIC uses 8 bits/byte

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

(i) 01001001 + 00101111 [2]

- 01001001 =73
  +00101111= 47
  ----- ----------
  01111000= 120
  _____

(ii) 01101001 / 00000101

01101001=100

00000101=5

Use Normal Division method Aside

100/5=20

20=00010100

(c) In the same 8 bit system, a student attempts to perform the following arithmetic operation

01100100 × 00000011

(i) Perform the operation giving the result in 8 bits. [3]

- 01100100 =100
  x 00000011=3

Same Concept, multiply DEC aside

100*3=300
300= 100101100

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----------Feel free to contact if you have any objections with this documentation ---------

(ii) State the type of error that is in this result. [1]

- Overflow of data due to the increased number of bits from the initial range

(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]

(1) 0.0000001 00000000
(2) 1.1111111 11111111

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

- An IP address is a number that uniquely identifies every host on an IP network. IP addresses operate at the Network layer of the TCP/IP protocol stack, so they are independent of lower-level Data Link layer MAC addresses, such as Ethernet MAC address.

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

- It ensures that data is transmitted to its correct address (IP address). Every device on the internet has its IP address

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

- A public IP address is a unique IP address assigned to your network router by your internet service provider(ISP)and can be accessed directly over the internet. A private IP address is a unique address that your network router assigns to your device. It is used with a private network to connect privately to other devices

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

- The network ID (or network address) identifies the network on which a host computer can be found.
- The host ID (or host address) identifies a specific device on the network indicated by the network ID

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

- A protocol is a set of rules that govern how data is transferred in a network. It defines the rules on how network devices communicate, e.g the TCP/IP.

(b) Describe the SMTP. [4]

- SMTP stands for "Simple Mail Transfer Protocol". It is a technical standard for transmitting electronic mail (email) over a network.
- SMTP defines a process for exchanging data between an email client and a mail server.
- An email client is what a user interacts with: the computer or web application where they access and send emails.
- A mail server is a specialized computer for sending, receiving, and forwarding emails; users do not interact directly with mail servers

(c) State any **two** functions of the data link layer. [2]

- Data Link Layer - provides error-checking and formats data for physical transmission, type of network and packet sequencing is defined, used for syncronisation

4 (a) Explain any **two** types of interrupts and give an example of how each may be generated. [6]

- Input / output interrupt: they are generated by the I/O devices when transfer is complete or when there is an error in transmission, e.g. disk full, printer out of paper, etc.

- Interrupts generated by running process: process may need more storage or to communicate with the operator

- Timer interrupts: generated by the processor clock, e.g. control being transferred to another user in a time sharing system, or the processor want to perform a routine task which is done at that exact time daily.

- Program check interrupts: caused by errors in a program, e.g division by zero

- Machine check interrupts: Caused by malfunctioning hardware. Clock (happens normally in time sharing systems where the clock transfers control from one computer to another.)

(b) Draw a diagram representing a Von Neumann Architecture and explain how it differs from the Harvard Architecture. [6]

Diagram A

Von Neumann Architecture

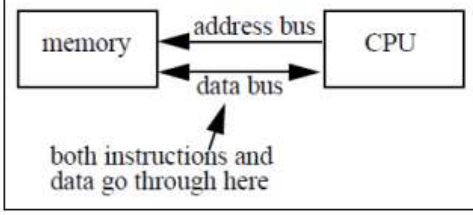
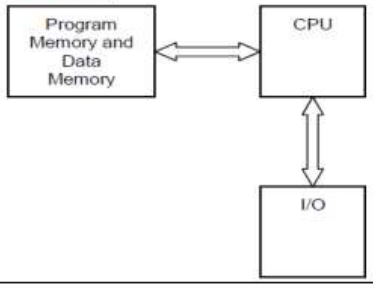


Diagram B



- The von Neumann architecture allows instructions and data to be mixed and stored in the same memory module and the contents of this memory are addressable by location only. The execution occurs in a sequential fashion.
- Von Neumann architectures usually have a single unified cache

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

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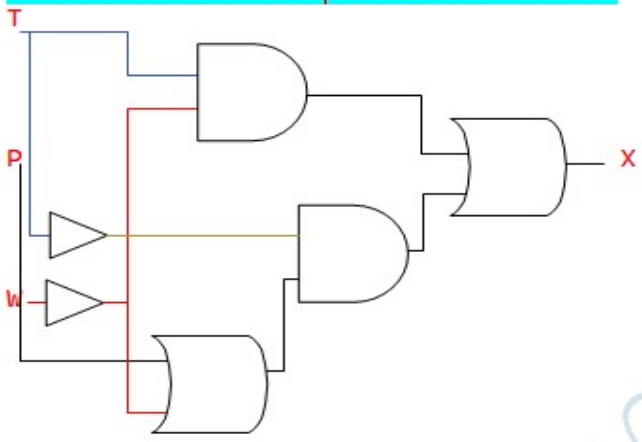
Draw a logic network and truth table to show all the possible situations when the warning signal could be received. [8]

Note different colors represent different links



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S=1 IF (T=1 AND W=NOT1) OR T=NOT1 AND(P=1 OR W=NOT1))

Truth table

t	p	w	t'	w'	t.w'	p+w'	t'.G	F+H=X
0	0	0	1	1	0	1	1	1
0	0	1	1	0	0	0	0	0
0	1	0	1	1	0	1	1	1
0	1	1	1	0	0	1	1	1
1	0	0	0	1	1	1	0	1
1	0	1	0	0	0	0	0	0
1	1	0	0	1	1	1	0	1
1	1	1	0	0	0	1	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]

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

6(a) E–waste is the discarded or unwanted electronic devices, such as computers and mobile phones ,which are no longer required or useful to the owner and may pose health risks to the environment is not disposed properly

(b)

- The e-waste business can provide employment opportunities for individuals within the community
- It can serve as a source of income and contribute to the economy of the immediate community
- The e-waste business can promote environmental protection by reducing the amount of electronic waste that ends up in landfills and pollutes the environment
- E-waste recycling can help safeguard public health by preventing the release of toxic or harzadous substances into the environment
- It can lead to technological advancements and contribute to the development of the community by facilitating the acquisition of new skills and knowledge

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

(ii) State any **two** business ethics the company should follow. [2]

(i) Data privacy refers to the protection of personal information from unauthorized access,use or disclosure

(ii)

- environmental responsibility :The company should prioritize the environment by adopting sustainable e-waste management practices that reduce harmful impacts on the ecosystem
- transparency and honesty :the company should be open ,honest , and transparent in all its e-waste management activities, including the handling and disposal of electronic waste
- it should also communicate clearly with its stakeholders on its intentions and actions towards environmental responsibility and e-waste management

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

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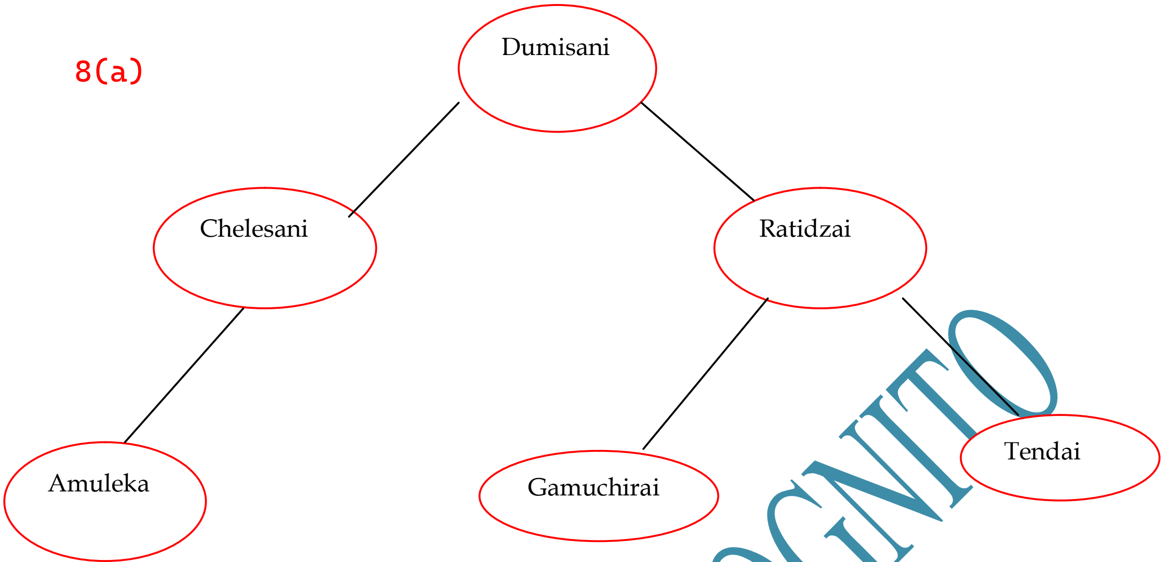
(b) Describe an algorithm for using the tree to read the names in alphabetic order. [2]

8(a)



(b)XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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

```
Sum=0
Repeat 200 times:
        Input positive number
        If input is positive then
                Add input to sum
        End If
End Repeat
Display sum
```

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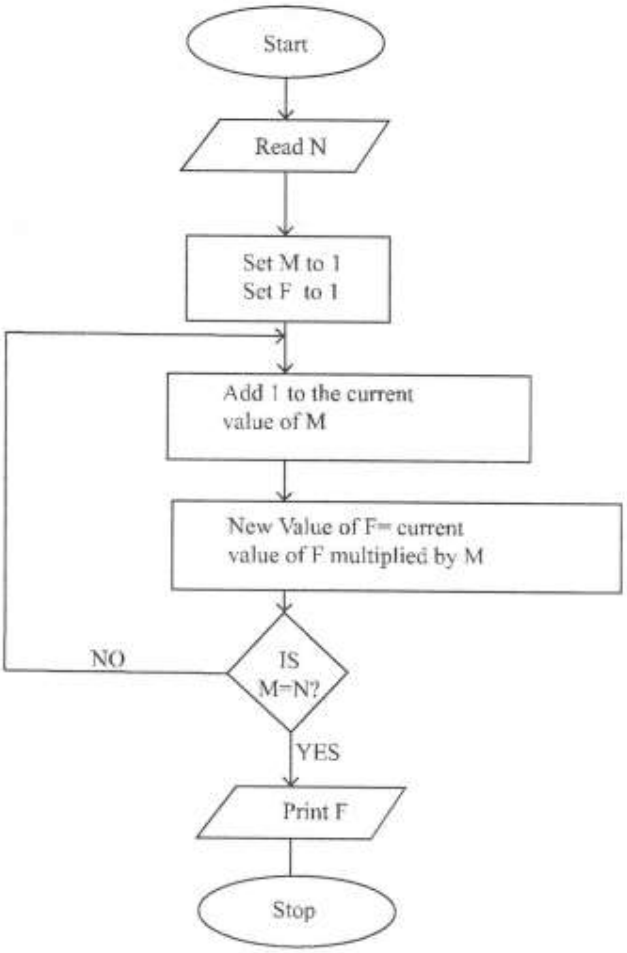
(b) Study the flowchart below and answer the questions that follow.



(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

[4]

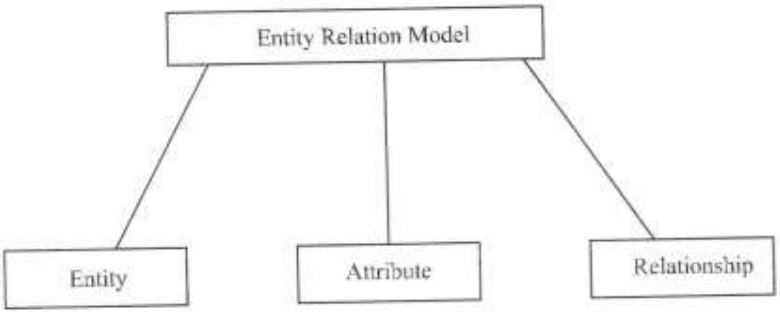
N	M	F	M=N?	Output
5	1	1	No	
	2	2	No	
	3	6	No	
	4	24	No	
	5	120	Yes	120

(ii) Outline the function or task that is performed by the flow chart above. [1]

(ii)Calculate the factorial of a given number or alternatives

9 **(a)** Explain why database design is important. [4]

(b)



The diagram above shows components of an Entity Relationship Diagram.

Describe the **three** components, giving examples. [6]

9(a)

- Efficiency: a well designed database can function at faster speeds
- Data Integrity: A well designed database ensures that the database stores correct, accurate data, consistent and reliable data
- Security: A well designed database can protect sensitive data from unauthorized access control mechanisms and security protocols
- Scalability : The design should be able to scale up and down as the design of the database shrinks or grows
- Cost: A well designed database can reduce costs associated with data management , such as storage and backup costs

(b)

- Entity- is an object or concept that is represented by data and stored in a database . examples are in company database, entities could include employees, departments and products
- Attributes: Each entity has an attribute that describes the characteristics of the entity .For example , an employee entity might have attributes such as name, address and salary
- Relationship: entities in a database can have relationships with each other .A relationship is an association between one or more entities. For example in a company database, an employee entity might have a relationship with a department entity indicating that between the two exists a one-to-one relationship

10.	(a)	Define the term *patent*.	[1]
	(b)	Justify why patents are necessary in systems development.	[3]
	(c)	Explain how the use of e-commerce could be beneficial for a small company.	[2]
	(d)	Explain any **two** ICT global changes in e-learning.	[4]

(a) A patent is a legal document granted to an inventor or assignee that gives exclusive rights to the invention usually for a period of 20yrs from the date of filling the patentapplication in return for disclosure of the invention to the public.

(b) Patents are necessary for

- Protection of intellectual property
- Encourages innovation
- Supports investment
- Enables licensing and revenue generation

(c)

- Increased market reach: it allows small companies to reach beyond their geographic location , which can help increase their customer base and increase sales
- Lower overhead costs:it reduces the need for physical storefronts and sales personell , which can help reduce overhead costs associated with traditional retail operations
- Increased customer convenience:it provides access to valuable customer data, including purchasing history and browsing behavior
- Increases competition:allows small companies to compete with larger ones

(d)

- The Growth of Artificial Intelligence (AI): AI is revolutionizing the way we interact with technology. Advances in AI are making it possible to create intelligent systems that can reason, learn, and adapt to new situations. AI is being used to automate routine tasks, such as customer service and data entry, and to develop more sophisticated applications, such as autonomous vehicles and drones.

- The Internet of Things (IoT): The IoT is a network of interconnected devices, sensors, and machines that can communicate with each other and the internet. The IoT is transforming industries such as healthcare, transportation, and manufacturing, by enabling the collection and analysis of vast amounts of data in real-time. The IoT is also creating new opportunities for innovation, such as smart homes and cities, and connected vehicles.

➢ In summary, two global changes in the ICT industry include the growth of AI, which is transforming the way we interact with technology, and the Internet of Things, which is creating new opportunities for innovation and transforming industries.

Follow my youtube channel for tutorials

https://youtu.be/pxRClxgQ_3s

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For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

COMPUTER SCIENCE 6023/2

PAPER 2 Practical

NOVEMBER 2022 SESSION 3 hours

Additional materials:
CD for each candidate
Printing facility
Bond paper

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

This is a purely practical examination. All answers should be printed. Handwritten answers will **not** be marked.

This paper consists of **three** sections.

Section	A	20 marks
Section	B	50 marks
Section	C	30 marks

Answer **one** question from each section.
Each answer sheet should include the following information in the header section:

- Candidate Name and Candidate Number
- Centre Name and Date
- Subject Code

When answering programming questions, indicate the language used.
All work should be backed up by a soft copy on a CD.
If you print on more than one sheet, fasten the sheets together.
All answers should be correctly and clearly numbered.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

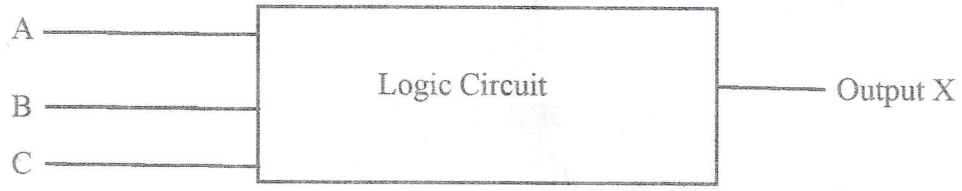
This question paper consists of 10 printed pages and 2 blank pages.

Section A [20 marks]

Answer any **one** question from this section.

1 **(a)** Three digital sensors **A**, **B** and **C** are used to monitor a process. The outputs from the sensors are used as the inputs to a logic circuit.

A signal **X**, is output from the logic circuit.



(i) Formulate a logic expression for the conditions below.

Output **X**, has a value of **1** if either of the following conditions occur:

- sensor **A** outputs the value **1** or sensor **B** outputs the value **0**.
- sensor **B** outputs the value **1** and sensor **C** outputs the value **0**. [3]

(ii) Draw a logic circuit to represent the logic expression in **(i)**. [5]

(iii) Construct the truth table for the logic circuit above. [4]

(b) The table below shows the five stages that occur when instructions are fetched and executed. Two instructions, **D** followed by **E**, are fetched and executed. The "**E**" in the incomplete table shows that instruction **E** has been fetched in time interval **2**.

	Time interval							
State	1	2	3	4	5	6	7	8
Fetch instruction		E						
Read registers and decode instruction								
Execute instruction								
Access operating memory								
Write result to register								

Copy and complete of the table. [8]

2 (a) Consider the logic statement below.

X = 1 if (A AND B) OR ((B OR C) AND (B AND C))

(i) Draw a logic circuit to represent the above expression. [7]

(ii) Construct a truth table to explain how the logic expression works. [5]

(b) Illustrate with an aid of a diagram the steps of the fetch-execute cycle. [8]

Section B [50 marks]

*Answer any **one** question from this section.*

3 **(a)** Produce a program code that rolls a dice **20** times and counts the number of times that 4 appears. The code should then print the number of times that 4 appears. [8]

(b) Produce a program that contains a calling statement to call a function that calculates the sum of **2** numbers and store the answer in the variable sum. Also define the function. [5]

(c) Bandile is working on developing an algorithm using a high level language to implement a substitution cipher. His plan is to:

- set up a random set of letters and store them in an array of **26** characters
- then in order to implement the cipher the program then substitutes each letter with the corresponding position in an array
- he has decided the letter '**A**' to be at position 1, letter '**B**' .... Until **Z** = position 26.

(i) Produce program code that declares a global array of 26 characters. [2]

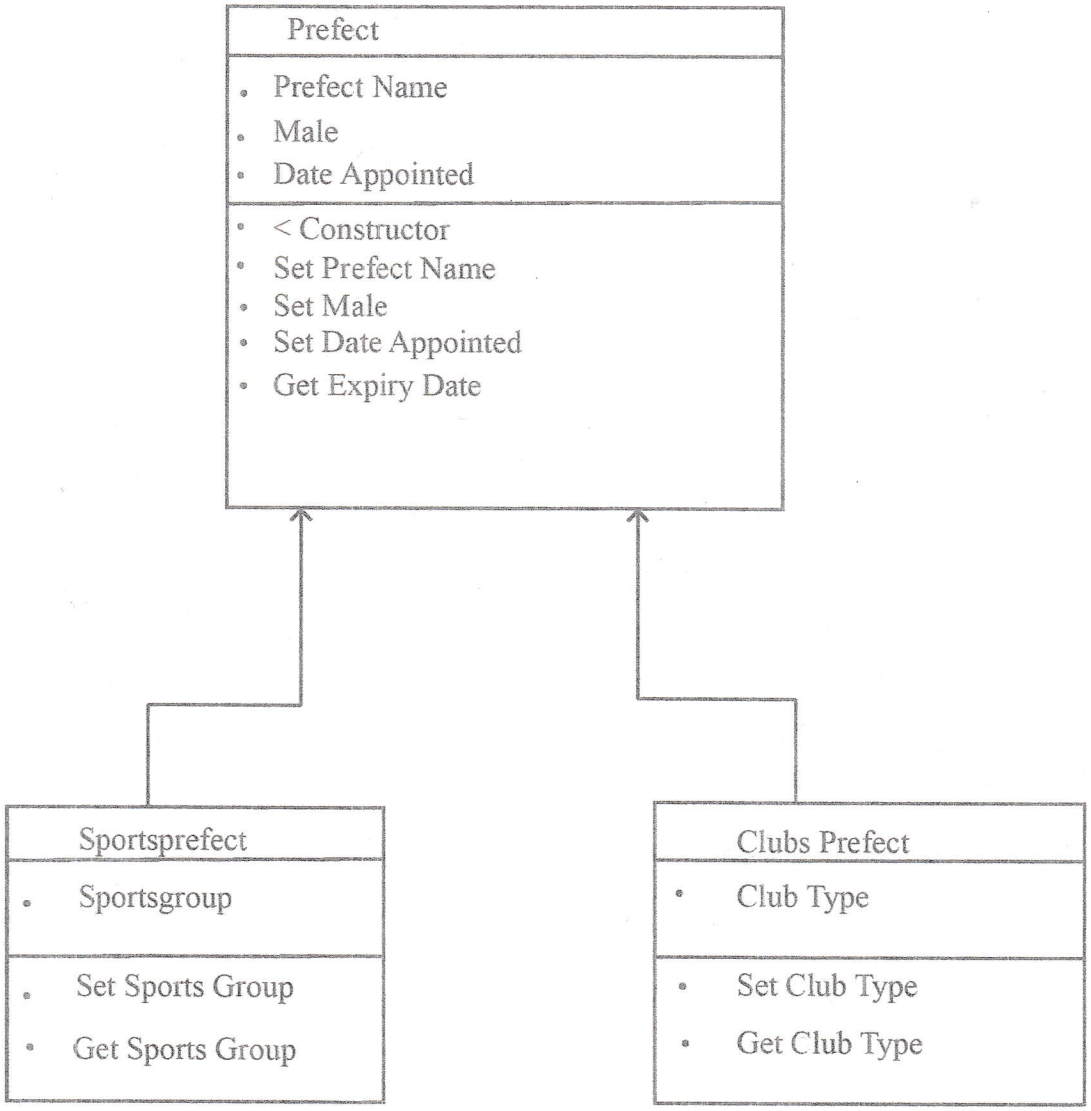
(ii) Produce code that implements a procedure which has a string arguments of the relevant scope. The purpose of which is to perform string substitution, for example

encrypt(<plain text>) [8]

(d) A school has a program for managing its prefect body. The program has been written in an object-oriented programming language.

A perfect class has been designed.
It has 2 subclasses.
- sports prefect
- clubs prefect

The following is an inheritance diagram for the classes.



Produce a program code to implement the structure above.

N.B. Function/method header only required. The code detail inside each function/method is not required. [10]

(e) A program is to be designed to collect data from learners:

- each time it runs, it collects data from form 1 learners
- the data are appended to a csv file
- the csv file has the following header

Student csv

Student table
Name, surname, D. O.B, Reg number, male
Samuel, Pasipanodya, 23/03/2003, 002591, yes
Angela, Dupute, 01/08/2004, 010053, No

(i) Produce a program that appends data for each learner onto the csv file. [10]

(ii) Produce a program that reads the file created in (i) and then writes another file using all capital letters. [7]

4 Jabatshaba Repairs offers repair services at a rate of **$20** per hour for labour. Cost of supplies are subject to **15%** sales tax.

(a) Using the chosen HLL, design an interface which presents the bill for the situation, the customer's name, labour hours and the cost of supplies. Output is customer's name, labour cost, supplier's cost and total cost. [5]

(b) Using the situation given in (a) produce a code that will calculate the total cost, labour cost, supplier's cost and display the customer name, labour cost, supplier's cost and total. [10]

(c) Produce code which will classify any mark captured according to the grades below. Use the IF statement.

A - 70 to 100
B - 60 to 69
C - 50 to 59
D - 40 to 49
E - 30 t0 39
U - 0 to 29

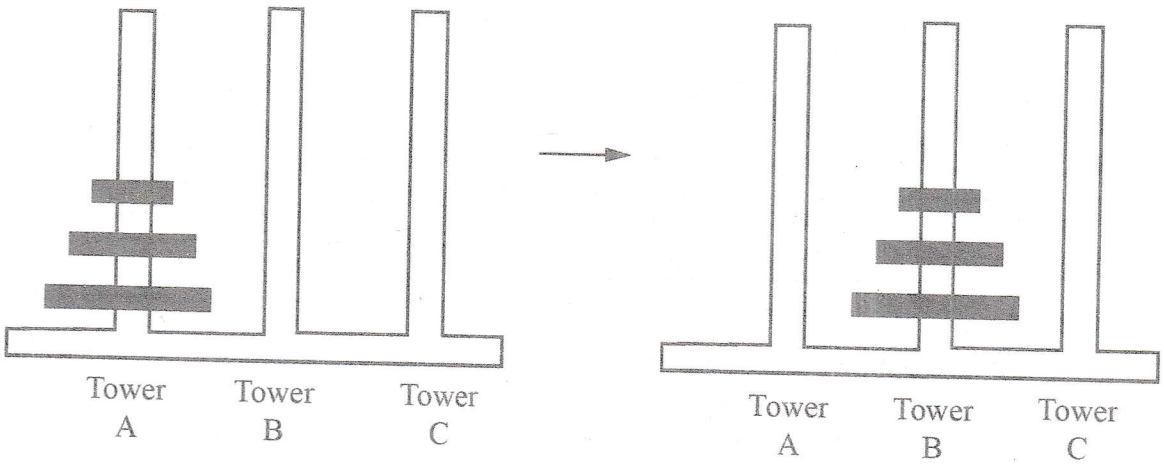
The grades should be displayed. [11]

(d)

x:	0	1	2	3	4
y:0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	1	0	0
3	0	1	1	1	0
4	1	1	1	1	1

The grid represents tables in a restaurant. The zeros (0) represent table not yet occupied, the ones (1) tables occupied. Using the concept of **2 D** arrays, produce code to represent the diagram [12]

(e)



The concept is referred to as the tower of Hanoi. The disks are of different size and are stacked in ascending order of size, largest at the bottom and smallest at the top. Stack the disks from tower **A** to tower **C** as shown in diagram. Only one disk may be moved at a time. No disk may be placed on top of a smaller disk at any time (even in the process of stacking.)

Design an algorithm to solve the problem. [7]

(f) Produce code that read all the contents of a text file and outputs the number of lines in the text file. [5]

Section C [30 marks]

Answer any **one** question from this section.

5 Study the Lupane University Athletics table below and answer the questions that follow.

Reg. No.	First name	Last name	Age	Course	Sport
MC1804	Sean	Gutsa	18	IT	Soccer
MC0808	Bongiwe	Shumba	18	Maths	Cricket
MC0708	Sisa	Bako	20	Maths	Chess
MC0309	Vimbai	Dube	19	Electronics	Soccer
MC0909	Dumisani	Nkomo	17	Economics	Cricket

(a) Produce the SQL code that defines a primary key of this table. [2]

(b) Produce the SQL code that can be used to produce the Athletics table above. [8]

(c) Produce the SQL command which can be used to add the record below.

MC 9414, Kuda, Moyo, 19, ICT, Cricket [7]

(d) The sports director for Lupane State University wants to see the Reg. Number and the sport fields only for the students.

Produce the SQL code to display Reg. Number and sport. [2]

(e) Athlete MC 0708 has moved to another university. Her details need to be removed from the table.

Produce the appropriate SQL command to remove her from the Athletics table. [2]

(f) Study the standard notation for a library system below.

Borrower (Borrower ID, Name, Address)
Book (AccessionNumber, Title, Author, Date Published)
Loan (AccessionNumber, BorrowerID, DateDue)

Using a drawing tool of your choice, draw and clearly label the ERD for the standard notation given above. [9]

6 A hospital is divided into two areas, Area A and Area B. Each area has several wards. All the ward names are different. A number of nurses are based in Area A. These nurses always work in the same ward. Each nurse has a unique Nurse ID of **STRING** data type.

(a) Describe the relationship shown on the diagram above. [1]

(b) A relational database is created to store the ward and nurse data. The two table designs for Area **A** are:

A – Ward (WardName, NumberOfBeds)

A – Nurse (Surname, FirstName, ….., ….)

(i) Complete the design for the table A-Nurse. [2]

(ii) Explain how the relationship in part **(a)** is implemented. [2]

(c) In Area **B** of the hospital, there are a number of wards and a number of nurses.

- Each Area **B** ward has a specialism
- Each Area **B** nurse has a specialism

A nurse can be asked to work in any of the Area **B** wards where their specialism matches with the ward specialism.

The relationship for Area **B** of the hospital is as shown below.

(i) State the degree of relationship between the entities **B**-Nurse and **B**-ward. [1]

(ii) The design for Area **B** data is as follows:

B-Nurse (NurseID, Firstname, FamilyName, Specialism)

B-Nurse (WardName, NumberOfBeds, Specialism)

B-Ward-Nurse(.....)

Complete the attributes of **B**-ward-Nurse table. [3]

(iii) Draw the relationships of the three tables above using an ERD. [3]

(d) Using the design for tables in part **(c)(iii)**.

(i) Produce a SQL query to display the NurseID and family name for all Area **B** nurses with a specialism of "Theatre". [3]

(ii) Tendero, who is an Area **B** nurse with the nurseID 076 has recently married and her new family name is Makwanzini. Produce an SQL command to update her record. [5]

(e) A student intends to create a database with tables whose records can be accessed using a form based interface created using a high level programming language. The standard normal form of the member table in the database is as follows:

member(**memberID**, FirstName, Surname, DateJoined, JoiningFee, CellNumber)

Using the information provided above,

(i) design a data structure (file design) of the member file in tabular form (using a word processor) with the following column headings:

FieldName, Size, Format/Validation, Data type [3]

(ii) design a form-based interface for the member table using a high level programming language of your choice. Command buttons are not necessary.

Produce a screenshot of the form and print it. [7]

1/1/2022

ZIMSEC

For Performance Measurement

PAPER2

N22 COMPUTER SCIENCE 6032

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……Proverbs 16:3

For Anhad Edurain Solutions Pvt. Ltd.

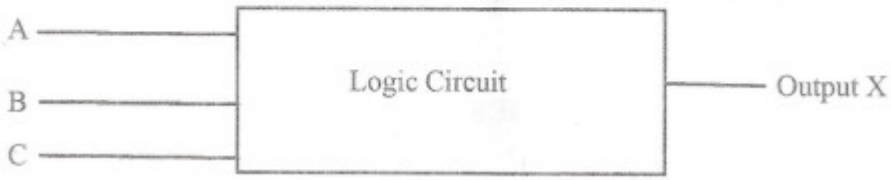
Director

Suggested solutions #Revised n Reviewed | 0716057680

SECTION A

1 (a) Three digital sensors **A**, **B** and **C** are used to monitor a process. The outputs from the sensors are used as the inputs to a logic circuit.

A signal **X**, is output from the logic circuit.



(i) Formulate a logic expression for the conditions below.

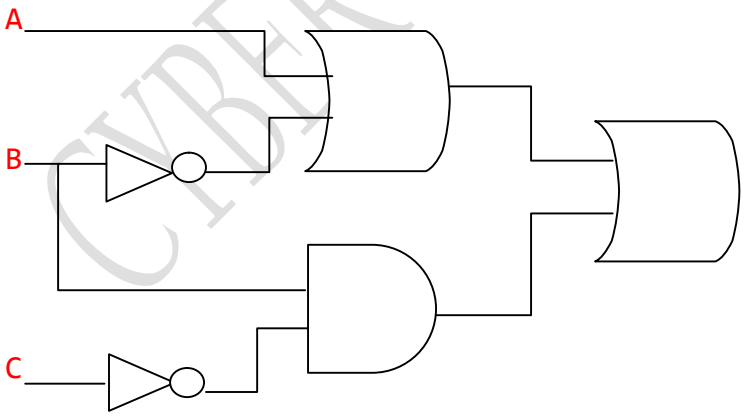
Output **X**, has a value of **1** if either of the following conditions occur:

- sensor **A** outputs the value **1** or sensor **B** outputs the value **0**.
- sensor **B** outputs the value **1** and sensor **C** outputs the value **0**. [3]

(ii) Draw a logic circuit to represent the logic expression in **(i)**. [5]

(iii) Construct the truth table for the logic circuit above. [4]

[1] X=1 IF A=1 OR B=NOT1 OR B=1 AND C=NOT1



A	B	C	A+INVB	INVB	INVC	B.INVC	X
0	0	0	1	1	1	0	1
0	0	1	1	1	0	0	1
0	1	0	0	0	1	1	1
0	1	1	0	0	0	0	0
1	0	0	1	1	1	0	1
1	0	1	1	1	0	0	1
1	1	0	1	0	1	1	1
1	1	1	1	0	0	0	1

(b) The table below shows the five stages that occur when instructions are fetched and executed. Two instructions, **D** followed by **E**, are fetched and executed. The "**E**" in the incomplete table shows that instruction **E** has been fetched in time interval **2**.

	Time interval							
State	1	2	3	4	5	6	7	8
Fetch instruction		E						
Read registers and decode instruction								
Execute instruction								
Access operating memory								
Write result to register								

Copy and complete of the table. [8]

State	1	2	3	4	5	6	7	8
Fetch Instruction	D	E						
Read registers and decode instruction		D	E					
Execute instruction			D	E				
Access operating memory				D	E			
Write result to register					D	E		

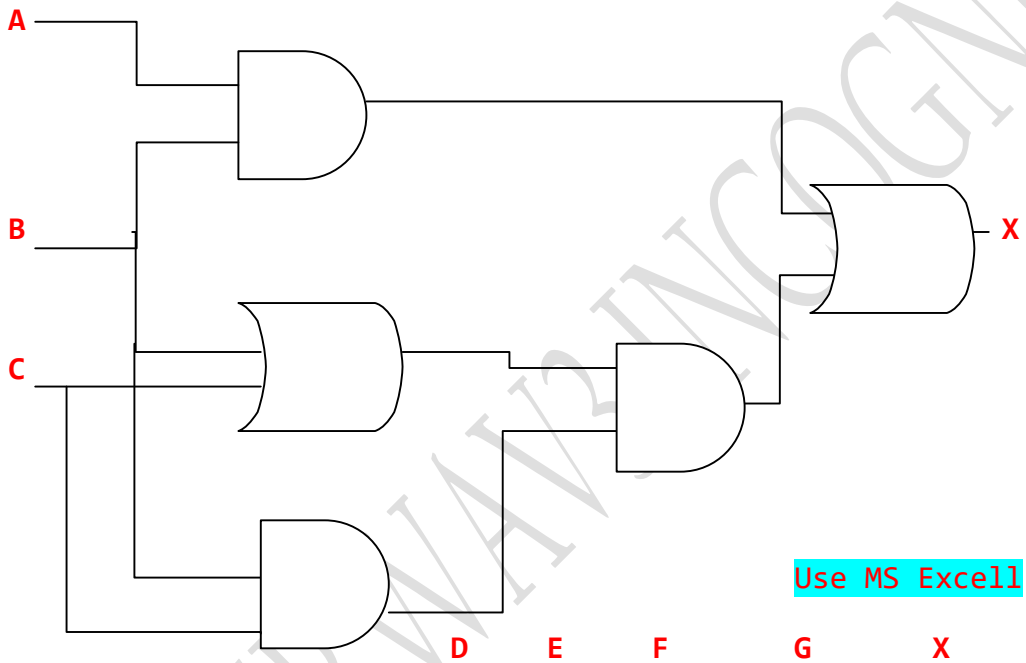
2 (a) Consider the logic statement below.

X = 1 if (A AND B) OR ((B OR C) AND (B AND C))

(i) Draw a logic circuit to represent the above expression. [7]

(ii) Construct a truth table to explain how the logic expression works. [5]

(b) Illustrate with an aid of a diagram the steps of the fetch-execute cycle. [8]

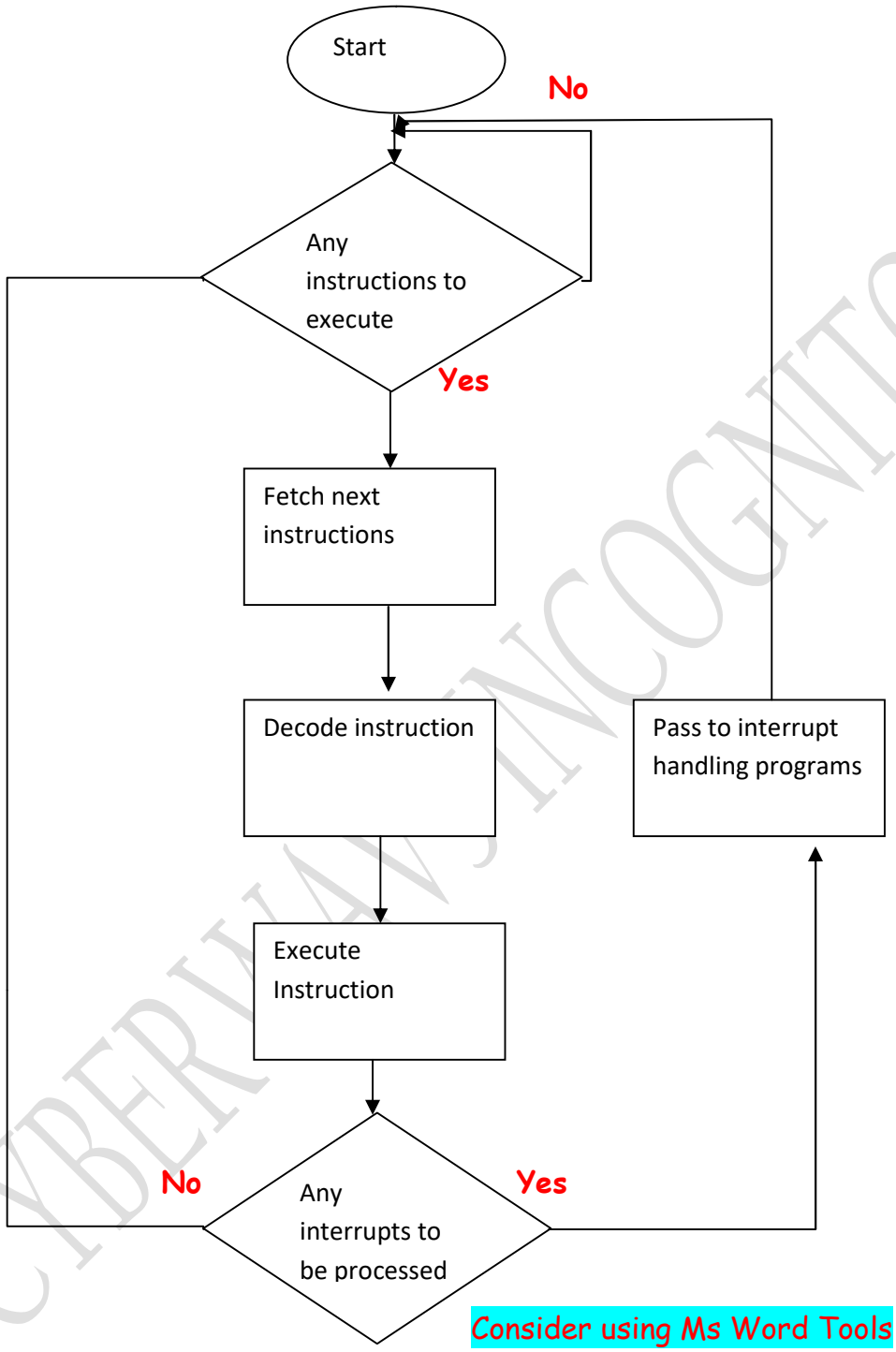


Use MS Excell

D E F G X

A	B	C	A.B	B+C	B.C	E.F	D+G
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	0	1	0	0	0
0	1	1	0	1	1	1	1
1	0	0	0	0	0	0	0
1	0	1	0	1	0	0	0
1	1	0	1	1	0	0	1
1	1	1	1	1	1	1	1

(b)



Consider using Ms Word Tools

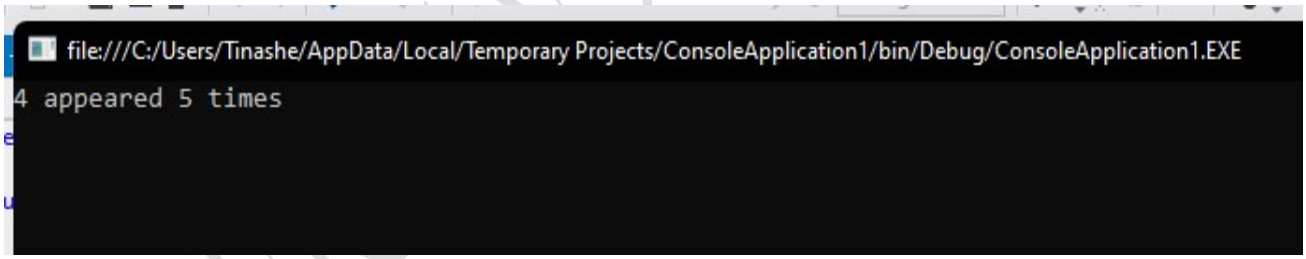
SECTION B

3 (a) Produce a program code that rolls a dice **20** times and counts the number of times that 4 appears. The code should then print the number of times that 4 appears. [8]

```
Module Module1

    Sub Main()
        Dim rand As New Random
        Dim face As Integer
        Dim count As Integer
        For i = 1 To 20
            face = rand.Next(1, 7)
            If face = 4 Then
                count += 1
            End If
        Next
        Console.WriteLine("4 appeared {0} times", count)
        Console.ReadLine()
    End Sub

End Module
```



(b) Produce a program that contains a calling statement to call a function that calculates the sum of **2** numbers and store the answer in the variable sum. Also define the function. [5]

```
Module Module1
    Private Function add(ByVal num1 As Integer, num2 As Integer) As Integer
        Dim sum As Integer
        sum = num1 + num2
        Return sum
    End Function

    Sub Main()
        Dim num1, num2 As Integer

        Console.WriteLine("please enter num1")
        num1 = Console.ReadLine()
        Console.WriteLine("please enter num2")
        num2 = Console.ReadLine
        Console.WriteLine("{0} + {1} = {2}", num1, num2, add(num1, num2))
```

Take note how I called the add() function

```
        Console.ReadLine()
    End Sub

End Module
```

(c) Bandile is working on developing an algorithm using a high level language to implement a substitution cipher. His plan is to:

- set up a random set of letters and store them in an array of **26** characters
- then in order to implement the cipher the program then substitutes each letter with the corresponding position in an array
- he has decided the letter '**A**' to be at position 1, letter '**B**' .... Until **Z** = position 26.

(i) Produce program code that declares a global array of 26 characters. [2]

(ii) Produce code that implements a procedure which has a string arguments of the relevant scope. The purpose of which is to perform string substitution, for example

encrypt(<plain text>) [8]

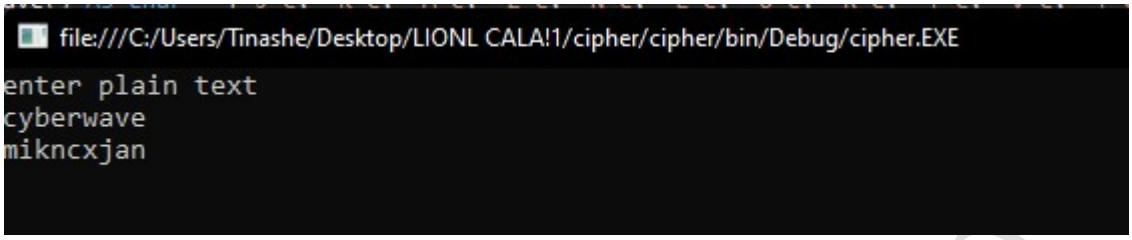
C(i)

```
Module Module1
    Public cyberwave() As Char = {"J"c, "K"c, "M"c, "Z"c, "N"c, "L"c, "Q"c, "R"c, "Y"c,
"V"c, "T"c, "T"c, "G"c, "W"c, "U"c, "D"c, "E"c, "C"c, "F"c, "B"c, "O"c, "A"c, "X"c, "S"c,
"I"c, "H"c, "P"c}
```

(ii)

```
Public Function encrypt(plntxt As String) As String
        Dim cyphertxt As String = ""
        For Each c As Char In plntxt
            If Char.IsLetter(c) Then
                If Char.IsUpper(c) Then
                   cyphertxt += cyberwave(Asc(c) - Asc("A"c))
                Else
                    cyphertxt += Char.ToLower(cyberwave(Asc(c) - Asc("a"c)))
                End If
            Else
                cyphertxt += c
            End If
        Next
        Return cyphertxt
    End Function
    Sub Main()
        While True
            Console.WriteLine("enter plain text")
            Dim plntxt As String = Console.ReadLine()
            Console.WriteLine(encrypt(plntxt))
            Console.ReadLine()
        End While
    End Sub

       End Module
```



4 Jabatshaba Repairs offers repair services at a rate of **$20** per hour for labour. Cost of supplies are subject to **15%** sales tax.

(a) Using the chosen HLL, design an interface which presents the bill for the situation, the customer's name, labour hours and the cost of supplies. Output is customer's name, labour cost, supplier's cost and total cost. [5]

(b) Using the situation given in **(a)** produce a code that will calculate the total cost, labour cost, supplier's cost and display the customer name, labour cost, supplier's cost and total. [10]

(c) Produce code which will classify any mark captured according to the grades below. Use the IF statement.

A	-	70 to 100
B	-	60 to 69
C	-	50 to 59
D	-	40 to 49
E	-	30 t0 39
U	-	0 to 29

The grades should be displayed.

(d) [11]

(a)

(b)

```
Public Class Form1

    Private Sub GunaAdvenceButton1_Click(sender As Object, e As EventArgs) Handles
Calculate.Click
        Dim labour As Double = Val(txthrs.Text) / 20
        Dim supplier As Double = (Val(txtcost.Text) * 0.15) + Val(txtcost.Text)
        Dim total As Double = labour + supplier

        GunaDataGridView1.Rows.Add(txtname.Text, labour, Supplier, total)
    End Sub
End Class
```

(c) CASE-1 Using Console

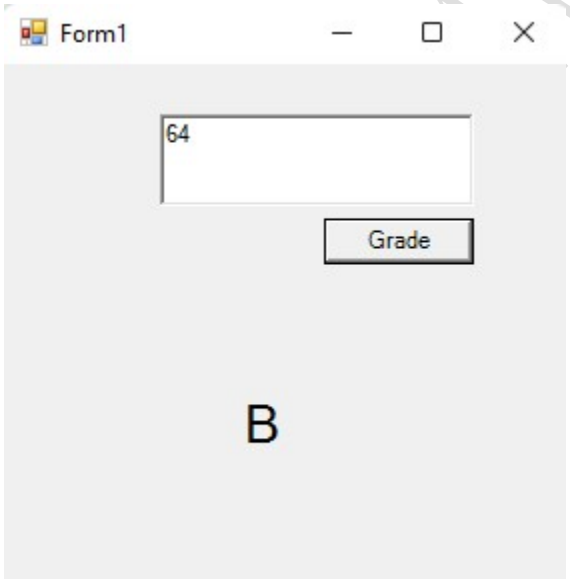
```
Module Module1

    Sub Main()
        While True
            Console.WriteLine("Enter your mark")
            Dim mark As Integer = Console.ReadLine()
            If mark >= 70 And mark <= 100 Then
                Console.WriteLine("A")
            ElseIf mark >= 60 And mark <= 69 Then
                Console.WriteLine("B")
            ElseIf mark >= 50 And mark <= 59 Then
                Console.WriteLine("C")
            ElseIf mark >= 40 And mark <= 49 Then
                Console.WriteLine("D")
            ElseIf mark >= 30 And mark <= 39 Then
                Console.WriteLine("E")
            ElseIf mark >= 0 And mark <= 29 Then
                Console.WriteLine("U")
            Else
                Console.WriteLine("Invalid results")
            End If
        End While
    End Sub
End Module
```

Case2-GUI

```
Public Class Form1
    Public Function grade(ByVal mark As Integer) As String
        Dim result As String
        If mark >= 70 And mark <= 100 Then
            Result = ("A")
        ElseIf mark >= 60 And mark <= 69 Then
            result = ("B")
        ElseIf mark >= 50 And mark <= 59 Then
            result = ("C")
        ElseIf mark >= 40 And mark <= 49 Then
            result = ("D")
        ElseIf mark >= 30 And mark <= 39 Then
            result = ("E")
        ElseIf mark >= 0 And mark <= 29 Then
            result = ("U")
        Else
            result = ("Invalid results")
        End If
        Return result
    End Function
    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        Dim mark As Integer = txtmark.Text
        lblgrade.Text = grade(mark)

    End Sub
End Class
```



(d)

x:	0	1	2	3	4
y:0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	1	0	0
3	0	1	1	1	0
4	1	1	1	1	1

The grid represents tables in a restaurant. The zeros (0) represent table not yet occupied, the ones (1) tables occupied. Using the concept of **2 D** arrays, produce code to represent the diagram [12]

```
Module Module1

    Sub Main()

        Dim tables(,) As Integer = {

            {0, 0, 0, 0, 0},

            {0, 0, 0, 0, 0},

            {0, 0, 1, 0, 0},

            {0, 1, 1, 1, 0},

            {1, 1, 1, 1, 1}

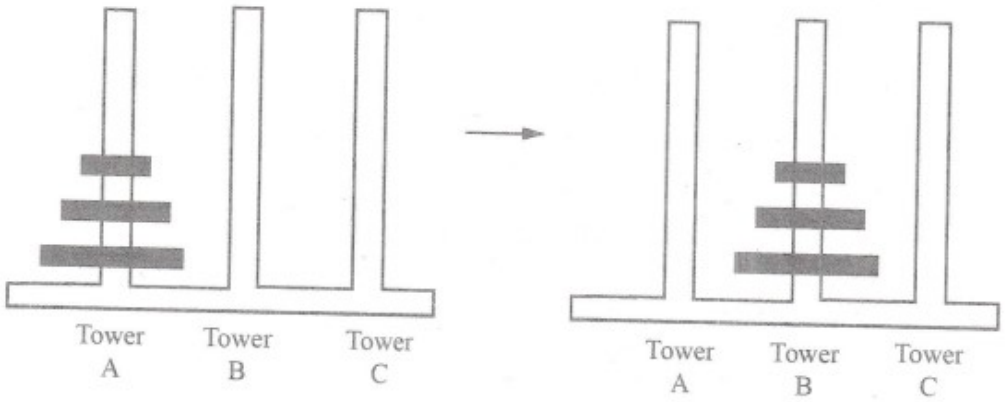
        }

    End Sub

End Module
```

Simple 2D array

(e)



The concept is referred to as the tower of Hanoi. The disks are of different size and are stacked in ascending order of size, largest at the bottom and smallest at the top. Stack the disks from tower A to tower C as shown in diagram. Only one disk may be moved at a time. No disk may be placed on top of a smaller disk at any time (even in the process of stacking.)

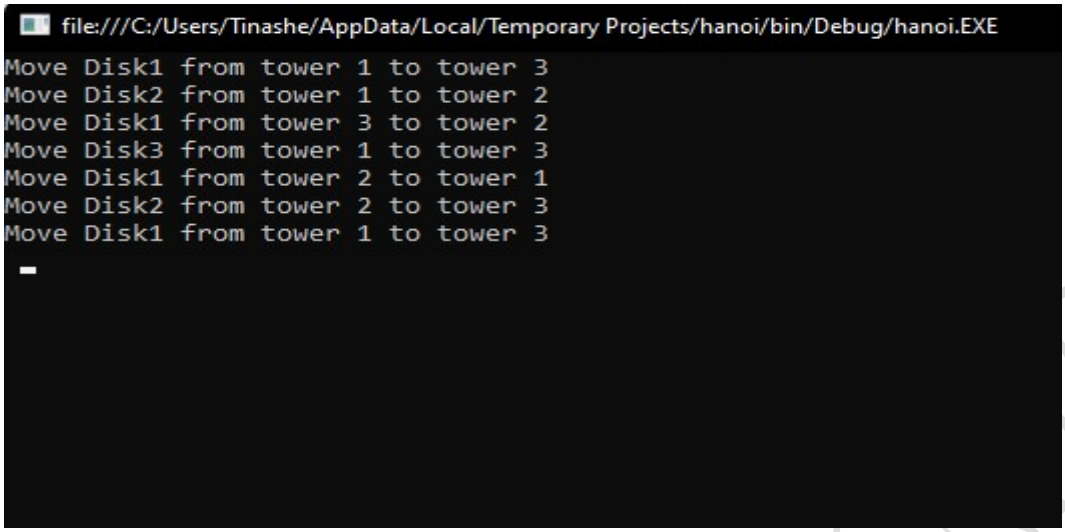
Design an algorithm to solve the problem. [7]

(f) Produce code that read all the contents of a text file and outputs the number of lines in the text file. [5]

```
Module Module1
    Sub main()
        hanoi(1, 3, 2, 3)
    End Sub
    Sub hanoi(ByVal source As Integer, dest As Integer, temptower As Integer, ndisks As
Integer)
        If ndisks > 1 Then
            hanoi(source, temptower, dest, ndisks - 1)
        End If
        Console.WriteLine("Move Disk{0} from tower {1} to tower {2}", ndisks, source,
dest)
        If ndisks > 1 Then
            hanoi(temptower, dest, source, ndisks - 1)

        End If
        Console.ReadKey()
    End Sub


End Module
```



(f)

```
Sub CountLines()
Dim text As String
Dim lineCount As Integer
' Get the input text
text = InputBox("Enter some text:")
' Initialize the line count
lineCount = 0
' Loop through the text and count the lines
For Each line In text.Split("\n")
    lineCount += 1
End For
' Display the number of lines
MsgBox("The number of lines in the text is: " & lineCount)
End Sub
```

SECTION-C

5 Study the Lupane University Athletics table below and answer the questions that follow.

Reg. No.	First name	Last name	Age	Course	Sport
MC1804	Sean	Gutsa	18	IT	Soccer
MC0808	Bongiwe	Shumba	18	Maths	Cricket
MC0708	Sisa	Bako	20	Maths	Chess
MC0309	Vimbai	Dube	19	Electronics	Soccer
MC0909	Dumisani	Nkomo	17	Economics	Cricket

(a) Produce the SQL code that defines a primary key of this table. [2]

(a) ALTER TABLE LupaneUniversityAthletics

```
ADD CONSTRAINT PK_LupaneUniversityAthletics PRIMARY KEY (RegNo);
```

(b) Produce the SQL code that can be used to produce the Athletics table above. [8]

(b)

```
CREATE TABLE LupaneUniversityAthletics (
  RegNo VARCHAR(8) NOT NULL,
  LastName VARCHAR(20) NOT NULL,
  Age INT NOT NULL,
  Course VARCHAR(20) NOT NULL,
  Sport VARCHAR(20) NOT NULL
);
INSERT INTO LupaneUniversityAthletics (RegNo, LastName, Age, Course, Sport)
VALUES
('MC1804', 'Sean Gutsa', 18, 'IT', 'Soccer'),
('MCO808', 'Bongiwe Shumba', 18, 'Maths', 'Cricket'),
('MC0708', 'Sisa Bako', 20, 'Maths', 'Chess'),
```

```
('MC0309', 'Vimbai Dube', 19, 'Electronics', 'Soccer'),
('MC0909', 'Dumisani Nkomo', 17, 'Economics', 'Cricket');
```

(c) Produce the SQL command which can be used to add the record below.

MC 9414, Kuda, Moyo, 19, ICT, Cricket [7]

```
(d) INSERT INTO LupaneUniversityAthletics (RegNo, LastName, Age,
    Course, Sport, CricketRuns) VALUES ('MC9414', 'Kuda', 'MoYo',
    19, 'ICT', 'Cricket', 171);
```

(d) The sports director for Lupane State University wants to see the Reg. Number and the sport fields only for the students.

Produce the SQL code to display Reg. Number and sport. [2]

```
(d) SELECT RegNo, Sport
FROM LupaneUniversityAthletics;
```

(e) Athlete MC 0708 has moved to another university. Her details need to be removed from the table.

Produce the appropriate SQL command to remove her from the Athletics table. [2]

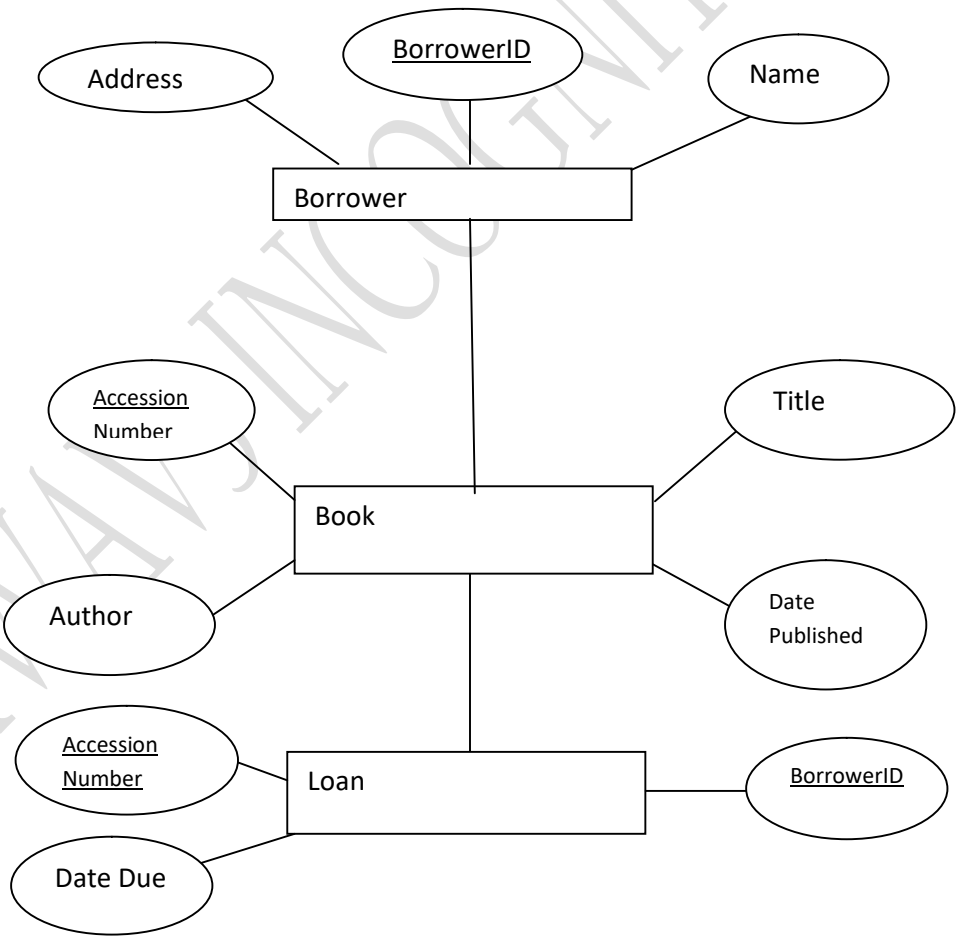
```
(e) DELETE FROM LupaneUniversityAthletics
WHERE RegNo = 'MC0708';
```

(f) Study the standard notation for a library system below.

Borrower (Borrower ID, Name, Address)
Book (AccessionNumber, Title, Author, Date Published)
Loan (AccessionNumber, BorrowerID, DateDue)

Using a drawing tool of your choice, draw and clearly label the ERD for the standard notation given above. [9]

```
Don’t worry about this construct
below
entity Borrower {
  BorrowerID PK
  Name
  Address
}
entity Book {
Accession Number PK
  Title
  Author
  DatePublished
}
entity Loan {
 Accession Number PK
  BorrowerID FK
  DateDue
}
BorrowerID --> Loan
ISBN --> Loan
```



6 A hospital is divided into two areas, Area A and Area B. Each area has several wards. All the ward names are different. A number of nurses are based in Area A. These nurses always work in the same ward. Each nurse has a unique Nurse ID of **STRING** data type.

(a) Describe the relationship shown on the diagram above. [1]

(b) A relational database is created to store the ward and nurse data. The two table designs for Area A are:

A – Ward (WardName, NumberOfBeds)

A – Nurse (Surname, FirstName, ….., ….)

(i) Complete the design for the table A-Nurse. [2]

(ii) Explain how the relationship in part (a) is implemented. [2]

6(a) Many-to-one

(b i)A-Nurse(Surname,Firstnmae,Ward_Number,NurseID)

(ii) The relationship between the A-Nurse and A-Ward tables is implemented using a one-to-many relationship. This means that one Nurse can be assigned to many Wards, but one Ward can only have one Nurse assigned to it.

(c) In Area **B** of the hospital, there are a number of wards and a number of nurses.

- Each Area **B** ward has a specialism
- Each Area **B** nurse has a specialism

A nurse can be asked to work in any of the Area **B** wards where their specialism matches with the ward specialism.

The relationship for Area **B** of the hospital is as shown below.

(i) State the degree of relationship between the entities **B**-Nurse and **B**-ward. [1]

C(i) Many-To-Many

(ii) The design for Area B data is as follows:

B-Nurse (NurseID, Firstname, FamilyName, Specialism)

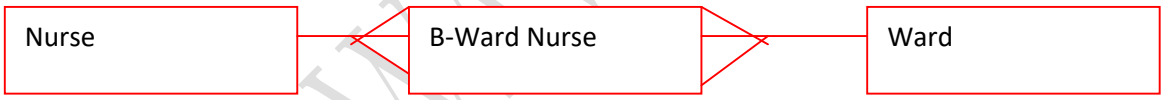
B-Nurse (WardName, NumberOfBeds, Specialism)

B-Ward-Nurse(.....)

Complete the attributes of B-ward-Nurse table. [3]

1. WardNurseID (primary key): A unique identifier for each record in the table.
2. WardID (foreign key): The WardID of the ward that the nurse is assigned to.
3. NurseID (foreign key): The NurseID of the nurse who is assigned to the ward

(iii) Draw the relationships of the three tables above using an ERD. [3]



(d) Using the design for tables in part (c)(iii).

(i) Produce a SQL query to display the NurseID and family name for all Area B nurses with a specialism of "Theatre". [3]

(ii) Tendero, who is an Area B nurse with the nurseID 076 has recently married and her new family name is Makwanzini. Produce an SQL command to update her record. [5]

(i)

```
SELECT NurseID, FamilyName
FROM B-Nurse
WHERE Specialism = 'Theatre';
```

Note how I used the keyword where

(ii)

```
UPDATE B-Nurse
SET FamilyName = 'Makwanzini'
WHERE NurseID = 076;
```

(e) A student intends to create a database with tables whose records can be accessed using a form based interface created using a high level programming language. The standard normal form of the member table in the database is as follows:

member(**memberID**, FirstName, Surname, DateJoined, JoiningFee, CellNumber)

Using the information provided above,

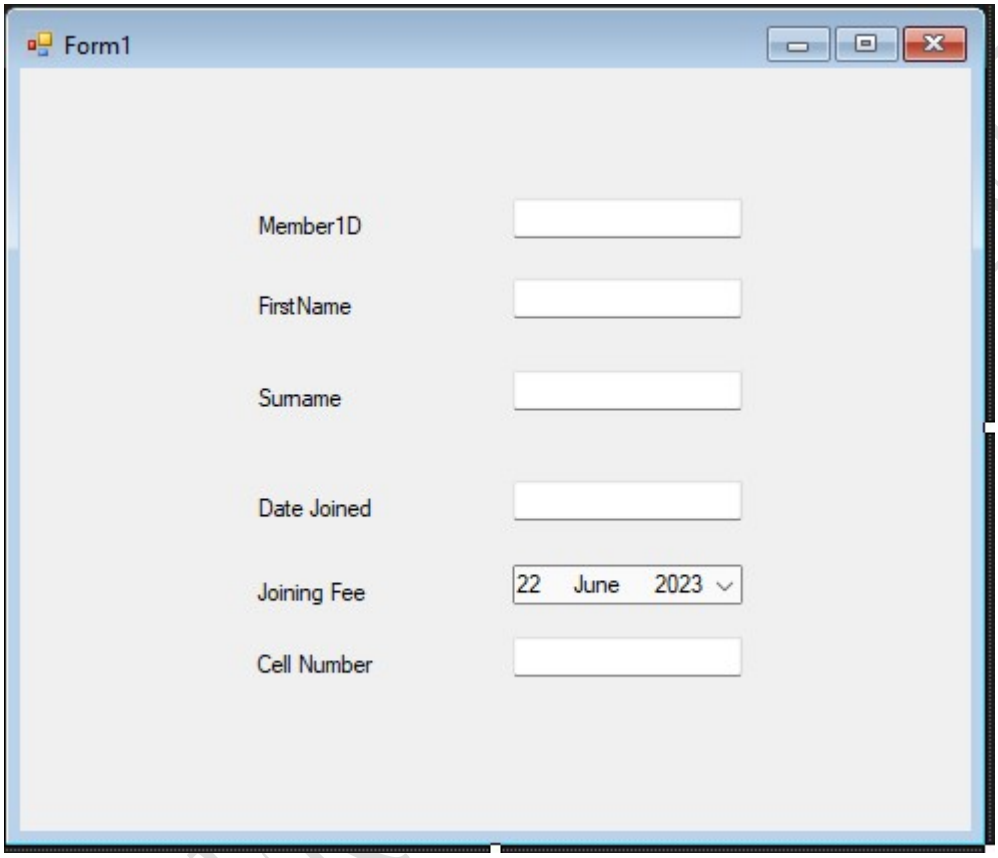
(i) design a data structure (file design) of the member file in tabular form (using a word processor) with the following column headings:

FieldName, Size, Format/Validation, Data type [3]

FieldName	Size	Format/Validation	Data type
memberID	10	Alphanumeric	Integer
FirstName	20	Alphabetic	String
Surname	20	Alphabetic	String
DateJoined	10	Date format	Date
JoiningFee	10	Decimal format	Decimal
CellNumber	15	Numeric format	Integer

(ii) design a form-based interface for the member table using a high level programming language of your choice. Command buttons are not necessary.

Produce a screenshot of the form and print it. [7]



Remember the question stated that command buttons are not necessary

Cyberwave Solutions

Inspired by the great works of God

Philippians 4:13

Proverbs 16:3

Tricks to ace paper 2 exams CS

- Regular coding practice
- Think outside the box before writing your everyday code
- Apply programming to your day to day life i.e create pure mathematics ,physics ,chemistry, cs ,geography math solving tools yeah u heard me
- Remember nobody is born a genius, never be afraid to ask
- GPT is an assistant, never tell it to do your programming assignments because those assignments are there to stretch you not to trouble you
- Have computer science related dreams in your mind at all times when you study, it will naturally push you to work harder

~PRAYER ALWAYS WINS~

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~Thanks for your unending support