CSE 222 HOMEWORK 8:

Graphs Social Network System

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Project Report

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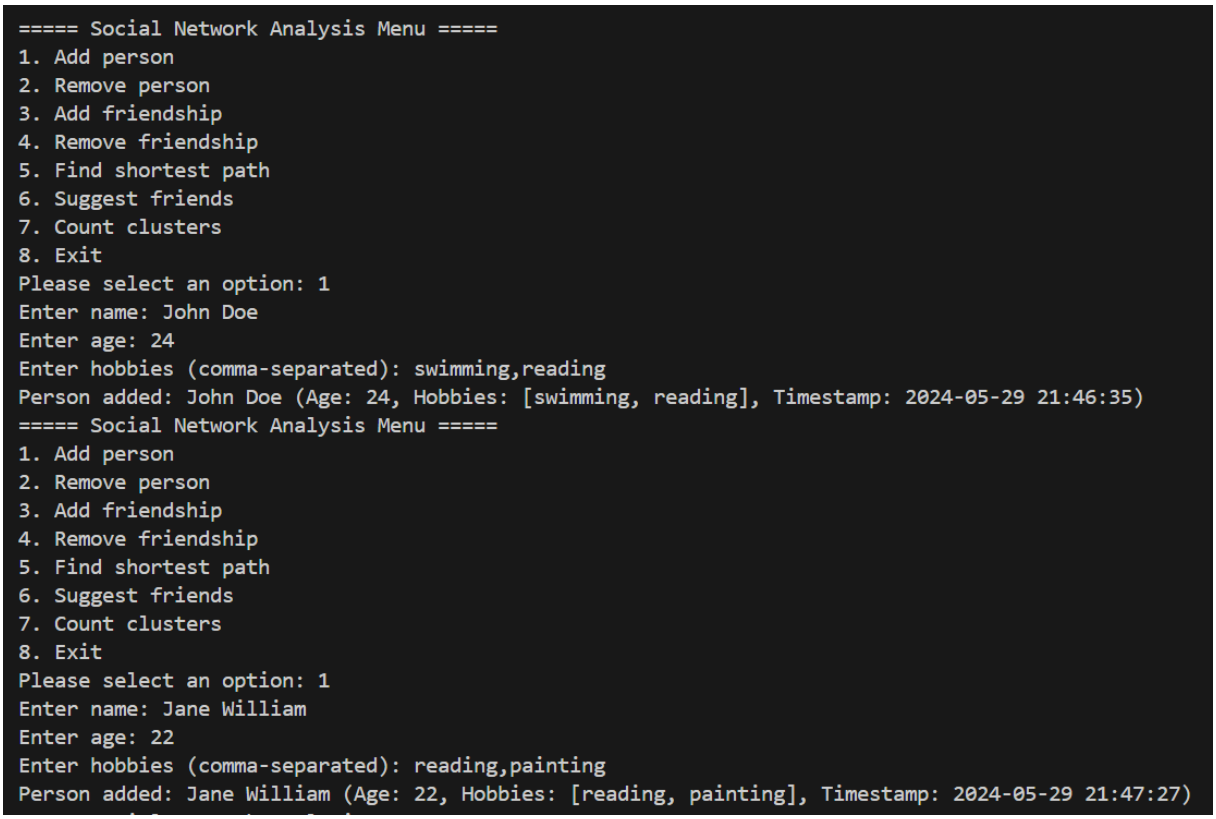
Introduction

The aim of this project is to develop a social network analysis system using graph data structures and algorithms. The goal is to simulate a social network where each person is represented by a node, and each friendship is represented by an edge. The system allows users to add and remove people, create and delete friendships, find the shortest path between two people, suggest friends based on mutual friends and common hobbies, and count clusters of connected people. This project helps in understanding the structure and dynamics of social networks through practical implementation and analysis.

Test and Results

1. Add Person

The new person is then added to the people map, using a unique key combining their name and timestamp to ensure uniqueness. Additionally, an empty list is initialized for the person's friendships in the friendships map.



When enter invalid input:

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 1
Enter name: Arya Stark
Enter age: asb
Invalid format. Please enter valid data.
```

2.Remove Person

This option lets you remove a person from the social network. You need to provide the person's name and the exact timestamp when they joined. The person and their friendships will be removed, and a confirmation message will be shown.

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 2
Enter name: Jane William
Enter timestamp: 2024-05-29 21:47:27
Person removed: Jane William (Timestamp: 2024-05-29T21:47:27.148547)
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 7
Cluster 1: John Doe
```

After removing Jane William is gone in Clusters

```
Please select an option: 7
Cluster 1: Jamie Lannister
Cluster 2: Jane Glenn, Paul White, John Doe
Cluster 3: Frank Wilson
Cluster 4: Emily Davis
Cluster 5: Alice Johnson
Cluster 6: David Kim
Cluster 7: Bob Brown
Number of clusters found: 7
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 2
Enter name: David Kim
Enter timestamp: 2024-05-29 22:16:36
Person removed: David Kim (Timestamp: 2024-05-29T22:16:36.137093)
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 7
Cluster 1: Jamie Lannister
Cluster 2: Jane Glenn, Paul White, John Doe
Cluster 3: Frank Wilson
Cluster 4: Emily Davis
Cluster 5: Alice Johnson
Cluster 6: Bob Brown
Number of clusters found: 6
```

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 2
Enter name: no one
Enter timestamp: 2024-05-29 12:23:23
Person not found: no one at 2024-05-29T12:23:23
```

Result of invalid input

3.Add Friendships

With this option, you can create a friendship between two people in the network. You need to enter the names and timestamps of both individuals.

```
Person added: Buket Gencer (Age: 24, Hobbies: [reading, watchingTV], Timestamp: 2024-05-29 21:55:46)
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 3
Enter first person's name: John Doe
Enter first person's timestamp: 2024-05-29 21:46:35
Enter second person's name: Buket Gencer
Enter second person's timestamp: 2024-05-29 21:55:46
Friendship added between John Doe and Buket Gencer
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 7
Cluster 1: John Doe, Buket Gencer
Number of clusters found: 1
```

When people have a friendship they ara in the same cluster.

4.Remove Friendship

This option triggers the removeFriendship method in the SocialNetworkGraph class. It requires the names and timestamps of the two people whose friendship you want to remove. The friendship is deleted from the network, and a confirmation message is printed.

```
Please select an option: 7
Cluster 1: Jamie Lannister
Cluster 2: Jane Glenn, Paul White, John Doe, Bob Brown
Cluster 3: Frank Wilson
Cluster 4: Emily Davis
Cluster 5: Alice Johnson
Number of clusters found: 5
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 4
Enter first person's name: Bob Brown
Enter first person's timestamp: 2024-05-29 22:16:35
Enter second person's name: John Doe
Enter second person's timestamp): 2024-05-29 22:16:34
Friendship removed between Bob Brown and John Doe
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 7
Cluster 1: Jamie Lannister
Cluster 2: Jane Glenn, Paul White, John Doe
Cluster 3: Frank Wilson
Cluster 4: Emily Davis
Cluster 5: Alice Johnson
Cluster 6: Bob Brown
Number of clusters found: 6
===== Social Network Analysis Menu =====
```

We can see in cluster result of removing friendships.

5.Shortest Path

This option invokes the findShortestPath method in the SocialNetworkGraph class. You need to input the names and timestamps of the start and end persons. The method uses breadth-first search (BFS) to find and display the shortest path between them.

Before Paul White and Emily Davis friendship:

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 5
Enter start person's name: Jane Glenn
Enter start person's timestamp): 2024-05-29 22:16:32
Enter end person's name: Emily Davis
Enter end person's timestamp: 2024-05-29 22:16:37
Shortest path: Jane Glenn -> Paul White -> John Doe -> Emily Davis
```

After Paul White and Emily Davis friendships:

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 3
Enter first person's name: Paul White
Enter first person's timestamp: 2024-05-29 22:16:33
Enter second person's name: Emily Davis
Enter second person's timestamp: 2024-05-29 22:16:37
Friendship added between Paul White and Emily Davis
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 5
Enter start person's name: Jane Glenn
Enter start person's timestamp): 2024-05-29 22:16:32
Enter end person's name: Emily Davis
Enter end person's timestamp: 2024-05-29 22:16:37
Shortest path: Jane Glenn -> Paul White -> Emily Davis
```

6.Suggest Friends

This option calls the suggestFriends method in the SocialNetworkGraph class. You provide the person's name, timestamp, and the maximum number of suggestions you want. The system calculates scores based on mutual friends and common hobbies and prints a list of suggested friends.

```
Please select an option: 6
Enter person's name: Paul White
Enter person's timestamp: 2024-05-29 22:16:33
Enter maximum number of friends to suggest: 3
Suggested friends for Paul White:
Bob Brown (Score: 0.5, 0 mutual friends, 1 common hobbies)
Frank Wilson (Score: 0.0, 0 mutual friends, 0 common hobbies)
Alice Johnson (Score: 0.0, 0 mutual friends, 0 common hobbies)
===== Social Network Analysis Menu =====
```

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 6
Enter person's name: Jane Glenn
Enter person's timestamp: 2024-05-29 22:16:32
Enter maximum number of friends to suggest: 3
Suggested friends for Jane Glenn:
John Doe (Score: 1.5, 1 mutual friends, 1 common hobbies)
Frank Wilson (Score: 0.0, 0 mutual friends, 0 common hobbies)
David Kim (Score: 0.0, 0 mutual friends, 0 common hobbies)
===== Social Network Analysis Menu =====
```

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 6
Enter person's name: Jane Glenn
Enter person's timestamp: 2024-05-29 23:28:01
Enter maximum number of friends to suggest: 4
Suggested friends for Jane Glenn:
Paul White (Score: 4.0, 3 mutual friends, 2 common hobbies)
John Doe (Score: 2.5, 2 mutual friends, 1 common hobbies)
Bob Brown (Score: 1.0, 1 mutual friends, 0 common hobbies)
David Kim (Score: 0.0, 0 mutual friends, 0 common hobbies)
```

7. Count Clusters:

his option uses the countClusters method in the SocialNetworkGraph class. It counts the number of clusters in the network, where a cluster is a group of interconnected people. The method prints the number of clusters and lists the members of each cluster.

```
===== Social Network Analysis Menu =====
1. Add person
2. Remove person
3. Add friendship
4. Remove friendship
5. Find shortest path
6. Suggest friends
7. Count clusters
8. Exit
Please select an option: 7
Cluster 1: John Doe, Frank Wilson, Jamie Lannister, Jane Glenn, Paul White, Bob Brown, Alice Johnson
Cluster 2: Arya Stark
Cluster 3: David Kim
Cluster 4: Emily Davis
Number of clusters found: 4
```