



ZIMBABWE EZEKIEL GUTI UNIVERSITY

FACULTY OF HEALTH, SCIENCE AND TECHNOLOGY

DEPARTMENT OF DIGITAL TECHNOLOGY

EXAMINATION PAPER

COURSE CODE: BIS123
COURSE TITLE: DATA STRUCTURES AND ALGORITHMS
SPECIAL REQUIREMENTS: NONE
LEVEL: 1.2
EXAM DURATION: 3 hours
DATE: 2024 12 APR 2024

INSTRUCTIONS TO CANDIDATES:

1. This paper consists of 2 sections
2. Answer **ALL** Questions in SECTION A and **ANY THREE** Questions from SECTION B in booklet provided.
3. Start each Question on a new page
4. Use C, C++, C#, Java or Python for code.

There are 3 printed pages for this question paper

QUESTION 5

You are required to provide an implementation of a queue based on a singly linked list. Using suitable illustrative diagrams, explain how you might do this. Your answer should pay particular attention to the location and resulting efficiency of the insertion and deletion operation.

[20 marks]

QUESTION 6

a) Write a procedure that counts the number of vowels in a given character string.

[10 marks]

b) Create a program that can take a positive integer greater than 2 as input and print out the number of times one must repeatedly divide this number by 2 before getting a value less than 2

[10 marks]

QUESTION 7

a) What are the merits and demerits of array implementation of lists?

[10 marks]

b) Discuss the greedy algorithm and its applications.

[10 marks]

QUESTION 8

a) State and briefly explain any FIVE operations of the stack?

[10 marks]

b) Write the routine to push an element into a stack

[10 marks]

*** Wish you all the best ***

9/15 am

SECTION A

Answer ALL questions from this section

QUESTION 1

- a) What is a data structure? [2 mark]
- b) Data structures are classified into TWO broad categories. Identify these and give a brief description of each. [4 marks]
- c) State TWO reasons why we need data structures [4 marks]

QUESTION 2

Given the following data in an unsorted array.

0	1	2	3	4	5	6	7	8	9
91	71	29	43	97	59	17	93	61	13

You are required to implement a *bubble-sort* algorithm. Illustrate its behaviour as it sorts the array. Your illustration must show the contents of the array throughout all the steps. **[10 marks]**

QUESTION 3

- a) Consider the expression $y + 2 * z ++ < 3 - w / 5$. Add parentheses to show the precise order of evaluation given the rules for operator precedence. [5 marks]
- b) What are the contents of string *s* after executing the following statements?

```
string s = "abc";  
string t = "cde";  
s += s + t[1] + s;
```

[5 marks]

QUESTION 4

Write a pseudo-code description of a method for finding the smallest and largest numbers in an array of integers. Use the description to also design a function procedure that would perform the same task. [10 marks]

SECTION B

Choose any **THREE** questions from this section each question carries **20 marks**.