

ZIMBABWE EZEKIEL GUTI UNIVERSITY



FACULTY OF HEALTH, SCIENCE AND TECHNOLOGY

Department of Digital Technology

MODULE: DESIGN AND ANALYSIS OF ALGORITHMS
(MAIN)
CODE: CDT 105
DATE: 27 May 2019
DURATION: 3 HOURS

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. SECTION A IS THEORY WHILE SECTION B IS PRACTICAL
2. ANSWER ALL QUESTIONS IN SECTION A
3. CREATE A FOLDER ON THE DESKTOP AND NAME IT AFTER YOUR REGISTRATION NUMBER. ALL YOUR ANSWERS MUST BE SAVED IN THAT FOLDER, WHICH YOU SHALL SUBMIT AT THE END OF THE EXAMINATION.
4. ATTEMPT ANY TWO QUESTIONS IN SECTION B.
5. ALL PROGRAMS MUST BE WRITTEN IN JAVA OR C
6. NUMBER OF MARKS FOR EACH QUESTION IS GIVEN IN SQUARE BRACKETS []

Section A: Answer ALL questions [50 Marks]

Question 1

Define the following terms:

- (a) Algorithm [2]
- (b) Algorithm design [2]
- (c) Algorithm analysis [2]
- (d) Time complexity [2]
- (e) Recursive algorithm [2]

Question 2

- (a) Explain any five (5) characteristics of algorithms. [10]
- (b) Determine the big O of $f(n) = 3n^2 + 4n + 1$ [2]
- (c) Explain the importance of algorithms in computer programming. [3]

Question 3

Design a flowchart for a program that does the following:

Accepts a person's height and weight and calculates their BMI (Body-Mass-Index). If the BMI is less than 18.5, display the message "You are underweight", else if it is between 18.5 and 25, display the message "Your weight is normal", else if it is more than 25 but less than or equal to 30, display the message "You are overweight" and else if it is above 30, display the message "You are obese". BMI is calculated as w/h^2 where h=height in metres and w=weight in kilograms. [25]

Section B: Answer ANY TWO questions [Practical]. All code to be written in Java or C [50 Marks]

Question 4

Implement the depth first search algorithm using a tree of your choice. [25]

Question 5

Implement the breadth first search algorithm using an example tree of your choice. The tree should have a depth of at least 3. [25]

Question 6

Write a program that sorts this list: **3,6,1,9,7,3,5,10** using:

- (a) Merge sort [5]
- (b) Quick sort [5]
- (c) Bubble sort [5]
- (d) Insertion sort [5]

Note: Correct syntax, main method, reference variables and output will be awarded [5]

Question 7

(a) Write a program that searches for 10 in the list **9,8,7,11,5,3,1,13,10,14** using each of the following algorithms.

- (i) binary search [10]
- (ii) Sequential search [10]

(b) Show the time efficiency of each of the algorithms in (a) above in searching using a method called time Efficiency(). [5]

*****End of Paper*****