Practical Discrete Mathematics (CSE 1402)

MINOR ASSIGNMENT-6: COMPUTATIONAL TOOLS FOR ALGORITHMS

1. Write a program that asks the user to choose between sequential, selection, and repetitive flow tasks and executes accordingly.
2. Write a program that counts how many even and odd numbers are in a list. Measure the execution time of the program and discuss its time complexity.
3. Write a program to check if a number is prime. Improve the algorithm from $O(n)$ to $O(\sqrt{n})$.
4. Write a program to merge two sorted arrays into a single sorted array. Measure the execution time of the program and discuss its time complexity.
5. Write a program to find the first duplicate element from a given list. Measure the execution time of the program and discuss its time complexity.
6. Write a program to find all the duplicate elements from a given list. Measure the execution time of the program and discuss its time complexity.
7. Write a program to identify the element that appears most frequently in a list. Measure the execution time of the program and discuss its time complexity.
8. Write a Python program to implement the linear search algorithm to find a target value in a list.
   (a) If the target is found, return its index.
   (b) If not found, return -1.

   Additionally, measure the execution time of the program and discuss its time complexity.
9. Write a Python program to implement the binary search algorithm to find a target value in a list.
   (a) If the target is found, return its index.
   (b) If not found, return -1.

   Additionally, measure the execution time of the program and discuss its time complexity.
10. Write a program that compares the number of comparisons made by linear search and binary search on the same sorted list.
11. Write a program that counts how many times each number appears in a list. Measure the execution time of the program and discuss its time complexity.
12. Create a program that prints all pairs of elements from a list. Measure the execution time of the program and discuss its time complexity.
13. Write a program that repeatedly divides a number n by 2 and counts how many steps it takes to reach 1. Measure the execution time of the program and discuss its time complexity.
14. Write a Python program to implement a recursive function for computing Fibonacci numbers. Measure the execution time of the program and discuss its time complexity.