National University of Computer and Emerging Sciences

School of Computing | Fall 24 | Islamabad Campus

CS-2009 Design and Analysis of Algorithms (Fall-2024)

Deadline: Monday, 9th December, 2024 (2:25 PM)

Project

Instructions:

- **Late submission will not be accepted (Even late by 1 second)**
- Project can be done in a group. **Max. group size is 2 members**. Cross-section group is allowed. In case of group size of 1 member, the student is required to solve both problems. Carefully form your group. Complaints related to group members not performing their tasks will not be entertained.
- Groups are required to list their information on the following spreadsheet latest by the submission deadline (you are required to lock the cells on the spreadsheet related to your group): https://docs.google.com/spreadsheets/d/1-tKTHY3XOHQvRJQCWmn2YrVxZYoZt0vltswXeSoyN4c/edit?usp=sharing Project-Algo-CY-Fall24
- Changes in the groups are possible till the deadline. The schedule of demonstrations will be made on the basis of groups' information submitted till the deadline.
- There will be no credit if the given requirements are changed.
- Your solution will be evaluated in comparison with the best solution. ***There will be no credit for a non-polynomial time solution.***
- **Plagiarism** in any problem may result in **zero marks in the whole project** regardless of the percentage plagiarized.
- **Implement your solutions using C++. No other programming language is allowed.**
- You are required to submit the **source code files** only (and not the complete project folder).
- Submit the PDF file of the project report having the algorithms (in pseudocode form) designed for the project and the asymptotic time complexity analysis of your algorithms. Handwritten reports will not be accepted. ***The report will constitute 20% weight of the project.***
- **Only one group member** will submit the source code file(s) of the problem(s) and project report. *You are required to double-check the zipped folder that you are going to submit. Excuses like corrupt zipped folders, submitting a wrong or earlier version, etc., will not be accepted. The student is solely responsible for checking the final zip files for any issues*.
- You have to submit cpp files in a Zip Folder named **(21I-XXXX_21I-XXXX.zip)**. ***Naming convention has to be followed strictly. 30% marks will be deducted for not following submission guidelines.***
- Be prepared for viva or anything else after the submission of the assignment.
- Understanding the Project is also the part of Project.

Submission Files:

i) **Source code file (Make separate cpp file for each part)**

ii) **PDF of the project report.**

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Social Network Analysis Project

Dataset:

For your Design and Analysis of Algorithm course project, you have to use a dataset on Social Networks from the following link:
https://drive.google.com/file/d/1SAcWvOR4cTwOrE_JHto3jHLfeJE3fkV2/view?usp=sharing

Part 1: Graph-Based

This dataset contains information about connections (e.g., frequency of interaction, intensity, or relevance) among multiple users in a social network. In this project, you need to find the most significant connections in this social network. To do this, you have to create a graph of the given dataset. In your graph, the **Node** represents a user and the **Edges** between them indicate their connection. The **weight** on the edges shows the distance between two users. The shorter the distance, the stronger the connection.

Your tasks are as follows:

1. Create an undirected graph from the file which has 3 columns: the first two columns represent users and the third represents the weight of the link between them.
2. Implement **Dijkstra algorithm** or **A* algorithm** to find the shortest path from the graph created in (1).

   For A* algorithm, use the following heuristic function h(n): The number of direct connections a user has.

   For a node n, h(n) equals the total number of neighbours connected to n. Implement efficiently by combining actual cost g(n) and the heuristic h(n).

   Please note implementing with A* algorithm contains bonus points as it is a more efficient method of finding the shortest path.

Part 2: Dynamic Programming on Graph

In a social network, each user can influence their direct connections. The level of influence for each user is given in the Influences file where the first column represents the user and the second column represents the influence score of the user. You need to find the longest chain of influence in the network such that the influence score of a user in the chain is strictly greater than the previous user.
Task:

1. Implement a **dynamic programming algorithm** to find the longest increasing path in terms of influence scores in the graph.
2. Return the maximum length of the chain and the sequence of users in the chain.

---------- **Happy Coding** 😊 ----------