“FRIEND SUGGESTION USING GRAPH”

A PROJECT REPORT

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ABSTRACT

Recommendation system is an important type of machine learning algorithm that provide precise suggestions to the users. Recommendation systems are used in innumerable types of areas such as generation of playlists, music and video services like Jio savaan, wynk, amazon prime music etc., and products recommendation for users in e-commerce applications and commercial applications. The recommendations that are provided by various types of applications increases the speed for identifying and makes easier to access the products that users are interested in. For each user, the recommendation system is capable of envisaging the future predilections on a set of items and recommend the top items. In several industries, recommendation systems are very useful as they generate huge amount of income and this type of industries can stand uniquely from competitors. Due to cumbersome number of items that each user can find in the web, the impact of recommendation system has been increased in the internet. Recommendation systems are used for custom-made navigation by getting huge amount of data particularly in social media domain for recommending friends.

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Mugesh Raj

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CHAPTER 1
INTRODUCTION

In this project, “Graph structure” is used for friend suggestion / recommendation.
Graphs are used to solve many real-life problems. Graphs are used to represent networks. A Graph is a non-linear data structure consisting of nodes and edges. The networks may include paths in a city or telephone network or circuit network. Graphs are also used in social networks like LinkedIn, Facebook. For example, in Facebook, each person is represented with a vertex (or node). A Graph is a non-linear data structure consisting of vertices and edges. The vertices are sometimes also referred to as nodes and the edges are lines or arcs that connect any two nodes in the graph. More formally a Graph is composed of a set of vertices(V) and a set of edges(E). The graph is denoted by G(E, V). Graphs in data structures are used to represent the relationships between objects. Every graph consists of a set of points known as vertices or nodes connected by lines known as edges. The vertices in a network represent entities. The main advantage of graph data structure is that it allows you to apply all the computer science algorithms related to graphs. Once you figured out how to represent your domain logic as a graph you can apply all the power of graph algorithms on solving your problem. The use of graphs in daily life also helps in making an analysis. For example, it provides structure in assessing performances, sales, and even deadlines. Graphs also help make calculations easier.

Motivation

By letting people simulate operations and games on a digital education operation system, schools are able to inspect learning achievement and teaching quality. In digital education area, we are able to use blockchain technology to improve competition mode. It's helpful to simplify process, improve efficiency and avoid the problem of opaque and falsification messages. Besides, it can provide unchangeable digital certification of academic achievement.

General Objective

The objective of this program is, that, it provides the basis for the “Friend suggestions in Facebook, Instagram”.Statistics is the branch of mathematics that involves collecting, organising, interpreting, presenting and analysing data. Based on the studies of data obtained, people can draw conclusions, make decisions and plan wisely.

Since pictures are good visual aids and leave a long-lasting effect on the mind of an observer, the information contained in numerical data can be easily understood if we represent it in the form of diagrams or graphs. A picture is better than a thousand words. This quote correctly fits with the graphs. Usually, comparisons among the individuals are best shown through graphs.

CHAPTER 2

LITERATURE STUDY

2.1 [GRAPH THEORY WITH APPLICATIONS NORfH-HOLLAND New York • Amsterdam • Oxford vaibhav mishra]-2020

Many real-world situations can conveniently be described by means of diagram consisting of a set of points together with lines joining certain pairs of these points. For example, the points could represent people, with lines joining pairs of friends; or the points might be communication centers, with lines representing communication links. Notice that in Such diagrams on~ us mail).T interested ill whether or not two given points are joined by a line; the manner in which they are joined is immaterial. A mathematical abstraction of situations of this type gives rise to the concept of a graph. . A graph G is an ordered triple (V(G), E(G), t/!G) consisting of a nonempty set V(G) of vert~ces, a set E(G), disjoint from V(G), of edges, and an incidence function t/Ja that associates with each edge of G an unordered pair of (not necessarily distinct) vertices of G. If e is an edge and u and t' are vertices such that t/!G(e) - UV, then e is said to join u and v; the vertices Ii and 'v 'are called the ends of e

2.2 [GRAPH THEORY AND PROBABILITY P. ERDOS **]- 2021**

A well-known theorem of Ramsay (8; 9) states that to every n there exists a smallest integer g(n) so that every graph of g(ri) vertices contains either a set of n independent points or a complete graph of order n, but there exists a graph of g(n) — 1 vertices which does not contain a complete subgraph of n vertices and also does not contain a set of n independent points. (A graph is called complete if every two of its vertices are connected by an edge; a set of points is called independent if no two of its points are connected by an edge.)

2.3 [Introducing the Graph 500 Richard C. Murphy Kyle B. Wheeler Brian W. Barrett James A. Ang Sandia National Laboratories**]- 2020**

In the words of Lord Kelvin, “if you cannot measure it, you cannot improve it”. One of the longlasting successes of the Top 500 list is sustained, community-wide floating point performance improvement. Emerging large-data problems, either resulting from measured real-world phenomena or as further processing of data generated by simulation, have radically different performance characteristics and architectural requirements. As the community contemplates scaling to large-scale HPC resources to solve these problems, we are challenged by the reality that supercomputers are typically optimized for the 3D simulation of physics, not large-scale, data-driven analysis. Consequently, the community contemplating this kind of analysis requires a new yard stick for evaluating future platforms

CHAPTER 3

PROBLEM STATEMENT

Friend Suggestion/recommendation - using graph :

You will be given a graph - (i/p to program - Adjacency Matrix)

Each node in the graph will represent a Person. Links between nodes will represent the association between persons.

The program shall suggest/recommend the friends by considering the association between nodes. - If friend is added the corresponding link shall be added to the adjacency matrix

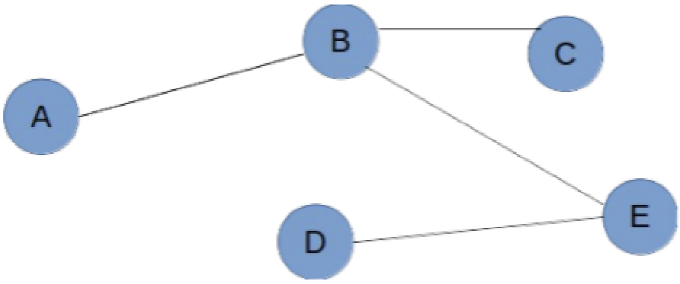


Figure A:- Example Graph

In above fig A. the Person A shall get recommendation to connect with Person C as B is a common Friend. Similarly Person D will get recommendation to connect to B and so on.

CHAPTER 4

ALGORITHM

Adjacency_count :

```
    1. Set i, j, count = 0;
    2. Repeat j = 0 to j < number ;
    a. If matrix[no][j] == 1, then increment count;
       [end loop]
    3. Return count;
```

Adjacency_cell :

```
    1. Set i, j, k, count = 0;
    2. count = adjacency_count(matrix, no);
    3. Repeat j = 0 to j < number;
            a. If matrix [no][j] == 1, then result [k] = j;
            b. Increment k;
           [end loop]
    4. Return result;
```

isPresent :

```
    1. Set i, flag = 0;
    2. Repeat for i = 0 to I <= top
    a. If stack[i] == no
Set flag = 1;
[end loop]
    3. Return flag;
```

Push :

```
    1. If isPresent(stack, no) = 1
[end if]
    2. Else
    a. Increment top;
    b. Stack[top] = no;
    3. Return stack;

Display_stack :
    1. For i = 0 to i <= top
    a. Print stack[i]
```

CHAPTER 5

IMPLEMENTATION

1. Enter the data of total nodes present in graph.
2. Enter the adjacency matrix to represent whether the link is present between the nodes.
3. Find the count of adjacent nodes present for each node.
4. For each adjacent find count of adjacent nodes.
5. Add those nodes once in stack.
6. If the node is already present in stack then discard the node.
7. Then display the stack.
8. This stack represents the friend suggestion to be given to node.
9. If the request is accepted then change the corresponding value in adjacency matrix.

CHAPTER 6

CONCLUSION

The different data structures are used to implement the various components in the design of social media. Hence we can conclude that friend request/recommendation problem can be solved using adjacency matrix, graph, etc. From this program we are able to suggest friends for people in friends circle. In this way Graph data structure can be used Friend Suggestion/recommendation

CHAPTER 7

FUTURE ENHANCEMENT

Facebook is an online social media and social networking service owned by American company Meta Platforms. Founded in 2004 by Mark Zuckerberg with fellow Harvard College students and roommates Eduardo Saverin, Andrew McCollum, Dustin Moskovitz, and Chris Hughes, its name comes from the face book directories often given to American university students. Membership was initially limited to Harvard students, gradually expanding to other North American universities and, since 2006, anyone over 13 years old. As of July 2022, Facebook claimed 2.93 billion monthly active users, and ranked third worldwide among the most visited websites as of July 2022. It was the most downloaded mobile app of the 2010s.

Facebook can be accessed from devices with Internet connectivity, such as personal computers, tablets and smartphones. After registering, users can create a profile revealing information about themselves. They can post text, photos and multimedia which are shared with any other users who have agreed to be their "friend" or, with different privacy settings, publicly. Users can also communicate directly with each other with Facebook Messenger, join common-interest groups, and receive notifications on the activities of their Facebook friends and the pages they follow

CHAPTER 8

APPENDIX

Source Code:

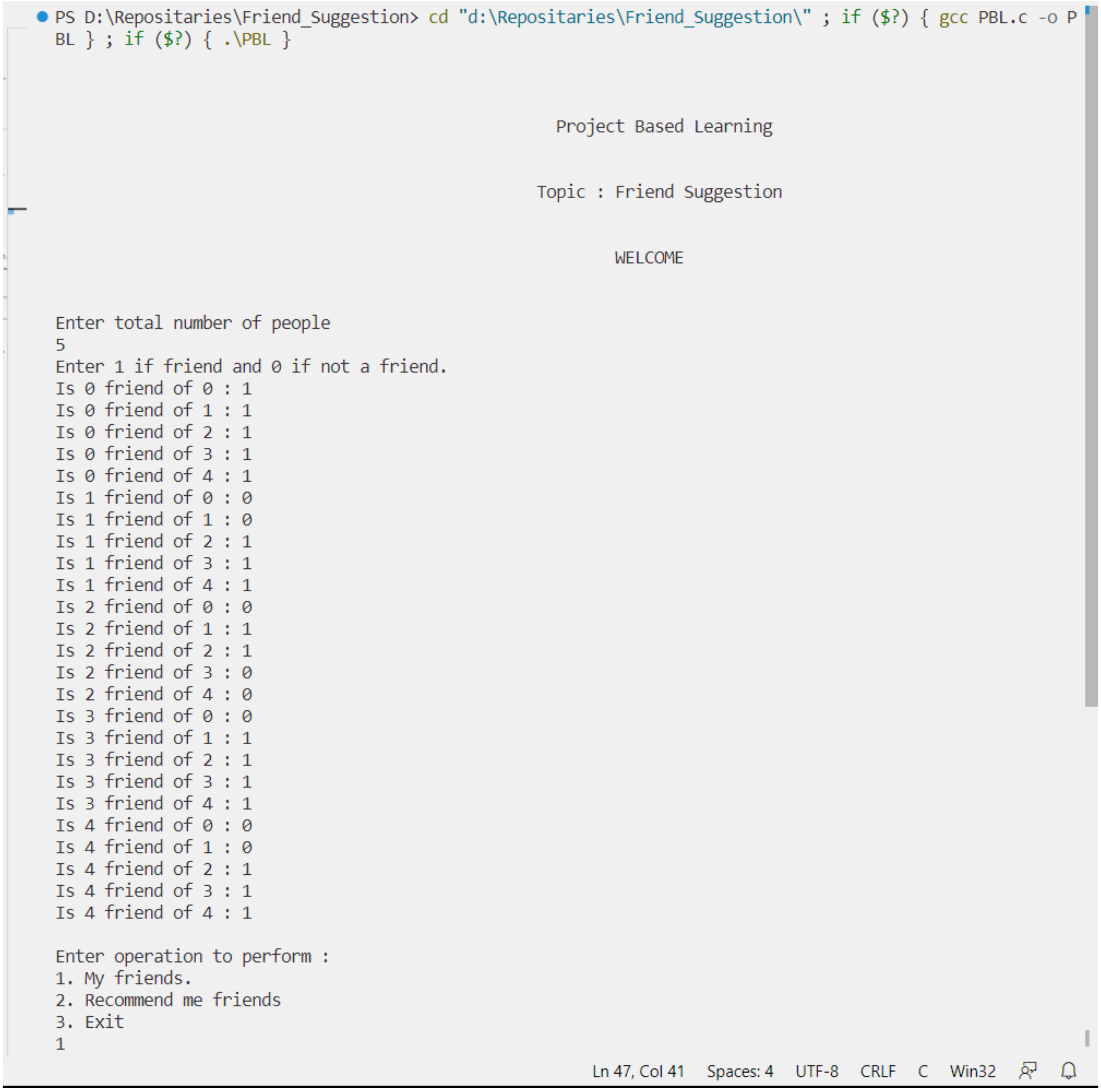
```
#include<stdio.h>
#include<stdlib.h>

int number;
int top = -1;
int isPresent(int* , int );
int* push(int * , int);
void Display_stack(int *);

int adjacency_count(int matrix[number][number], int no)
{
        int i,j;
        int count =0;
        for(j=0;j<number;j++)
        {
                if(matrix[no][j]==1)
                {
                        count++;
                }
        }
        return count;
}

int * adjacency_result (int matrix[number][number], int no, int * result)
{
        int i,j,k=0;
        int count;
        count = adjacency_count(matrix,no);
        for(j=0;j<number;j++)
        {
                if(matrix[no][j]==1)
                {
                        result[k]=j;
                        k++;
                }
        }
        return result;
}


void main()
{
   printf("\n\n\n\t\t\t\t\t\t   Project Based Learning\n\n\n");
   printf("\t\t\t\t\t\t Topic : Friend Suggestion\n\n\n");
   printf("\t\t\t\t\t\t\t ");
   printf("WELCOME\n\n\n");
        printf("Enter total number of nodes\n");
        scanf("%d",&number);
        int matrix[number][number];
        int count_adj[number];
        int i,j,k,no;
        int count;
        int *stack;
   char decision;
        stack = (int *)malloc(number * sizeof(int));
        printf("Enter 1 if friend and 0 if not a friend.\n");
        for(i=0;i<number;i++)
        {
                for(j=0;j<number;j++)
                {
                   printf("Is %d friend of %d : ",i,j);
                        scanf("%d",&matrix[i][j]);
                }
```

```
    }
    while(1)
{
  printf("\nEnter operation to perform : ");
  printf("\n1. My friends.\n2. Recommend me friends\n3. Exit\n");
  int choice;
  scanf("%d",&choice);
  switch(choice)
  {
  case 1:
    printf("Who are you : ");
    scanf("%d",&no);
    int * friends;
    count = adjacency_count(matrix,no);
    friends = (int *) malloc(count*sizeof(int));
    friends = adjacency_result(matrix,no,friends);
    printf("Your friends are : ");
    for(i=0;i<count;i++)
    {
      printf("%d, ",friends[i]);
    }
    break;

  case 2:
    printf("Who are you : ");
    scanf("%d",&no);
    int flag;
    count = adjacency_count(matrix,no);
    int *result;
    result = (int *) malloc(count*sizeof(int));
    int *final_result;
    for(i=0;i<number;i++)
    {
      count_adj[i]=adjacency_count(matrix,i);
    }
```

```
int final_result_size=0;

for(i=0;i<count;i++)
{
   final_result_size = final_result_size+ count_adj[i];
}
final_result = (int *) malloc(final_result_size*sizeof(int));
//printf("Size of final result : %d  %d\n",final_result_size,sizeof(final_result));
//printf("Count : %d\n",count);
for(i=0;i<count;i++)
{
   result = adjacency_result(matrix,no,result);
   final_result = adjacency_result(matrix,result[i],final_result);
   for(j=0;j<final_result_size;j++)
   {
      flag =1;
      if(final_result[j]==no)
      {
         flag =0;
      }
      else
      {
         for(k=0;k<count;k++)
         {
            /*printf("%d=%d=%d=  ",i,j,count);
            printf("Result = %d, Final Result = %d\t",result[i],final_result[j]);*/
            if(final_result[j]==result[k])
            {
               flag = 0;
               break;
            }
         }
      }
      if(flag ==1)
      {
            //printf("Element pushed = %d .\n",final_result[j]);
            stack = push(stack,final_result[j]);
        }
    }
}

printf("\n");
printf("Recommendations : ");

Display_stack(stack);
printf("\n");
printf("Do you want to send friend request? [y/n] : ");
scanf(" %c",&decision);
if(decision=='y')
{
    printf("To whom do you want to send friend request : ");
    int send_req;
    scanf("%d",&send_req);
    printf("\n\nAccording to %d ",send_req);
    printf("\n%d has sent you friend request.",no);
    char accept_request;
    printf("\nDo you want to accept request? [y/n] : ");
    scanf(" %c",&accept_request);
    if(accept_request=='y')
    {
        matrix[no][send_req]=1;
        matrix[send_req][no]=1;
    }
}
top=-1;
count=0;
result = NULL;
final_result = NULL;
flag=1;
break;
```

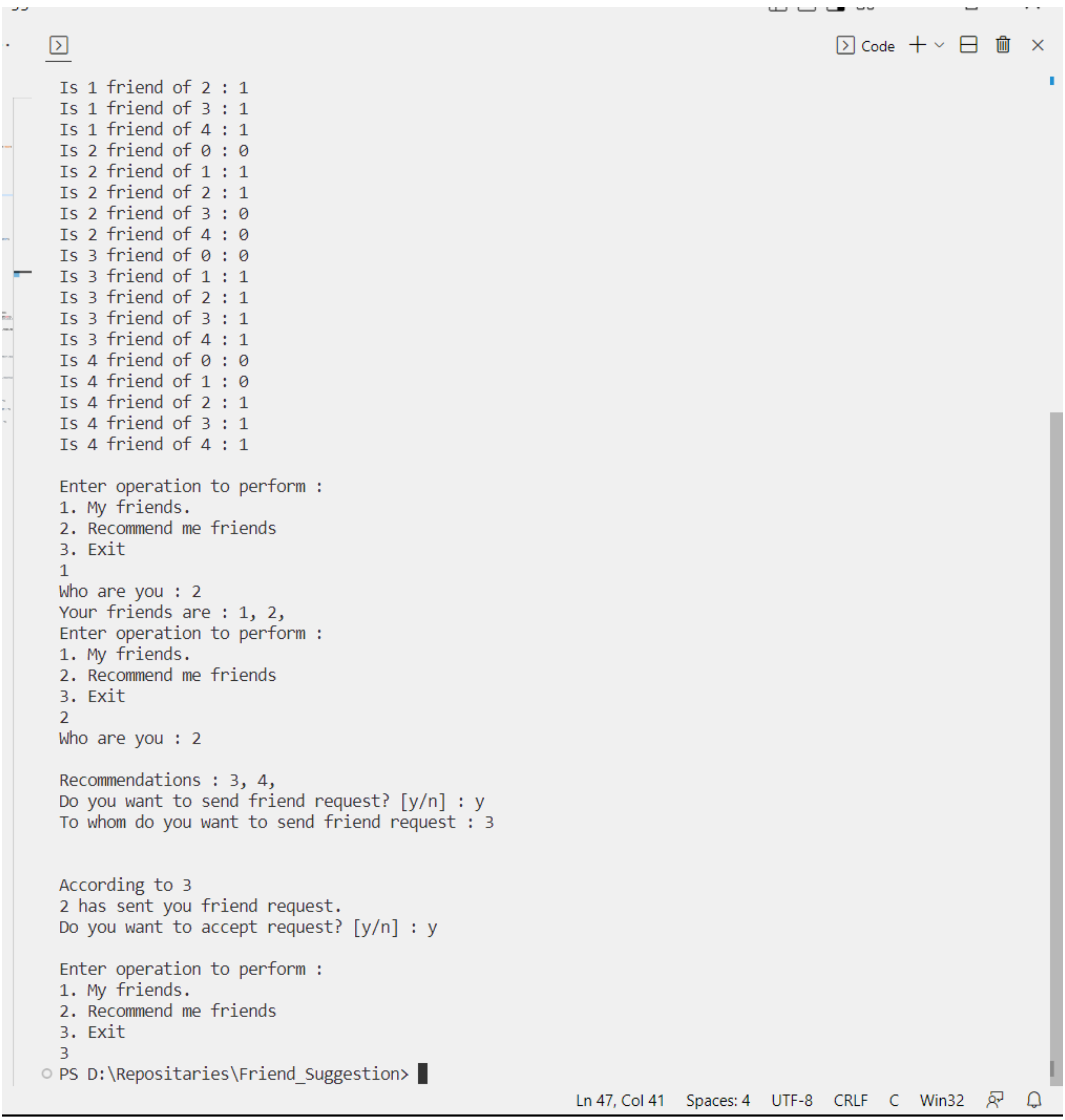
```
        case 3:
            exit(0);

        default:
            printf("Enter valid option\n");
        }
    }
}


int * push(int * stack, int no)
{
    if(no>=number||no<0)
    {
    }
    else if(isPresent(stack,no))
    {
    }
    else
    {
        top++;
        stack[top] = no;
        //printf("\tNo : %d--",stack[top]);
        //printf("\tTop : %d-",top);
    }
    return stack;
}

int isPresent(int *stack, int no)
{
    int i,flag = 0;
    for(i=0;i<=top;i++)
    {
        if(stack[i]==no)
        {
            flag = 1;
            break;
        }
    }
    return flag;
}

void Display_stack(int *stack)
{
    int i;
    for(i=0;i<=top;i++)
    {
        printf("%d, ",stack[i]);
    }
}
```

OUTPUT



```
PS D:\Repositaries\Friend_Suggestion> cd "d:\Repositaries\Friend_Suggestion\" ; if ($?) { gcc PBL.c -o P
BL } ; if ($?) { .\PBL }


                                                    Project Based Learning


                                                  Topic : Friend Suggestion


                                                         WELCOME


Enter total number of people
5
Enter 1 if friend and 0 if not a friend.
Is 0 friend of 0 : 1
Is 0 friend of 1 : 1
Is 0 friend of 2 : 1
Is 0 friend of 3 : 1
Is 0 friend of 4 : 1
Is 1 friend of 0 : 0
Is 1 friend of 1 : 0
Is 1 friend of 2 : 1
Is 1 friend of 3 : 1
Is 1 friend of 4 : 1
Is 2 friend of 0 : 0
Is 2 friend of 1 : 1
Is 2 friend of 2 : 1
Is 2 friend of 3 : 0
Is 2 friend of 4 : 0
Is 3 friend of 0 : 0
Is 3 friend of 1 : 1
Is 3 friend of 2 : 1
Is 3 friend of 3 : 1
Is 3 friend of 4 : 1
Is 4 friend of 0 : 0
Is 4 friend of 1 : 0
Is 4 friend of 2 : 1
Is 4 friend of 3 : 1
Is 4 friend of 4 : 1

Enter operation to perform :
1. My friends.
2. Recommend me friends
3. Exit
1
```

Fig 8.1 Output screenshot



```
Is 1 friend of 2 : 1
Is 1 friend of 3 : 1
Is 1 friend of 4 : 1
Is 2 friend of 0 : 0
Is 2 friend of 1 : 1
Is 2 friend of 2 : 1
Is 2 friend of 3 : 0
Is 2 friend of 4 : 0
Is 3 friend of 0 : 0
Is 3 friend of 1 : 1
Is 3 friend of 2 : 1
Is 3 friend of 3 : 1
Is 3 friend of 4 : 1
Is 4 friend of 0 : 0
Is 4 friend of 1 : 0
Is 4 friend of 2 : 1
Is 4 friend of 3 : 1
Is 4 friend of 4 : 1

Enter operation to perform :
1. My friends.
2. Recommend me friends
3. Exit
1
Who are you : 2
Your friends are : 1, 2,
Enter operation to perform :
1. My friends.
2. Recommend me friends
3. Exit
2
Who are you : 2

Recommendations : 3, 4,
Do you want to send friend request? [y/n] : y
To whom do you want to send friend request : 3


According to 3
2 has sent you friend request.
Do you want to accept request? [y/n] : y

Enter operation to perform :
1. My friends.
2. Recommend me friends
3. Exit
3
PS D:\Repositaries\Friend_Suggestion>
```

Fig 8.2 Output screenshot

REFERENCES

[1] L. Katz, "A new status index derived from sociometric analysis[J]," (Psychometrika, vol. 18, no. 1, pp. 39-43, 1953).

[2] R N Lichtenwalter, J T Lussier, N V. Chawla, "New perspectives and methods in link prediction[C]," (Proceedings of the 16th ACM SIGKDD international conference on Knowledge discovery and data mining, pp. 243-252, 2010).

[3] M Al Hasan, V Chaoji, S Salem et al., "Liinkprediction using supervised learning[C]," (SDM'06: Workshop on Link Analysis Counter- terrorism and Security, 2006).

[4] N Benchettara, R Kanawati, C. Rouveirol, "Supervised machine learning applied to link prediction in bipartite social networks[C]," (Advances in Social Networks Analysis and Mining (ASONAM) 2010 International Conference on, pp. 326-330, 20

[5] P. Jaccard, "Etude comparative de la distribution florale dans une portion des Alpes et du Jura[M]," (Impr. Corbaz, 1901).

[6] LA Adamic, E. Adar, "Friends and neighbors on the web[J]," (Social networks, vol. 25, no. 3, pp. 211-230, 2003).

[7] Y B Xie, T Zhou, B H. Wang, "Scale-free networks without growth[J]," (Physica A: Statistical Mechanics and its Applications, vol. 387, no. 7, pp. 1683-1688, 2008).