Semester Project Report

Submitted By:

Affan Hameed. 22i-2582

Shoaib Mehmood, 22i-2448

Bilal Mehmood, 22i-2452

CS 2009 Design and Analysis of Algorithms

Semester Project

Algorithm Analysis Report

Submitted to Sir Bilal Khalid Dar

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1. Introduction

The following is the work division for this project:

a. Member 1 - Affan Hameed, 22i-2582
b. Member 2 - Bilal Mehmood, 22i-2452
c. Member 3 - Shoaib Mehmood, 22i-2448

2. Machine Specifications

The machine that was used for this project for the purpose of testing all the member's algorithms against the selected dataset has the following specifications:

- Processor: Core i7 11th Generation
- Memory: 16 GB DDR4 at 3200 Mhz
- Graphics: Intel Iris Xe Graphics

3. Complete Algorithms with Time Complexity Analysis

a. Member 1 Code and TC Analysis:

Algorithm Name	Best Case TC	Worst Case TC	Average Case TC
Dijkstra	O((nodes+edges) log nodes)	O((nodes+edges) log nodes)	O((nodes²)log nodes)
Bellman Ford	O(edges+nodes²)	O(edges*nodes)	O(edges*nodes)
Diameter of Graph	O(nodes)	O(nodes)	O(nodes)

b. Member 2 Code and TC Analysis:

Algorithm Name	Best Case TC	Worst Case TC	Average Case TC
Prims	O(nodes²)	O(nodes²)	O(nodes²)
Kruskals	O(edges*	O(edges*	O(edges*

	log(edges))	log(edges))	log(edges))
Avg Degree	O(nodes)	O(nodes)	O(nodes)

c. Member 3 Code and TC Analysis:

Algorithm Name	Best Case TC	Worst Case TC	Average Case TC
BFS	O(nodes)	O(nodes+edges)	O(nodes+edges)
DFS	O(nodes)	O(nodes+edges)	O(nodes+edges)
Cycle Detection	O(nodes+E)	O(nodes+edges*log(edges))	$O(nodes^3)$

4. Dataset Details

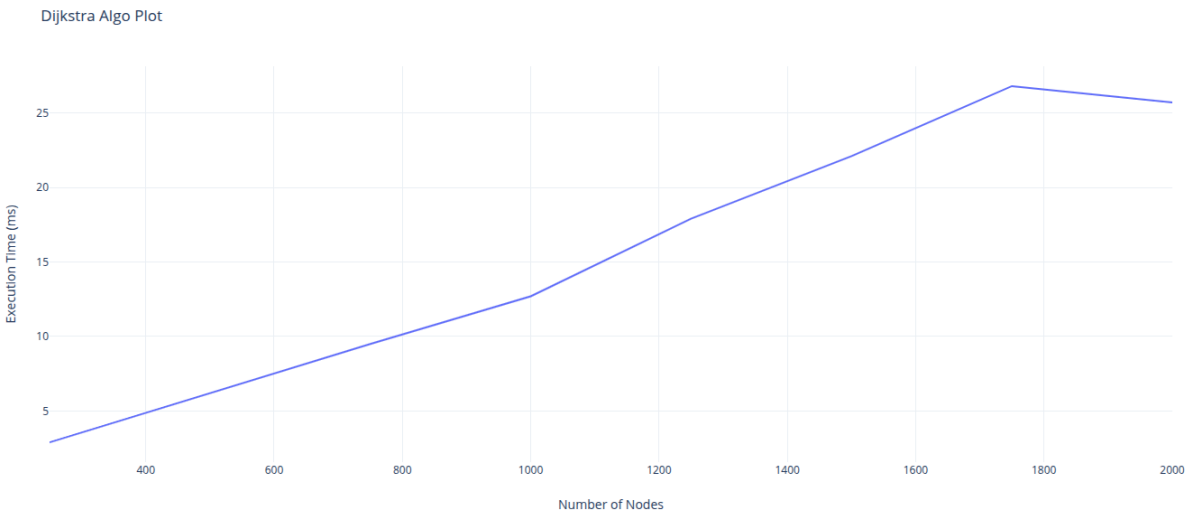
This is who-trusts-whom network of people who trade using Bitcoin on a platform called Bitcoin Alpha. Since Bitcoin users are anonymous, there is a need to maintain a record of users' reputation to prevent transactions with fraudulent and risky users. The details for the dataset are as follows:

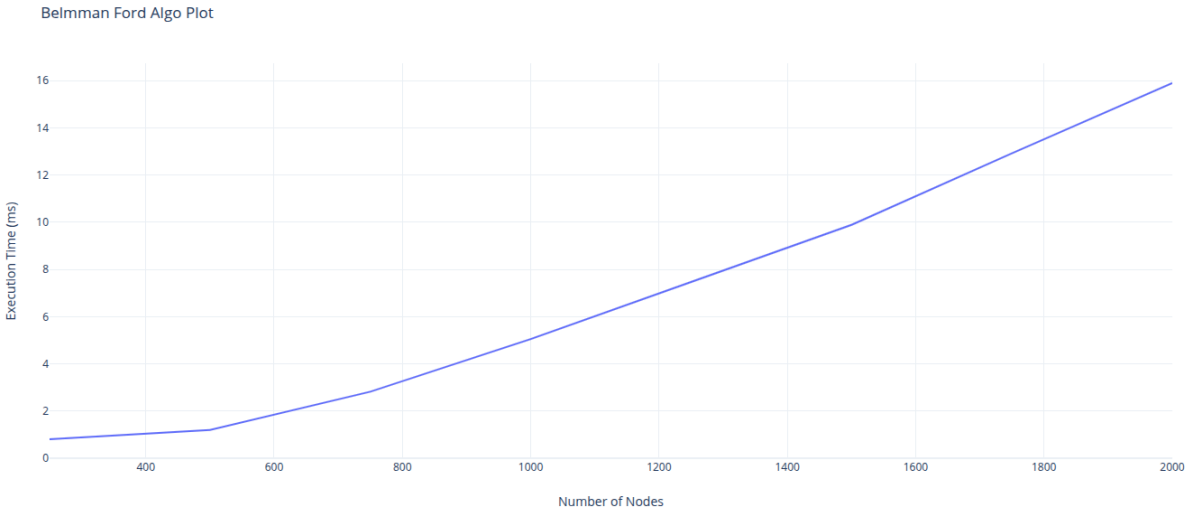
- Total Nodes = 7605
- Total Edges = 24,186
- Weight Range = +1 to +10

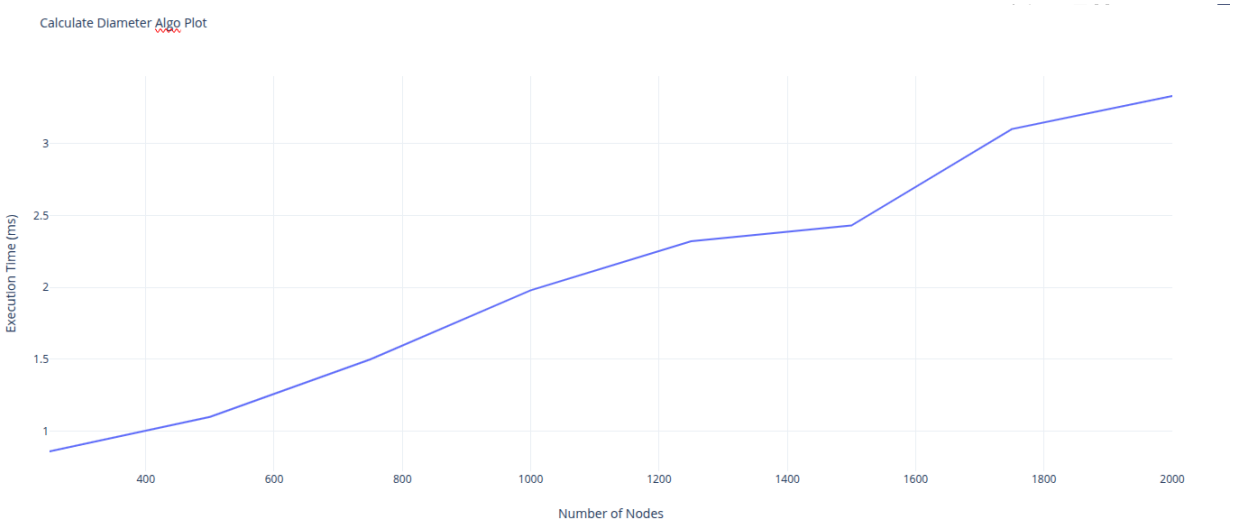
5. Comparison of Algorithms Using Plots of Results

a. Member 1

i. Directed Graph

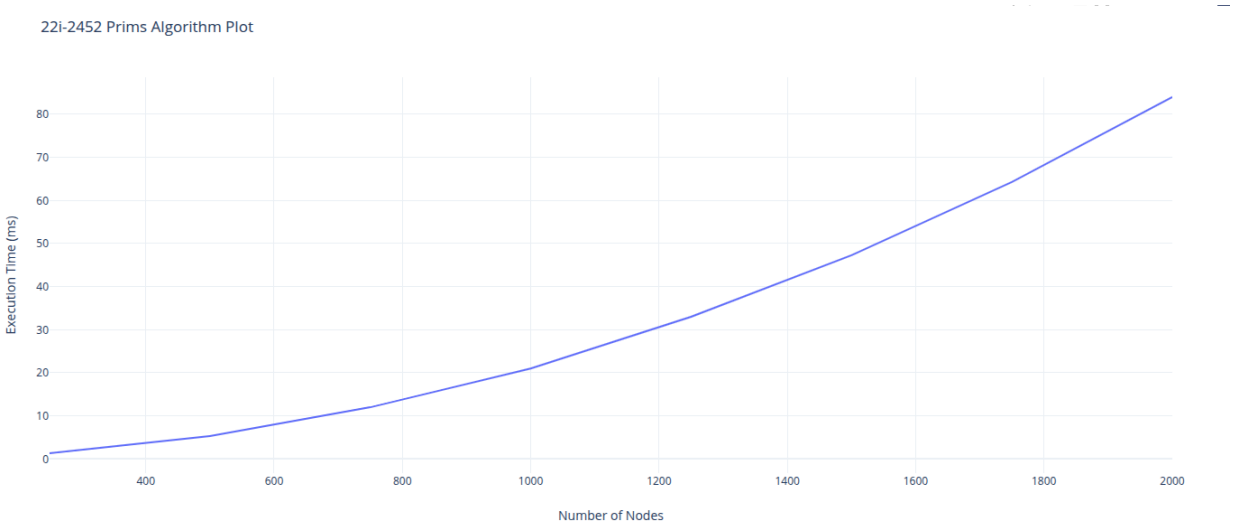




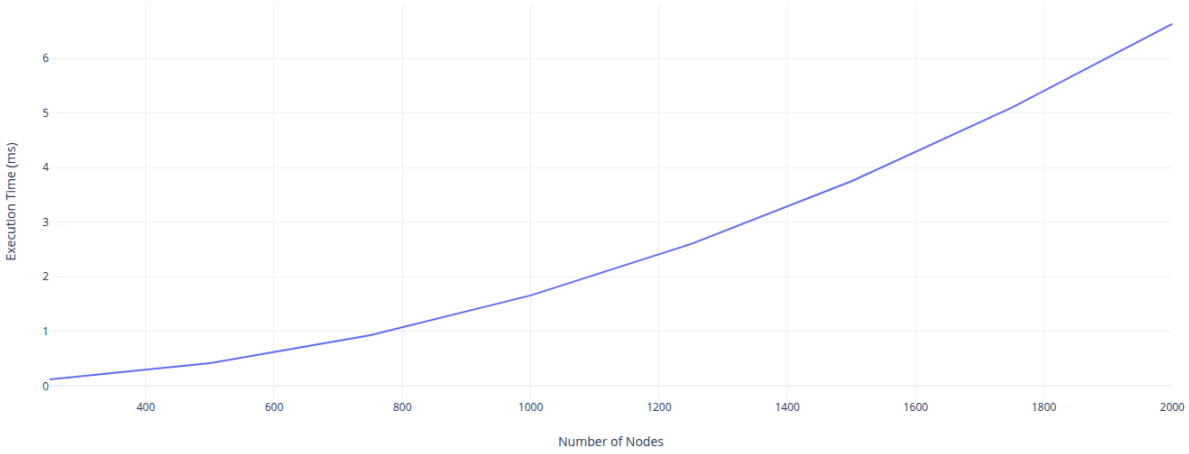


b. Member 2

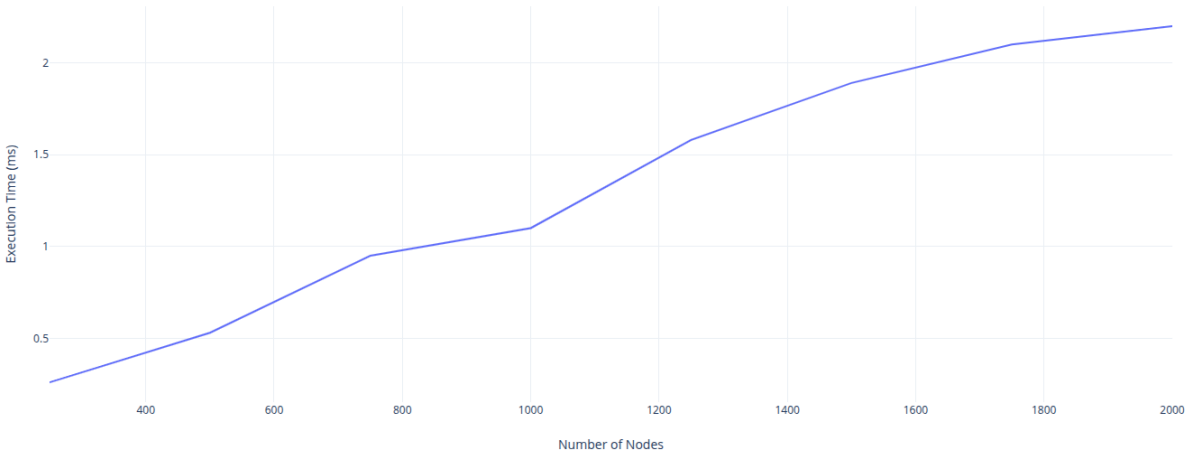
i. Undirected Graph (except for average degree)



22i-2452 Kruskals Algorithm Plot

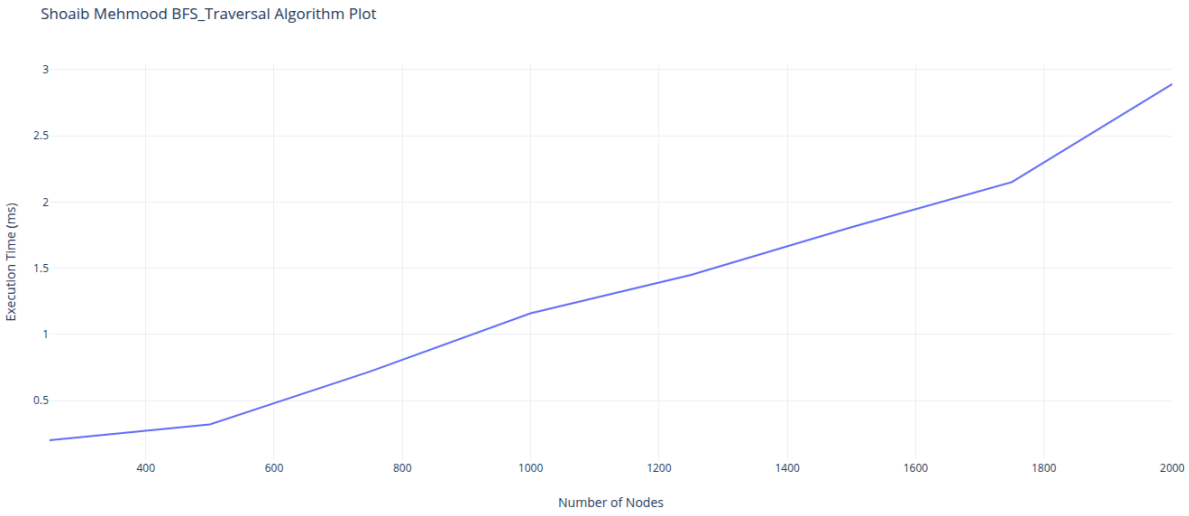


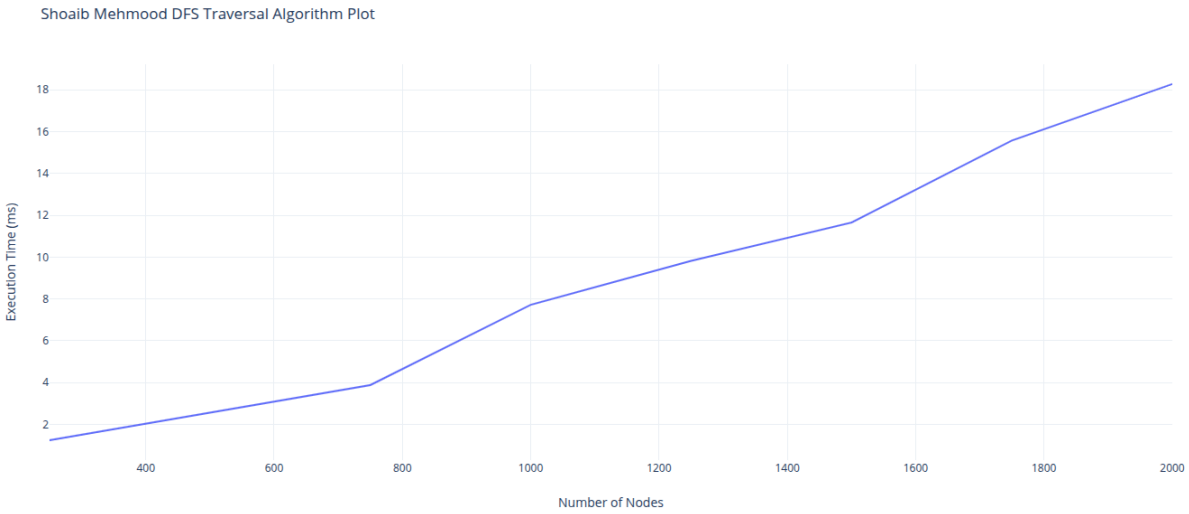
22i-2452 Average degree Algorithm Plot

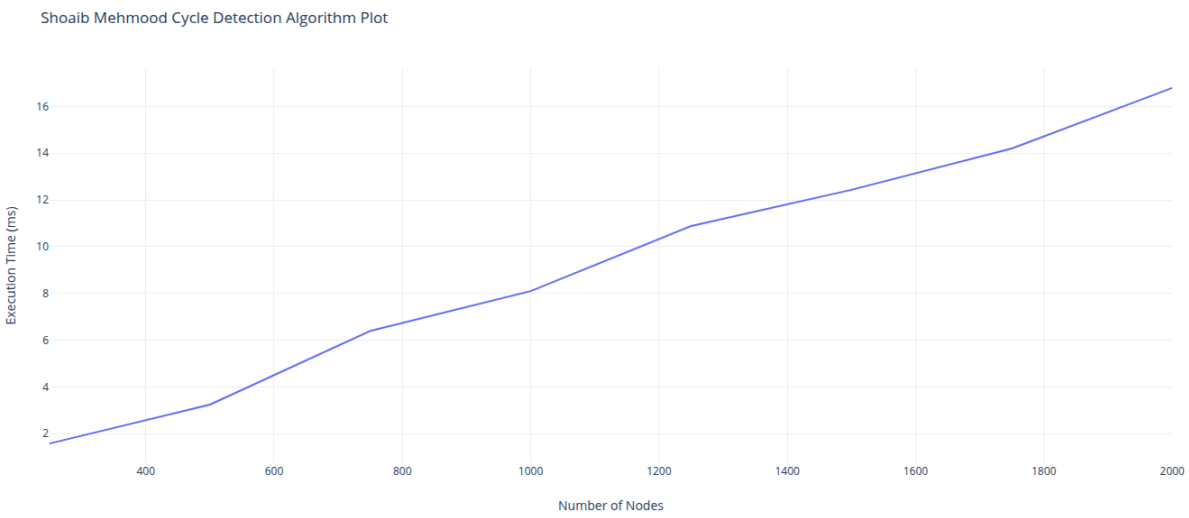


c. Member 3

i. Undirected Graph (except for cycle detection)






Shoaib Mehmood Cycle Detection Algorithm Plot
Execution Time (ms)
16
14
12
10
8
6
4
2
400
600
800
1000
1200
1400
1600
1800
2000
Number of Nodes