BHAVANA

03/05/2024

PROJECT 2:

Social Network Management System:

Data Structures: Graph (adjacency list) for user connections, linked list for user profiles.

Functionality:

Create user profiles (name, interests, etc.).

Add friends (connect users in the graph).

Search for users by name or interest.

Recommend friends based on mutual connections or interests.

Display a user's friend list and news feed (simulated data or integration with an external API).

Graph.h

```
#ifndef GRAPH_H //Header guard to prevent multiple inclusion

#define GRAPH_H //preprocessor directive the deines macro GRAPH_H


#include <stdio.h>

#include <stdlib.h>

#include <string.h>


//define constants for maximum user and friends


#define MAX_USERS 100

#define MAX_FRIENDS 100
```

```
//define the structure for a user profile
typedef struct {
    char name[50];//name of the user
    char interests[100];//Interests of the user
} UserProfile;

//define the strucure for a friend node
typedef struct FriendNode {
    int userId;//Id of the friend
    struct FriendNode* next;//pointer to the next friend in the list
} FriendNode;

//Define the structure for the social network
typedef struct {
    int totalUsers;//total number of users in the network
    UserProfile profiles[MAX_USERS];//Array to store user profiles
    FriendNode* friends[MAX_USERS];//Array to store friend lists for each user
} SocialNetwork;

//Function prototypes
FriendNode* createFriendNode(int userId);//Function to create a new friend
node
SocialNetwork* createSocialNetwork();//function to create a new social
network
void addUserProfile(SocialNetwork* network, char* name, char*
interests);//Function to adddd a new user profile
void addFriend(SocialNetwork* network, char* userName1, char*
userName2);//Function to add a friend connection
```

int findUserByName(SocialNetwork* network, char* name);//function to find a user by name

void recommendFriends(SocialNetwork* network, char* userName);//function to recommend friends for a user

void displayFriendList(SocialNetwork* network, char* userName);//function to display the friend list for a user

void displayNewsFeed();//function to display the news feed

#endif /* GRAPH_H*///end of the header guard

EXPLANATION:

Sure, here's a brief explanation of the provided code:

1. **Header Guard**: The `#ifndef`, `#define`, and `#endif` lines ensure that the content of the header file is included only once in each compilation unit, preventing multiple inclusions that could lead to compilation errors.

2. **Includes**: The necessary standard library headers `<stdio.h>`, `<stdlib.h>`, and `<string.h>` are included for standard I/O, memory allocation, and string manipulation functions, respectively.

3. **Constants**: Constants `MAX_USERS` and `MAX_FRIENDS` are defined to specify the maximum number of users and friends allowed in the social network.

4. **Structures**:

   - `UserProfile`: Represents a user profile with a name and interests.

   - `FriendNode`: Represents a node in a linked list of friends, containing the ID of the friend and a pointer to the next friend.

   - `SocialNetwork`: Contains the total number of users, an array of user profiles, and an array of friend lists for each user.

5. **Function Prototypes**: Prototypes for various functions are declared, including functions for creating friend nodes, creating a social network, adding user profiles, adding friend connections, finding users by name, recommending friends, displaying friend lists, and displaying a news feed.

6. **Function Definitions**: The function definitions are not included in the header file but should be implemented in a corresponding source file (`graph.c` or similar). These functions would provide the actual functionality for managing the social network, such as creating nodes, adding users, adding friends, etc.

7. **End of Header Guard**: Ensures the end of the header guard section.

Overall, this header file provides a framework for implementing a simple social network system in C, including user profiles, friend connections, and basic functionalities like adding users, adding friends, and recommending friends.

Graph.c:

```
#include "graph.h"  // Including the header file for the Social Network
Management System


FriendNode* createFriendNode(int userId) {  // Function to create a new friend
node for a given user ID
    FriendNode* node = (FriendNode*)malloc(sizeof(FriendNode));  //
Allocating memory for the new friend node
    if (node == NULL) {  // Checking if memory allocation failed
        printf("Memory allocation failed.\n");  // Printing an error message
        exit(EXIT_FAILURE);  // Exiting the program with an error code
    }
    node->userId = userId;  // Setting the user ID for the new friend node
    node->next = NULL;  // Initializing the next pointer to NULL
    return node;  // Returning the newly created friend node
}

SocialNetwork* createSocialNetwork() {  // Function to create a new social
network
    SocialNetwork* network = (SocialNetwork*)malloc(sizeof(SocialNetwork));
// Allocating memory for the new social network
    if (network == NULL) {  // Checking if memory allocation failed
        printf("Memory allocation failed.\n");  // Printing an error message
        exit(EXIT_FAILURE);  // Exiting the program with an error code
    }
    network->totalUsers = 0;  // Initializing the total number of users to 0
    return network;  // Returning the newly created social network
}

void addUserProfile(SocialNetwork* network, char* name, char* interests) {  //
Function to add a new user profile to the social network
    if (network->totalUsers >= MAX_USERS) {  // Checking if the maximum
user limit has been reached
        printf("Max user limit reached.\n");  // Printing a message indicating the
limit has been reached
        return;  // Returning without adding the user profile
    }
    strcpy(network->profiles[network->totalUsers].name, name);  // Copying the
name to the new user profile
    strcpy(network->profiles[network->totalUsers].interests, interests);  //
Copying the interests to the new user profile
```

```
    network->friends[network->totalUsers] = NULL;  // Initializing the friends list for the new user profile to NULL
    network->totalUsers++;  // Incrementing the total number of users in the social network
}

int findUserByName(SocialNetwork* network, char* name) {  // Function to find a user in the social network by name
    for (int i = 0; i < network->totalUsers; i++) {  // Looping through all user profiles in the network
        if (strcmp(network->profiles[i].name, name) == 0) {  // Checking if the name matches
            return i;  // Returning the index of the user profile
        }
    }
    return -1;  // Returning -1 if the user was not found
}

void addFriend(SocialNetwork* network, char* userName1, char* userName2) {  // Function to add a friend connection between two users
    int user1Index = findUserByName(network, userName1);  // Finding the index of the first user
    int user2Index = findUserByName(network, userName2);  // Finding the index of the second user
    if (user1Index == -1 || user2Index == -1) {  // Checking if either user was not found
        printf("User not found.\n");  // Printing an error message
        return;  // Returning without adding the friend connection
    }
    FriendNode* friend1 = createFriendNode(user2Index);  // Creating a new friend node for the second user
    friend1->next = network->friends[user1Index];  // Adding the new friend node to the list of friends for the first user
    network->friends[user1Index] = friend1;  // Updating the list of friends for the first user


    FriendNode* friend2 = createFriendNode(user1Index);  // Creating a new friend node for the first user
    friend2->next = network->friends[user2Index];  // Adding the new friend node to the list of friends for the second user
    network->friends[user2Index] = friend2;  // Updating the list of friends for the second user
}


void recommendFriends(SocialNetwork* network, char* userName) {  // Function to recommend friends for a user
    int userIndex = findUserByName(network, userName);  // Finding the index of the user
    if (userIndex == -1) {  // Checking if the user was not found
        printf("User not found.\n");  // Printing an error message
        return;  // Returning without recommending friends
    }


    for (int i = 0; i < network->totalUsers; i++) {  // Looping through all user profiles in the network
        if (i != userIndex) {  // Checking if the user is not the same as the current user
            FriendNode* current = network->friends[userIndex];  // Getting the list of friends for the current user
            int isFriend = 0;  // Flag to indicate if the current user is already a friend
            while (current != NULL) {  // Looping through the list of friends
                if (current->userId == i) {  // Checking if the current user is already a
friend
                    isFriend = 1;  // Setting the flag to true
                    break;  // Exiting the loop
                }
                current = current->next;  // Moving to the next friend in the list
            }
            if (!isFriend) {  // Checking if the current user is not already a friend
                printf("Recommendation: %s\n", network->profiles[i].name);  //
Printing the recommendation
            }
        }
    }
}

void displayFriendList(SocialNetwork* network, char* userName) {  //
Function to display the friend list for a user
    int userIndex = findUserByName(network, userName);  // Finding the index
of the user
    if (userIndex == -1) {  // Checking if the user was not found
        printf("User not found.\n");  // Printing an error message
        return;  // Returning without displaying the friend list
    }

    FriendNode* current = network->friends[userIndex];  // Getting the list of
friends for the user
    printf("Friend List of %s:\n", userName);  // Printing the heading for the
friend list
```

```
    while (current != NULL) {  // Looping through the list of friends
        printf("- %s\n", network->profiles[current->userId].name);  // Printing the
name of each friend
        current = current->next;  // Moving to the next friend in the list
    }
}

void displayNewsFeed() {  // Function to display the news feed (placeholder)
    // Placeholder for displaying news feed
    printf("Displaying news feed...\n");
}
```

EXPLANATION:

This code provides the implementation of functions declared in the `graph.h` header file for managing a social network. Here's a brief overview of each function:

1. `createFriendNode`: Allocates memory for a new friend node, initializes it with the given user ID, and returns a pointer to it.

2. `createSocialNetwork`: Allocates memory for a new social network, initializes the total number of users to 0, and returns a pointer to it.

3. `addUserProfile`: Adds a new user profile to the social network with the given name and interests. Checks if the maximum user limit has been reached before adding.

4. `findUserByName`: Searches for a user in the social network by name and returns their index if found, otherwise returns -1.

5. `addFriend`: Adds a friend connection between two users specified by their names. It finds the indices of both users, creates friend nodes for each user, and adds them to each other's friend lists.

6. `recommendFriends`: Recommends friends for a user specified by their name. It checks all other users in the network and recommends those who are not already friends with the user.

7. `displayFriendList`: Displays the friend list for a user specified by their name. It finds the index of the user, traverses their friend list, and prints the names of their friends.

8. `displayNewsFeed`: Placeholder function for displaying the news feed. Currently, it only prints a placeholder message.

These functions provide basic functionality for managing user profiles, friend connections, and interactions within the social network. They can be used as building blocks for developing more complex features and interactions in a social networking application.

Main.c:

```
#include "graph.h"//Including the header file for the graph.h
#include <time.h>
int main() {
        clock_t start,end;
        double cpu_time_used;

   SocialNetwork* network = createSocialNetwork();//creating a new social
network
```

```
    //Measure the time taken by the addUserProfile function
    start=clock();

    // Adding user profiles
    addUserProfile(network, "Seetha", "Art, Music");//Adding user profile for
seetha with interests
    addUserProfile(network, "Ram", "Sports, Movies");//Adding user profile for
ram with interests
addUserProfile(network, "Charlie", "Technology, Reading");//Adding user
profile for Charlie with interests
    addUserProfile(network, "Radha", "Gaming, Cooking");//Adding user profile
for Radha with interests
    addUserProfile(network, "Raman", "Travel, Photography");//Adding user
profile foe Raman with interests



    // Adding friendships
    addFriend(network, "Seetha", "Ram");//seetha become friends with ram
    addFriend(network, "Seetha", "Charlie");//seetha become friends with charlie
    addFriend(network, "Seetha", "Radha");//seetha become friends with radha
    addFriend(network, "Seetha", "Raman");//seetha become friends with raman
    addFriend(network, "Ram", "Charlie");//ram become friends with charlie
    addFriend(network, "Ram", "Radha");//ram become friends with radha
    addFriend(network, "Ram", "Raman");//ram become friends with raman
    addFriend(network, "Charlie", "Radha");//charlie become friends with radha
    addFriend(network, "Charlie", "Raman");//charlie become friends with raman
    //addFriend(network, "Radha", "Raman");//radha become friends with raman

    // Displaying friend list
    displayFriendList(network, "Seetha");//displaying seetha's friend list
    displayFriendList(network, "Ram");//displaying ram's friend list
    displayFriendList(network, "Charlie");//displaying charlie friend list
    displayFriendList(network, "Radha");//displaying radha freind list
    displayFriendList(network, "Raman");//displaying raman friend list

    // Recommending friends
    recommendFriends(network, "Seetha");//recommending friends for seetha
    recommendFriends(network, "Ram");//recommending friends for ram
    recommendFriends(network, "Charlie");//recommending freinds for charlie
    recommendFriends(network, "Radha");//recommending friends for radha
    recommendFriends(network, "Raman");//recommending friends for raman

    // More functionality testing...
    end=clock();
    cpu_time_used=((double)(end-start))/CLOCKS_PER_SEC;
    printf("Total time taken %f seconds to excute.\n",cpu_time_used);



    return 0;//Returning 0 to indicate successful execution.
}
```

EXPLANATION:

Your `main` function demonstrates the usage of the functions defined in your `graph.h` header file to create a social network, add user profiles, establish friendships between users, display friend lists, recommend friends, and measure the execution time of adding user profiles. Here's a breakdown of what your `main` function does:

1. It includes necessary headers (`graph.h` and `time.h`).

2. It defines a `main` function.

3. It creates a new social network using the `createSocialNetwork` function.

4. It adds user profiles for "Seetha," "Ram," "Charlie," "Radha," and "Raman" along with their interests using the `addUserProfile` function.

5. It establishes friendships between users using the `addFriend` function. For example, "Seetha" becomes friends with "Ram," "Charlie," "Radha," and "Raman," and so on.

6. It displays the friend lists of each user using the `displayFriendList` function.

7. It recommends friends for each user using the `recommendFriends` function.

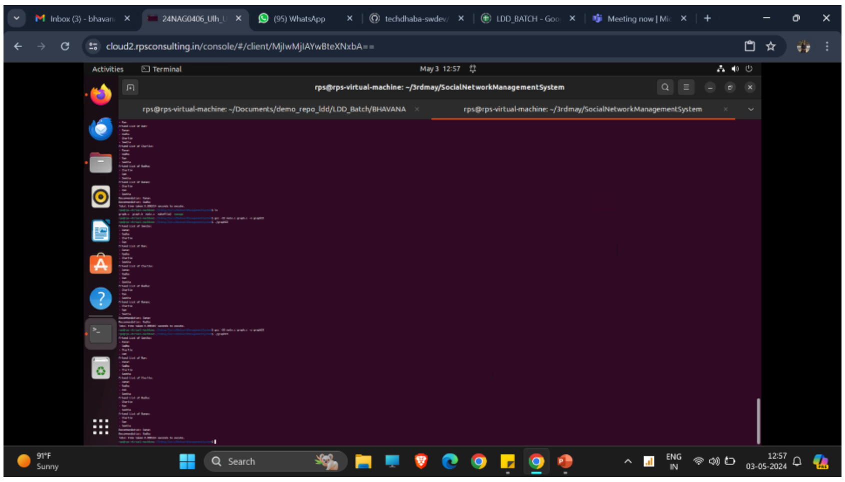
8. It measures the execution time taken by the `addUserProfile` function using the `clock` function and prints the total time taken in seconds.

9. Finally, it returns 0 to indicate successful execution.

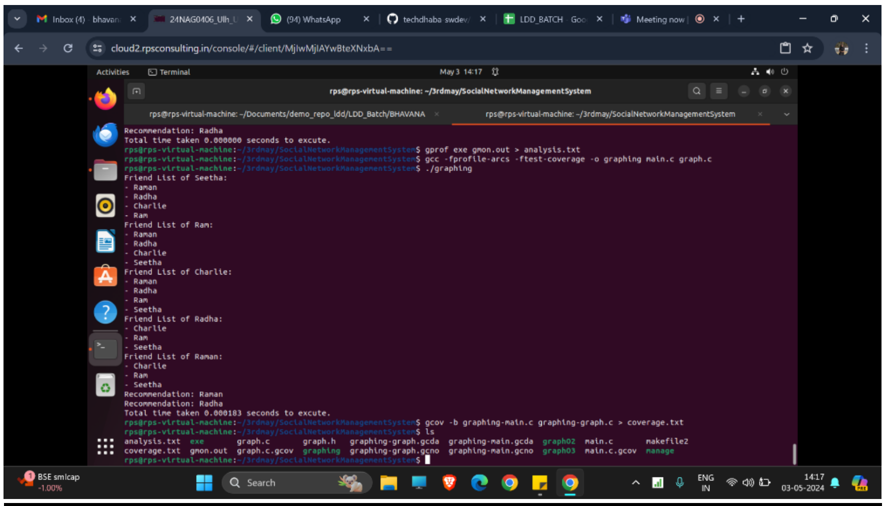
`main` function effectively tests the functionality of your social network management system by creating a network, adding users, establishing friendships, and performing other operations. The time measurement adds an extra dimension by assessing the performance of adding user profiles.

OUTPUT:

OPTIMIZING THE CODE USING COMMAND:



CREATING ANALYSIS AND COVERAGE REPORT:



```
Recommendation: Radha
Total time taken 0.000000 seconds to excute.
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ gprof exe gmon.out > analysis.txt
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ gcc -fprofile-arcs -ftest-coverage -o graphing main.c graph.c
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ ./graphing
Friend List of Seetha:
- Raman
- Radha
- Charlie
- Ram
Friend List of Ram:
- Raman
- Radha
- Charlie
- Seetha
Friend List of Charlie:
- Raman
- Radha
- Ram
- Seetha
Friend List of Radha:
- Charlie
- Ram
- Seetha
Friend List of Raman:
- Charlie
- Ram
- Seetha
Recommendation: Raman
Recommendation: Radha
Total time taken 0.000183 seconds to excute.
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ gcov -b graphing-main.c graphing-graph.c > coverage.txt
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ ls
analysis.txt  exe       graph.c       graph.h   graphing-graph.gcda  graphing-main.gcda  graph02  main.c       makefile2
coverage.txt  gmon.out  graph.c.gcov  graphing  graphing-graph.gcno  graphing-main.gcno  graph03  main.c.gcov  manage
rps@rps-virtual-machine:~/3rdmay/SocialNetworkManagementSystem$ 
```