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]

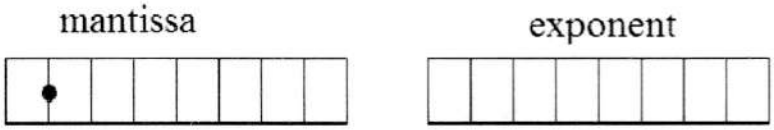
(c) In the same 8 bit system, a student attempts to perform the following arithmetic operation

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
```

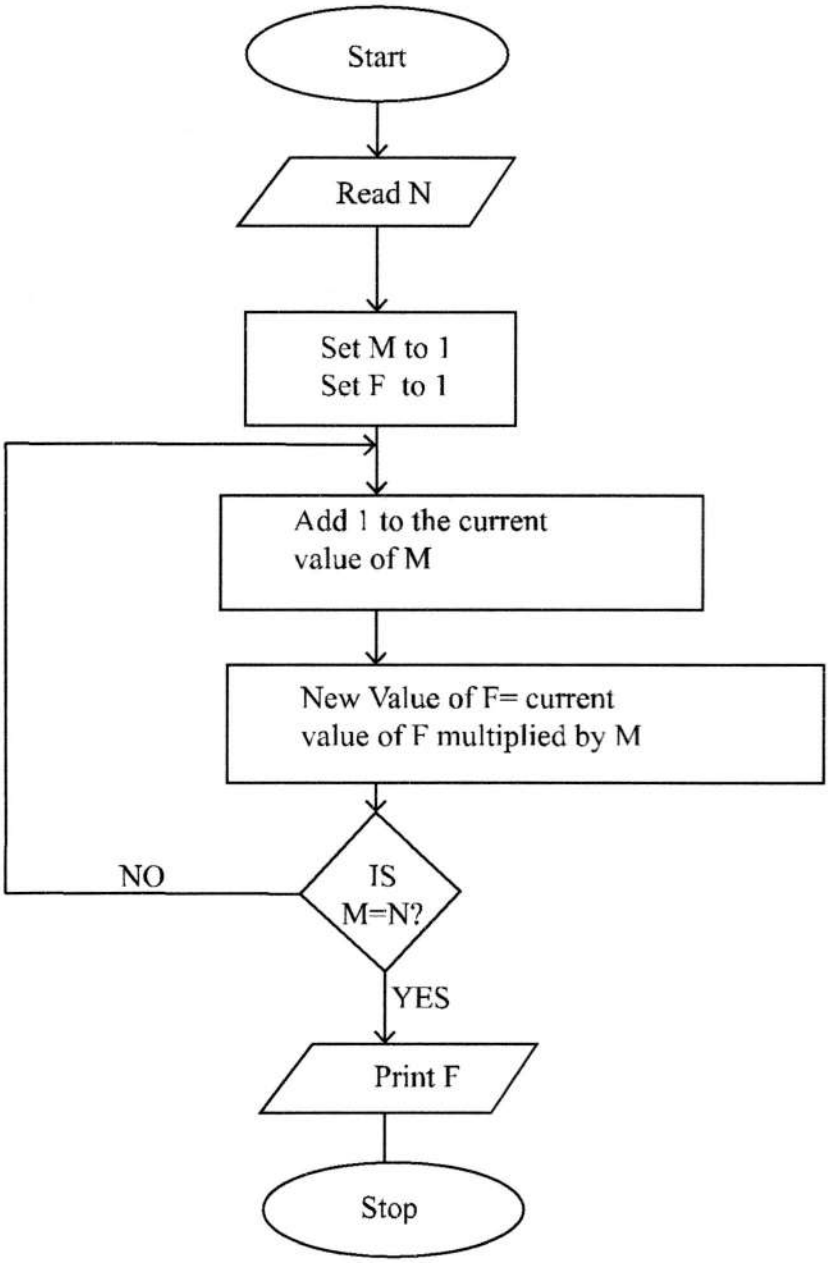
(a) Given that the root node is Dumisani, create a binary tree resulting from inserting the following in the order given:

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.

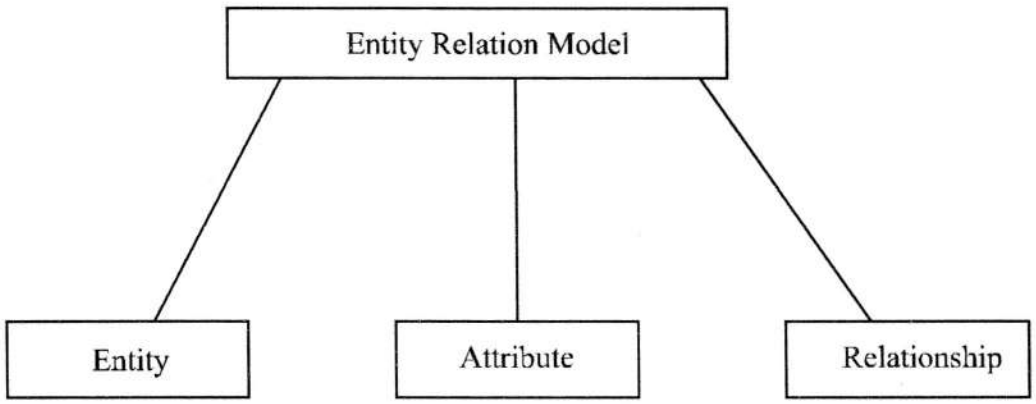
N	M	F	M = N?	Output

[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]

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.

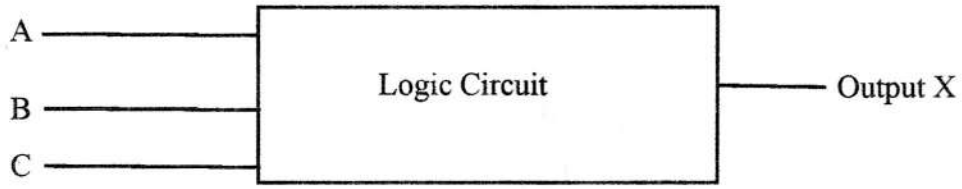
This question paper consists of 10 printed pages and 2 blank pages.

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 **O**.
- sensor **B** outputs the value **1** and sensor **C** outputs the value **O**. [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

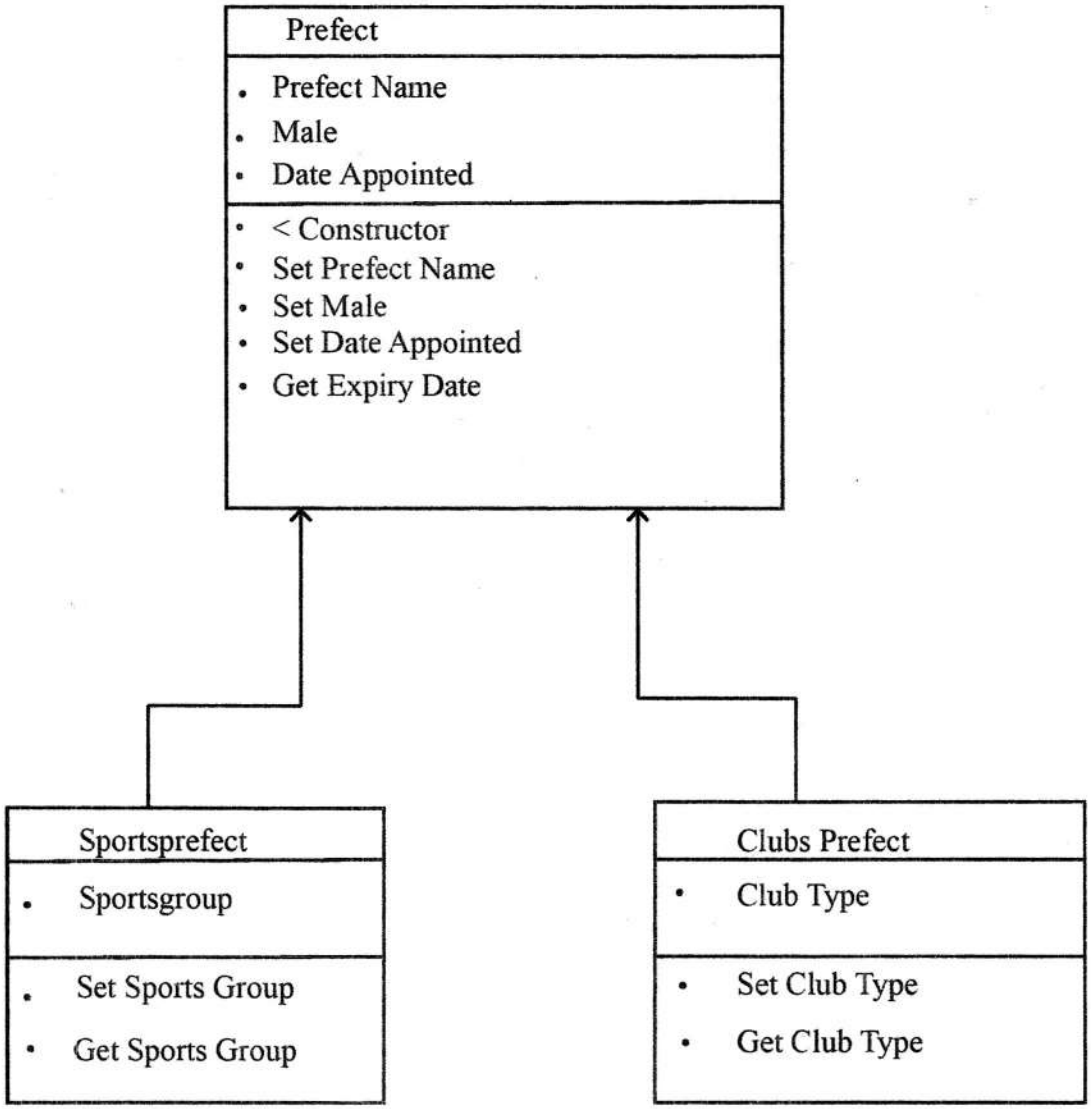
encrypt(<plain text>) [8]

(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.

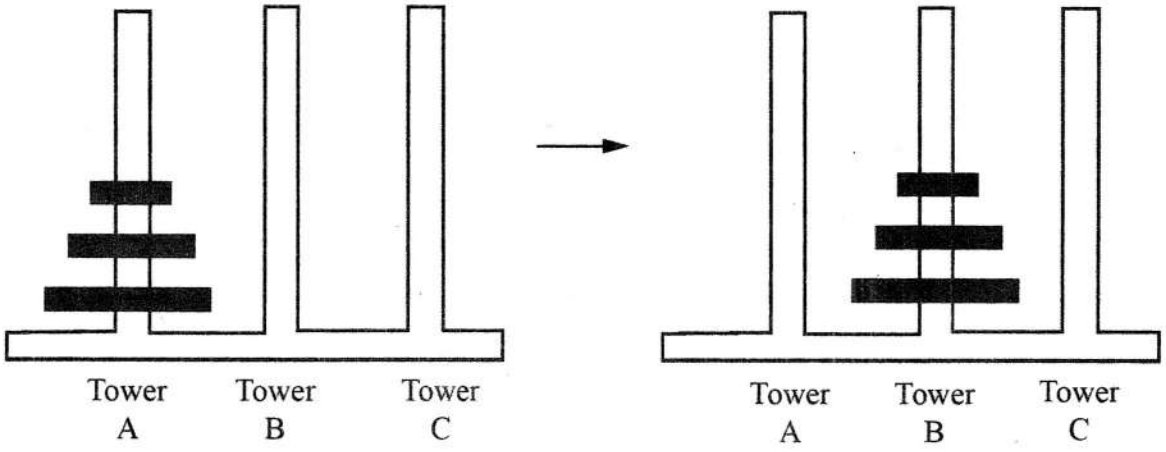
[11]

(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]