

Assignment 3 : Solving Problems Using Binary Search Variations (Divide and Conquer Algorithm)

Objective:

To understand and analyze the implementation and efficiency of Binary Search algorithms in solving various problems.

Instructions:

1. Introduction

- Provide a brief overview of the Binary Search algorithm. Explain the main concept and how this algorithm works in general.

2. Problem 1: Finding the Peak Element in an Array

- **Description:** Define the problem of finding a peak element in an array. A peak element is an element that is greater than its neighbours.
- **Pseudocode:** Write the pseudocode for finding the peak element using the Binary Search approach.
- **Sample Input and Output:**
 - Input: [1, 3, 20, 4, 1, 0]
 - Output: 20
- **Testing:** Test the implemented solution with different sets of input data. Provide the code and screenshots of the output.
- **Analysis:** Analyze the time complexity and space complexity of the solution. Discuss the performance based on the test results.

3. Problem 2: Searching in a Rotated Sorted Array

- **Description:** Define the problem of searching for a target value in a rotated sorted array.
- **Pseudocode:** Write the pseudocode for searching in a rotated sorted array using the Binary Search approach.
- **Sample Input and Output:**
 - Input: array = [4, 5, 6, 7, 0, 1, 2], target = 0
 - Output: 4 (index of the target in the array)
- **Testing:** Test the implemented solution with different sets of input data. Provide the code and screenshots of the output.
- **Analysis:** Analyze the time complexity and space complexity of the solution. Discuss the performance based on the test results.

4. Problem 3: Finding the Square Root of a Number Using Binary Search

- **Description:** Define the problem of finding the square root of a given number using the Binary Search approach.
- **Pseudocode:** Write the pseudocode for finding the square root using Binary Search.
- **Sample Input and Output:**
 - Input: 16
 - Output: 4
- **Testing:** Test the implemented solution with different sets of input data. Provide the code and screenshots of the output.
- **Analysis:** Analyze the time complexity and space complexity of the solution. Discuss the performance based on the test results.

