



6023/2

3 hours

CD / flash disk for each candidate
Printing facility
Bond paper

INSTRUCTIONS TO CANDIDATES

This paper consists of three sections.

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

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 / flash disk.
If you print on more than one sheet, fasten the sheets together.
All answers should be correctly and clearly numbered.

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

This question paper consists of 8 printed pages.

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[Turn over



Section A [20 marks]

Answer any one question from this section.

- 1 (a) A chemical plant gives out a warning signal ($w = 1$) when the process goes wrong. A logic network is used to provide input and decide whether or not $w = 1$.

Input	Binary	Plant status
C	1 0	Chemical Rate = $10 \text{ m}^3/\text{s}$ Chemical Rate < $10 \text{ m}^3/\text{s}$
T	1 0	Temperature = 87°C Temperature > 87°C
X	1 0	Concentration > 2 moles Concentration = 2 moles

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

- a) Chemical Rate < $10 \text{ m}^3/\text{s}$
 OR b) Temperature > 87°C and Concentration > 2 moles
 OR c) Chemical rate = $10 \text{ m}^3/\text{s}$ and Temperature > 87°C

- (i) Formulate a logic expression for the conditions. [3]
- (ii) Draw a logic network to represent how this chemical plant is monitored. [7]
- (iii) Compute a truth table for the logic network in (ii). [5]
- (b) Draw a clearly labelled diagram that represents the Von Neumann Architecture. [5]
- 2 (a) Draw the logic circuit for each of the Boolean expressions given below
- (i) $A \cdot B + C$ [2]
- (ii) $\overline{(P+Q) \cdot (P+R)}$ [3]
- (b) Draw a flowchart or other diagram to illustrate how the sequence of instructions are carried out during interrupt servicing. [8]



- (c) In a processor three instructions (J followed by K, followed by M) are processed using pipelining.

The following table shows the five stages that occur when instructions are fetched and executed.

STAGE	TIME INTERVAL								
	1	2	3	4	5	6	7	8	9
Fetch instruction									
Decode instruction	J								
Execute instruction									
Access operand in memory									
Write result to register									

- (i) The 'J' in the table indicates that instruction has been fetched in time interval 1.

Copy and complete the table to show the time interval in which each stage of each instruction (J, K, M) is carried out.

[4]

- (ii) The completed table shows how pipelining allows instructions to be carried out more rapidly. Each time interval represents one clock cycle.

Calculate how many clock cycles are saved by the use of pipelining in the above example.

Show your working.

[3]



Section B [50 marks]

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

- 3 (a) Produce a program using a high level programming language.

- The program should output the Fibonacci sequence up to the 150th element.
- The first 12 elements are as follows: -
0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 ...
- Your program should use an iterative method. [6]

- (b) The same task can be accomplished using the following recursive technique:

- where 'i' is the element number
- for the case where $i = 1$ (first element)
- for the case where $i = 2$ (second element) $\rightarrow$ fib of $i = 0$
 $\rightarrow$ fib of $i = 1$
- for the case where $i = 2$ (third element upward)
 $\rightarrow$ fib of $i = \text{fib of } (i - 2) + \text{fib of } (i - 1)$

Produce a recursive function only for the Fibonacci. [5]

- (c) For this task, you are required to produce a program using a high level programming language that works with **2 files**.

- opens file 1 for reading
- opens file 2 for writing

- (i) Use a text editor to create a text file with the following content: -

	<i>* use Consolas / courier Font for blue text</i>
< Line 1>	This is my source File
< Line 2>	Number 1 is:
< Line 3>	Number 2 is:
< Line 4>	My name is:
	<i>* end of Consolas / courier</i>

Produce a screen shot of the typed file showing the text content as above. [3]

- (ii) Produce program code that reads the content of File 1 and then writes it to File 2 as follows: -

** use Consolas / Courier font*

< Line 1>
< Line 2> < centre number >
< Line 3> < candidate number >
< Line 4> < Name, Surname >
< Date / time stamp >

Sample Output

This is my source file
Number 1 is: 0100015
Number 2 is: 0059
My Name is: Chipu Made
01/01/ 2020

** end of Consolas / courier font*

** NB: Submit only your source code for this question.* [14]

- (d) Produce a program using the high level programming language that initialises an array of 20 characters with capital letters of the alphabet.
* N.B ASCII code for 'A' = 65 [4]
- (e) Produce a program by copying and modifying your code from (d) above or otherwise.
The program in this case works with a 2 D array, each element containing 2 characters. (capital letters and small letters)
- Array should be a 20 × 20 elements.
*N. B ASCII code for 'a' = 97. [10]
- (f) Multiplication can be considered to be repeated addition.
Produce a program using pseudocode or a high level programming language that multiplies 2 positive integers.
- The program should implement an iterative function (A full description of function is required).
 - There should (only this line is required) be a calling statement in the main program. [8]
- 4 (a) Produce a program that prints out characters whose values range from exclamation to backslash in a list box.
NOTE ASCII value of ! = 33 and / = 47 [4]
- (b) Design an interface and code for a program that converts unsigned integer number (whole number) to its binary equivalent. [9]
- (c) Produce a code that inputs 10 items and then outputs the weight of the heaviest and the lightest item. The code should also output the average weight of all items. Produce a screen shot for your answer. [6]
- (d) A perfect positive number is called perfect if the sum of its factors is equal to twice the number. It is called abundant if the sum of its factors is greater than twice the number. It is called deficient if the sum of its factors is less than twice the number.
Produce a program code that reads a number and prints out whether it is perfect, abundant or deficient. [9]
- (e) The employees of a company all have 8-character personnel numbers. An algorithm will do the following:
Enter the number and then test if it contains exactly 8 characters, less than 8 characters or more than 8 characters.
Display appropriate messages for each condition.
- (i) Produce an algorithm in the form of a pseudocode for the above narration. [6]
 - (ii) produce a code for your pseudocode in (i) above. [8]



- (f) The following section of pseudocode inputs 100 numbers and outputs the **largest positive** and **largest negative** number. There are some errors in the pseudocode.

1. Input number
2. $\text{neg} = \text{number}$: $\text{pos} = \text{number}$
3. For $x = 0$ to 100
4. Input number
5. If $\text{number} > \text{pos}$ then $\text{number} = \text{pos}$
6. If $\text{number} < \text{neg}$ then $\text{number} = \text{neg}$
7. $x = x + 1$
8. Next x
9. Output pos , neg

(i) Identify the errors in the pseudocode. [4]

(ii) Correct the errors identified in (i) above. [4]



Section C [30 marks]

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

- 5 (a) Gabaza video club maintains a database of movies to be rented out. Without normalisation, all information is stored in one table as shown below.

Member ID	Title	Full Name	Address	Movie Rented	Category
1	Mrs	Jane Moyo	902 Mutare	Pirates Titans	Action, Action
2	Mr	Robert Dube	54 Gweru	Forgotten Daddy	Educational Comedy
3	Mrs	Anesu Ncube	100 Airport	Titans	Action

Normalise the above table to second normal form.

[14]

(b)

Student-ID	F Name	Surname	Sport	Venue
4241	Sibo	Nare	cricket	Harare
4741	Takunda	Mafu	soccer	Harare
4858	Farai	Muganu	volley	Kwekwe
4740	Sean	Gutsa	volley	Mutare
4848	Layla	Tanguni	cricket	Kwekwe
4742	Sindiso	Moyo	cricket	Mutare
4444	Thubani	Malahleka	soccer	Mutare

- (i) Using DBMS of your choice, identify the primary key and create the sport table above. [4]
- (ii) Create a query to display the records of students who play cricket, print the screen shot and the SQL code. [4]
- (iii) Produce the delete query to remove Farai Muganu from the table. Print the screen shot and SQL code. [4]
- (iv) Produce the updated query to add the following record 4748, Kenneth, Shawa, soccer, Gweru. Print the result and the SQL. [4]



- 6 A school website has a relational database, SCHOOLWEB, that stores the website's information.
The Database has 3 tables to store student details, image details and text that they post.
The tables are as shown below:

Student (**Student ID**, Surname, First Name, Date of Birth)

Photo (**Photo ID**, Student ID, Comment, Upload Date)

Text Post (**Post ID**, Student ID, Date of post, The Text)

- (a) (i) Explain how the relationship between the tables **Student** and **Photo** has been implemented. [2]
- (ii) Draw the ERD to show the relationship between the 3 tables. For fields, only include the primary keys on the ERD. [7]
- (b) The following table shows sample data for a **student** table.

Student ID	First Name	Surname	Date of Birth
tino123	Tinotenda	Mutamba	01/01/95
jackmoyo	Jacob	Moyo	23/02/56
muteroa	Anesu	Mutero	03/03/97
bigboss3	Mazvita	Tongogara	04/03/82

- (i) Produce an SQL statement to create the student table above. [5]
- (ii) Produce an SQL statement to add a new field, country, to the student table. [2]
- (iii) Produce an SQL statement to display all attributes for students who were born before 1990. [3]
- (iv) Produce an SQL statement to display all records in descending order of student surname. [3]
- (c) Draw a well-labelled diagram showing the 3-layered schema of the Database Management System (DBMS).
Give a brief description of each layer. [8]

