University of Technology, Jamaica
Faculty of Engineering and Computing
School of Computing and Information Technology

Analysis of Algorithms (CIT3003)

Semester 1 – 2021/2022
Draft Student Group Project (worth 10% + 20%)

Implement a Real-world solution for a Recommendation System
Based on Social Connections

Lecturers: Mr. David White,
Date Given: Week of October 17, 2022
Due Date: Week of November 14, 2022

Project Team Members		
Name	Id Number	Signature

This project is designed to test the ability of students taking this course, to understand a real-life problem which can be solved by appropriate and efficient algorithms, then propose an efficient solution, decide on the computational means and design technique of their proposed solution, design or choose a suitable version of the algorithm, prove its correctness, and analyze and implement it in accordance to what was taught in the course.

Background

The authors Edunov, Bhagat, Burke, Diuk and Filiz (2016) cited previous work done by others that had revealed that everybody is in the world was separated by only six people. This notion has been around for some time and has led to the designation that we all have on average only six degrees of separation. This phrase is often attributed to Milgram (1967). Social media networks like Facebook (Meta) has used this to great advantage in recommending persons to "friend" on Facebook, or what to buy/watch/do, based on what one's friends have bought/watch/done. The "6 Handshake Rule" in the reference at the end of this project document also explains the principle.

<u>Required</u>

This project requires you to develop an efficient applications employing algorithms to allow the uploading of a list of persons. For each person in the list there is a first name, last name, phone number, email address, residential community, school, employer, and whether of not the person requested privacy.

The application should also read a list of activities that persons are engaged in. This list contains the first and last name of the person, and an activity (e.g. bought a specific fitness tracker, bought a pair of shoes of a particular brand, listening to a particular music, watching a certain movie. A person can be engaged in more than one activity or none at all.

The application should scan through the list of activities file, and recommend to each person's close contact, all the activities that the person is engaged in (e.g. recommend to person y to buy a fitness tracker because their direct contact person x bought one). A person's close contact is defined in this project as someone who shares the same residential community, school or employer with another person. Note that if a person requested privacy then no recommendations are to be sent to that person.

The application should allow the names of two random persons who exist in the list of persons file to be entered, then it should calculate the degrees of separation between those two persons. For instance, if Mike Gallenger is a close contact of Sally Green, and Sally Green is a close contact of Ojay Donaldson, and Ojay Donaldson is a close contact of Gina Kingston, then there are three (3) degrees of separation between Mike Gallenger and Gina Kingston.

The application should also compute the average degree of separation based on all persons in the list of persons file.

Write the code for an application that provides a solution or approximate solution to the problem using the algorithms you have chosen. Use any programming language of your choice and make use of the most efficient techniques, data structures, and algorithmic designs you have learned in this course, or can find through your own research.

Your completed project should summarize the problem in your own words, show the computational means and design technique you decided to use, show the design of the algorithm you used to solve the problem, prove the correctness of the algorithm, and analyze the algorithm to show how efficient and appropriate it is. You should also provide the source code and run-time executable of the application you develop.

Marking Scheme

<u>Theory Component</u>

Summarizing the problem in your own words and why its important.........3%

Stating the problem category this problem belongs to..............................2%

Complexity class (P, NP, NP-Complete, NP-Hard) the problem belongs
 to and its implications...5%

Stating the computational means and design technique.............................5%

Stating the algorithmic design and description of how it/they work............10%

Stating the category your chosen algorithm(s) belongs to..........................2%

Demonstrating a proof of correctness of your algorithm.............................5%

Analysis of Algorithms (including asymptotic efficiency of each algorithm
in terms of space, search, insert, and delete, showing calculations)............5%

<u>Practical Component</u>

Correct, efficient and effective implementation of the selected algorithms:

      User interface (user friendly and correct input and output).....10%

      Correct operation of your algorithm in solving the problem..... 30%

      Algorithm representation in code...30%

      Error handling...10%

      Innovation and creativity...10%

<u>Additional Instructions:</u>

The project should be appropriately documented, including the design, implementation and sample runs. Your tutor will mark your project during the tutorial session. Extra marks will be considered for parallel algorithms.

Your completed project must run and you must attend an interview with your tutor during the tutorial class time assigned, to receive a project grade. Bring a copy of this project sheet with you to the interview and place your name and id number in the space provided. Projects which do not run cannot receive more than 49% but may receive a much lower grade.

During the interview, your tutor may ask you to run your application with various configurations of input. You application must be flexible enough to do so. The tutor may also provide files preloaded with persons and activities.

No individual projects will be accepted, nor will projects with more than four persons listed as members. Plagiarism is a serious offense and will be penalized as outlined in the Student handbook.

References

"6 Handshake Rule - Are We Still 6 People Away From Each Other?". Youth Time Magazine. June 10, 2020. Retrieved October 17, 2022 from https://youth-time.eu/6-handshake-rule-are-we-still-6-people-away-from-each-other/

Edunov, S., Bhagat, S., Burke, M., Diuk, C., Filiz, I.O. (2016). Three and a half degrees of separation. Retrieved on October 17, 2022 from https://research.facebook.com/blog/2016/2/three-and-a-half-degrees-of-separation/

Milgram, S. (May 1967). "The Small World Problem". Psychology Today. Ziff-Davis Publishing Company.