

ZIMBABWE EZEKIEL GUTI UNIVERSITY



FACULTY OF HEALTH, SCIENCE AND TECHNOLOGY

Department of Digital Technology

MODULE: DESIGN AND ANALYSIS OF ALGORITHMS
(SUPPLEMENTARY)
CODE: CDT 105
DATE: JULY 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 LANGUAGE
6. EACH FULL QUESTION CARRIES 25 MARKS.
7. NUMBER OF MARKS FOR EACH QUESTION IS GIVEN IN SQUARE BRACKETS[]

SECTION A: ANSWER ALL QUESTIONS

QUESTION 1

- (a) Define the term **algorithm analysis**. [3]
- (b) State **two** approaches to algorithm analysis [2]
- (c) Explain time complexity and space complexity [4]
- (d) Explain the Big-O concept [4]
- (e) Explain any **four** reasons why algorithm analysis is important. [12]

QUESTION 2

- (a) Explain any **five** factors that determine the running time of a program. [10]
- (b) Consider the undirected graph in Figure 2 and determine the shortest path between the nodes a and z. [Show all workings]. [8]

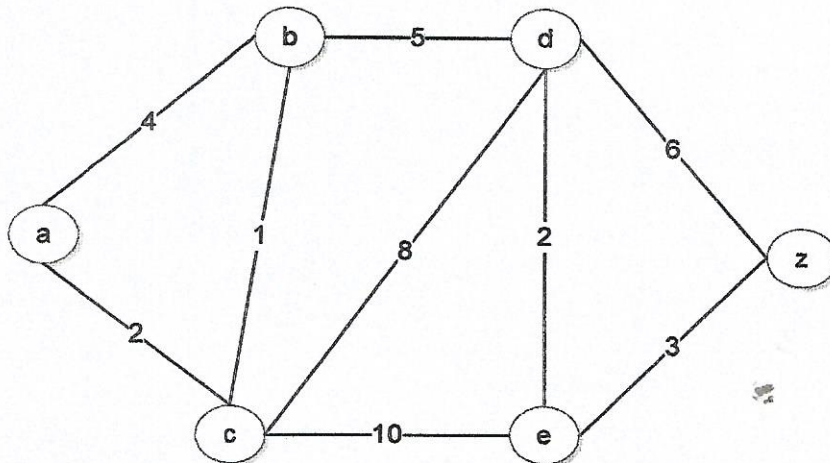


Figure 2 Undirected graph

- (c) A binary tree structure can be used to store words for a lookup thesaurus for English words, so as to reduce the amount of time it takes to look up a word. Assume that the root of the binary tree is occupied by the first word in the list. The left child of each parent node must be alphabetically less than the parent, and the right child must be alphabetically greater than the parent.

- (i) Construct a binary tree with the following words: *minute, local, sober, crowbar, disaster, towboat, stain, egg, trouble, crazy, zebra*. [4]
- (ii) State the depth of the left subtree and that of the right subtree. [2]
- (iii) How many leaves does the tree have? [1]

SECTION B: ANSWER ANY TWO (2) QUESTIONS

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- (a) Write a program that uses a recursive function/method to find the factorial of a number entered by a user. Your program should validate the input. [10]
- (b) Write a program that finds an n^{th} term in a Fibonacci series. The user should enter what term they want, that is n . [Hint: A Fibonacci series is $f(n) = f(n-1) + f(n-2)$]. Use recursion to achieve this. [15]

QUESTION 4

- (a) Write a program that searches for the number 5 in the list 7,3,6,2,1,9,4,5 using:
- (i). Sequential search algorithm [10]
 - (ii). Binary search algorithm [10]
- (b) Use the `current Time Millis()` method to compare the time complexity of the two search algorithms in (a) above, and state which of the two is faster in this case. [5]

QUESTION 5

Write a program that implements the Dijkstra's algorithm on a specified graph of your choice. [Indicate the distances between the nodes as comments in your code]. [25]

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