

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



LAB REPORT on

Analysis and Design of Algorithms

Submitted by

Dhruva S(1BM21CS057)

in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



B.M.S. COLLEGE OF ENGINEERING

(Autonomous Institution under VTU)

BENGALURU-560019

June-2023 to September-2023

B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering



CERTIFICATE

This is to certify that the Lab work entitled “**Analysis and Design of Algorithms**” carried out by **Dhruva S(1BM21CS057)**, who is bonafide student of **B.M.S. College of Engineering**. It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the academic semester June-2023 to September-2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **Analysis and Design of Algorithms (22CS4PCADA)** work prescribed for the said degree.

Dr. Radhika A D
Assistant Professor
Department of CSE
BMSCE, Bengaluru

Dr. Jyothi S Nayak
Professor and Head
Department of CSE
BMSCE, Bengaluru

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Course Outcome

CO1	Analyze time complexity of Recursive and Non-recursive algorithms using asymptotic notations.
CO2	Apply various design techniques for the given problem.
CO3	Apply the knowledge of complexity classes P, NP, and NP-Complete and prove certain problems are NP-Complete
CO4	Design efficient algorithms and conduct practical experiments to solve problems.

1. Write program to do the following:

a. Print all the nodes reachable from a given starting node in a digraph using BFS method.

b. Check whether a given graph is connected or not using DFS method.

Code:

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

```
int a[15][15],n;
void bfs(int);
```

```
void main() {
    int i,j,root;
    printf("\nEnter the no of nodes:\t");
    scanf("%d",&n);
    printf("\nEnter the adjacency matrix:\n");
    for(i=1;i<=n;i++)
        for(j=1;j<=n;j++)
            scanf("%d",&a[i][j]);
    printf("\nEnter the source node:\t");
    scanf("%d",&root);
    bfs(root);
}
```

```
void bfs(int root) {
    int q[15],f=0,r=-1,vis[15],i,j;
```

```

for(j=1;j<=n;j++)
    vis[j]=0;
vis[root]=1;
r=r+1;
q[r]=root;
while(f<=r) {
    i=q[f];
    f=f+1;
    for(j=1;j<=n;j++)
    {
        if(a[i][j]==1&&vis[j]!=1) {
            vis[j]=1;
            r=r+1;
            q[r]=j;
        }
    }
}
for(j=1;j<=n;j++) {
    if(vis[j]!=1)
        printf("\nNode %d is not reachable",j);
    else{
        printf("\nNode %d is reachable",j);
    }
}

```

Output:

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL

PS D:\VS Code\OS> cd "d:\VS Code\OS\" ; if ($?) { gcc ada.c -o ada } ; if ($?) { .\ada }

Enter the no of nodes:  4

Enter the adjacency matrix:
0 1 1 1
0 0 0 1
0 0 0 0
0 0 1 0

Enter the source node:  1

Node 1 is reachable
Node 2 is reachable
Node 3 is reachable
Node 4 is reachable
PS D:\VS Code\OS> █
```

```

#include<stdio.h>
#include<conio.h>

int a[10][10],n,vis[10];
int dfs(int root){
    int j;
    vis[root]=1;
    for(j=1;j<=n;j++)
        if(a[root][j]==1&&vis[j]!=1)
            dfs(j);
    for(j=1;j<=n;j++) {
        if(vis[j]!=1)
            return 0;
    }
    return 1;
}

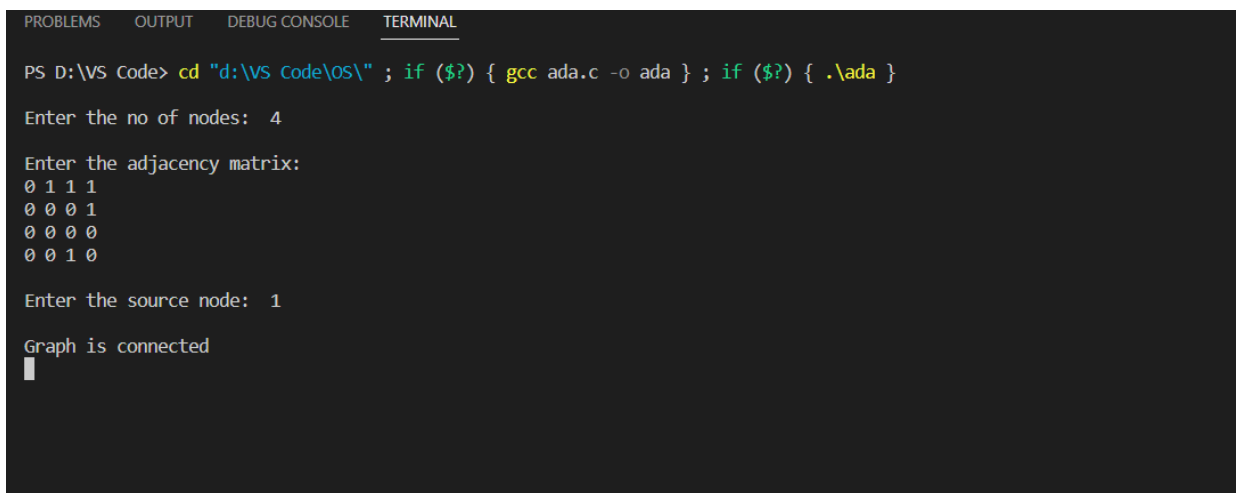
void main()
{
    int i,j,root,ans;
    for(j=1;j<=n;j++)
        vis[j]=0;
    printf("\nEnter the no of nodes:\t");
    scanf("%d",&n);
    printf("\nEnter the adjacency matrix:\n");
    for(i=1;i<=n;i++)
        for(j=1;j<=n;j++)
            scanf("%d",&a[i][j]);

```



```
printf("\nEnter the source node:\t");  
scanf("%d",&root);  
ans=dfs(root);  
if(ans==1)  
    printf("\nGraph is connected\n");  
else  
    printf("\nGraph is not connected\n");  
getch();  
}
```

Output:



The screenshot shows a terminal window with the following content:

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  
  
PS D:\VS Code> cd "d:\VS Code\OS\" ; if ($?) { gcc ada.c -o ada } ; if ($?) { .\ada }  
  
Enter the no of nodes: 4  
  
Enter the adjacency matrix:  
0 1 1 1  
0 0 0 1  
0 0 0 0  
0 0 1 0  
  
Enter the source node: 1  
  
Graph is connected  
█
```

2. Write a program to obtain the Topological ordering of vertices in a given digraph.

Code:

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

void main(){
    int a[10][10],n,i,j;
    int indeg[10],flag[10],c=0;

    printf("Enter number of vertices \n");
    scanf("%d",&n);

    printf("Enter adjacency matrix: \n");
    for(i=0;i<n;i++)
        for(j=0;j<n;j++)
            scanf("%d",&a[i][j]);

    for(i=0;i<n;i++)
        indeg[i]=0;

    for(i=0;i<n;i++)
        flag[i]=0;

    for(i=0;i<n;i++)
        for(j=0;j<n;j++)
```

```

if(a[i][j]==1)
indeg[j]+=1;

printf("Order is : ");
while(c<=n)
{
    for(i=0;i<n;i++)
    {
        if(indeg[i]==0 && flag[i]==0)
        {
            printf("%d ",i+1);
            flag[i]=1;
        }
    }
    for(i=0;i<n;i++)
    {
        if(flag[i]==1)
        {
            for(j=0;j<n;j++)
            {
                if(a[i][j]==1)
                {
                    indeg[j]-=1;
                    a[i][j]=0;
                }
            }
        }
    }
}

```

```

        c++;
    }
}

```

Output:

```

PS D:\VS Code\OS> cd "d:\VS Code\OS\" ; if ($?) { gcc ada.c -o ada } ; if ($?) { .\ada }
Enter number of vertices
5
Enter adjacency matrix:
0 0 1 0 0
0 0 1 0 0
0 0 0 1 1
0 0 0 0 1
0 0 0 0 0
Order is : 1 2 3 4 5

```

```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
PS D:\VS Code\ADA> cd "d:\VS Code\ADA\" ; if ($?) { gcc topological.c -o topological } ; if ($?) { .\topological }
Enter number of vertices
4
Enter adjacency matrix:
0 1 1 0
0 0 0 1
0 0 0 1
0 0 0 0
Order is : 1 2 3 4
PS D:\VS Code\ADA>

```

3. Implement Johnson Trotter algorithm to generate permutations.

Code:

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

#define left_to_right true
#define right_to_left false

int getPosOfMobile(int a[], int n, int mobile) {
    for (int i = 0; i < n; i++) {
        if (a[i] == mobile)
            return i + 1;
    }
    return 0;
}

int getMobile(int a[], bool dir[], int n) {
    int mobile_prev = 0, mobile = 0;
    for (int i = 0; i < n; i++) {
        // direction 0 represents RIGHT TO LEFT.
        if (dir[a[i] - 1] == right_to_left && i != 0) {
            if (a[i] > a[i - 1] && a[i] > mobile_prev) {
                mobile = a[i];
                mobile_prev = mobile;
            }
        }

        // direction 1 represents LEFT TO RIGHT.
        if (dir[a[i] - 1] == left_to_right && i != n - 1) {
            if (a[i] > a[i + 1] && a[i] > mobile_prev) {
                mobile = a[i];
                mobile_prev = mobile;
            }
        }
    }
}
```

```

    if (mobile == 0 && mobile_prev == 0)
        return 0;
    else
        return mobile;
}

void produceOnePermutation(int a[], bool dir[], int n) {
    int mobile = getMobile(a, dir, n);
    int pos = getPosOfMobile(a, n, mobile);

    if (dir[a[pos] - 1] == right_to_left) {
        int temp = a[pos - 1];
        a[pos - 1] = a[pos - 2];
        a[pos - 2] = temp;
    } else if (dir[a[pos] - 1] == left_to_right) {
        int temp = a[pos];
        a[pos] = a[pos - 1];
        a[pos - 1] = temp;
    }

    // changing the directions for elements
    // greater than largest mobile integer.
    for (int i = 0; i < n; i++) {
        if (a[i] > mobile) {
            if (dir[a[i] - 1] == left_to_right)
                dir[a[i] - 1] = right_to_left;
            else if (dir[a[i] - 1] == right_to_left)
                dir[a[i] - 1] = left_to_right;
        }
    }

    for (int i = 0; i < n; i++)
        printf("%d ", a[i]);
    printf("\n");
}

```

```

int fact(int n)
{
    int result=1;
    for(int i=1;i<=n;i++)
    {
        result*=i;
    }
    return result;
}

void producePermutation(int n) {
    // To store the current permutation
    int a[n];

    // To store the current directions
    bool dir[n];

    // Storing the elements from 1 to n and
    // printing the first permutation.
    for (int i = 0; i < n; i++) {
        a[i] = i + 1;
        printf("%d ", a[i]);
    }
    printf("\n");

    // Initially all directions are set
    // to RIGHT TO LEFT i.e. 0.
    for (int i = 0; i < n; i++)
        dir[i] = right_to_left;

    // For generating permutations in order.
    for (int i = 1; i < fact(n); i++)
        produceOnePermutation(a, dir, n);
}

void main()
{
    int n;

```

```

printf("\nEnter the number of objects whose permutations are to be generated: ");
scanf("%d",&n);
producePermutation(n);
}

```

Output:

```

PS D:\VS Code\ADA> cd "d:\VS Code\ADA\" ; if ($?) { gcc JT.c -o JT } ; if ($?) { .\JT }

Enter the number of objects whose permutations are to be generated: 4
1 2 3 4
1 2 4 3
1 4 2 3
4 1 2 3
4 1 3 2
1 4 3 2
1 3 4 2
1 3 2 4
3 1 2 4
3 1 4 2
3 4 1 2
4 3 1 2
4 3 2 1
3 4 2 1
3 2 4 1
3 2 1 4
2 3 1 4
2 3 4 1
2 4 3 1
4 2 3 1
4 2 1 3
2 4 1 3
2 1 4 3
2 1 3 4
PS D:\VS Code\ADA>

```

```

PS D:\VS Code\ADA> cd "d:\VS Code\ADA\" ; if ($?) { gcc trotter.c -o trotter } ; if ($?) { .\trotter }

Enter the number of objects whose permutations are to be generated: 3
1 2 3
1 3 2
3 1 2
3 2 1
2 3 1
2 1 3
PS D:\VS Code\ADA>

```


- 4. Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort.**

Code:

```
#include <stdio.h>
#include <stdlib.h>
void merge(int low,int mid,int high,int a[])
{
    int c[50];
    int i,j,k;
    i=low;
    j=mid+1;
    k=low;
    while(i<=mid&& j<=high)
    {
        if(a[i]<a[j])
        {
            c[k]=a[i];
            i++;
            k++;
        }
        else{
            c[k]=a[j];
            j++;
            k++;
        }
    }
    while(i<=mid)
    {
        c[k]=a[i];
        k++;
        i++;
    }
    while(j<=high)
    {
        c[k]=a[j];
        k++;
    }
}
```

```

        j++;
    }
    for(i=low;i<=high;i++)
    {
        a[i]=c[i];
    }
}
void mergeSort(int low, int high,int a[])
{
    if(low<high)
    {
        int mid=(low+high)/2;
        mergeSort(low, mid, a);
        mergeSort(mid+1,high,a);
        merge(low, mid, high, a);
    }
}
void main()
{
    int n;
    printf("\nEnter the size");
    scanf("%d",&n);
    int i, a[50], low=0, high=n-1;
    printf("Enter the elements to be sorted: ");
    for(i=0;i<n;i++)
    {
        scanf("%d",&a[i]);
    }
    mergeSort(low, high, a);
    for(i=0;i<n;i++)
    {
        printf("%d\t",a[i]);
    }
}

```

Output:

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
PS D:\VS Code\ADA> cd "d:\VS Code\ADA\" ; if ($?) { gcc monotonic.c -o monotonic } ; if ($?) { .\monotonic }

Enter the size7
Enter the elements to be sorted: 99 88 77 66 55 44 33
33    44    55    66    77    88    99
PS D:\VS Code\ADA> 
```

```
Enter the size5
Enter the elements to be sorted: -3 100 5 10 -7
-7    -3    5    10    100
PS D:\VS Code\ADA> 
```

5. Sort a given set of N integer elements using Quick Sort technique and compute its time taken.

Code:

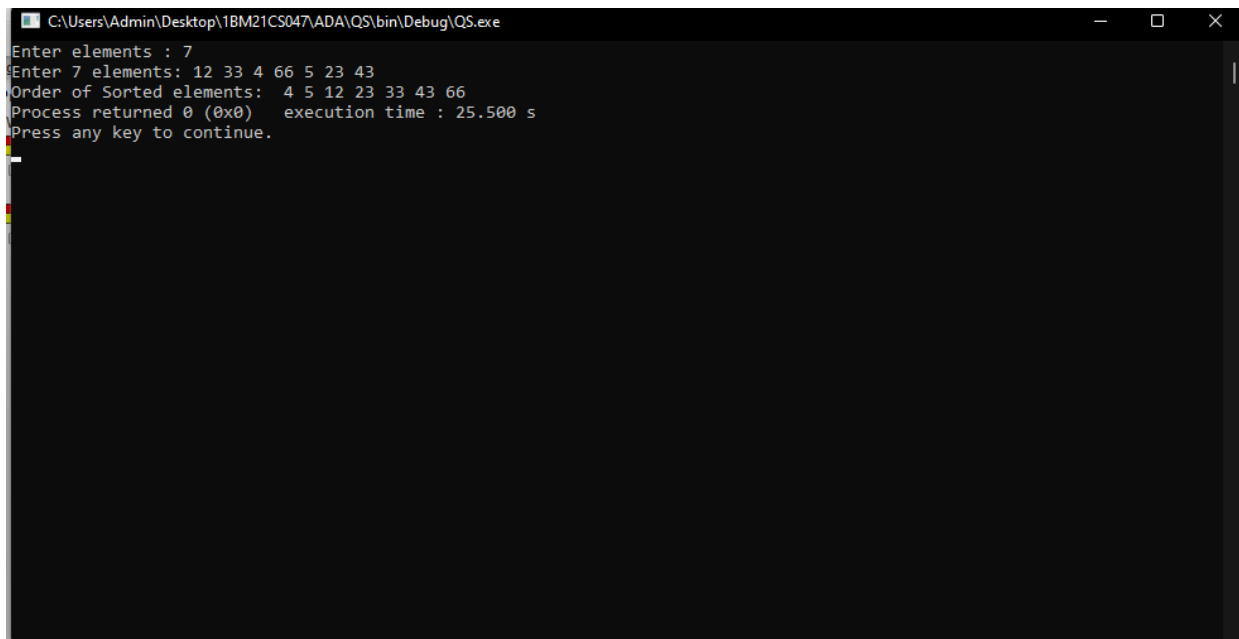
```
#include <stdio.h>
void quicksort(int number[25], int first, int last)
{
    int i, j, pivot, temp;
    if (first < last)
    {
        pivot = first;

        i = first;
        j = last;
        while (i < j)
        {
            while (number[i] <= number[pivot] && i < last)
                i++;
            while (number[j] > number[pivot])
                j--;
            if (i < j)
            {
                temp = number[i];
                number[i] = number[j];
                number[j] = temp;
            }
        }
        temp = number[pivot];
        number[pivot] = number[j];
        number[j] = temp;
        quicksort(number, first, j - 1);
        quicksort(number, j + 1, last);
    }
}

int main()
{
    int i, count, number[25];
    printf("Enter elements : ");
    scanf("%d", &count);
    printf("Enter %d elements: ", count);
    for (i = 0; i < count; i++)
        scanf("%d", &number[i]);
}
```

```
quicksort(number, 0, count - 1);  
printf("Order of Sorted elements: ");  
for (i = 0; i < count; i++)  
    printf(" %d", number[i]);  
return 0;  
}
```

Output:



The screenshot shows a Windows command prompt window with the title bar "C:\Users\Admin\Desktop\18M21CS047\ADA\QS\bin\Debug\QS.exe". The window contains the following text:

```
Enter elements : 7  
Enter 7 elements: 12 33 4 66 5 23 43  
Order of Sorted elements: 4 5 12 23 33 43 66  
Process returned 0 (0x0)   execution time : 25.500 s  
Press any key to continue.
```

6. Sort a given set of N integer elements using Heap Sort technique and compute its time taken.

```
#include <stdio.h>

void heapify(int arr[], int n, int i) {
    int largest = i, left = 2 * i + 1, right = 2 * i + 2;
    if (left < n && arr[left] > arr[largest])
        largest = left;
    if (right < n && arr[right] > arr[largest])
        largest = right;
    if (largest != i) {
        int temp = arr[i];
        arr[i] = arr[largest];
        arr[largest] = temp;
        heapify(arr, n, largest);
    }
}

void heapsort(int arr[], int n) {
    for (int i = n / 2 - 1; i >= 0; i--)
        heapify(arr, n, i);
    for (int i = n - 1; i >= 0; i--) {
        int temp = arr[0];
        arr[0] = arr[i];
        arr[i] = temp;
        heapify(arr, i, 0);
    }
}

int main() {
    int arr[10], n, i;
    printf("Enter number of elements \n");
    scanf("%d", &n);
    printf("Enter %d elements \n", n);
    for (i = 0; i < n; i++)
        scanf("%d", &arr[i]);
    heapsort(arr, n);
}
```

```
printf("\nSorted array: ");  
for (i = 0; i < n; i++)  
    printf("%d ", arr[i]);  
  
return 0;  
}
```

Output:

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  
  
PS D:\VS Code\ADA> cd "d:\VS Code\ADA\" ; if ($?) { gcc heap.c -o heap } ; if ($?) { .\heap }  
Enter number of elements  
5  
Enter 5 elements  
0 1 7 5 1  
  
Sorted array: 0 1 1 5 7  
PS D:\VS Code\ADA> █
```

```
Enter number of elements  
8  
Enter 8 elements  
-3 5 1 10 9 22 -7  
25  
  
Sorted array: -7 -3 1 5 9 10 22 25  
PS D:\VS Code\ADA> █
```

7. Implement 0/1 Knapsack problem using dynamic programming.

Code:

```
#include <stdio.h>
#include <conio.h>
void knapsack();
int max(int, int);
int i, j, n, m, p[10], w[10], v[10][10];
void main()
{
    printf("\nEnter the no. of items:\n");
    scanf("%d", &n);
    printf("\nEnter the weight of the each item:\n");
    for (i = 1; i <= n; i++)
    {
        scanf("%d", &w[i]);
    }
    printf("\nEnter the profit of each item:\n");
    for (i = 1; i <= n; i++)
    {
        scanf("%d", &p[i]);
    }
    printf("\nEnter the knapsack's capacity:\n");
    scanf("%d", &m);
    knapsack();
    getch();
}
void knapsack()
{
    int x[10];
    for (i = 0; i <= n; i++)
    {
        for (j = 0; j <= m; j++)
        {
            if (i == 0 || j == 0)
            {
                v[i][j] = 0;
            }
            else if (j - w[i] < 0)
            {
                v[i][j] = v[i - 1][j];
            }
            else{
```



```

        v[i][j] = max(v[i - 1][j], v[i - 1][j - w[i]] + p[i]);
    }
}
printf("\nThe output is:\n");
for (i = 0; i <= n; i++)

{
    for (j = 0; j <= m; j++)
    {
        printf("%d ", v[i][j]);
    }
    printf("\n\n");
}
printf("\nThe optimal solution is %d", v[n][m]);
printf("\nThe solution vector is:\n");
for (i = n; i >= 1; i--)
{
    if (v[i][m] != v[i - 1][m])
    {
        x[i] = 1;
        m = m - w[i];
    }
    else
    {
        x[i] = 0;
    }
}
for (i = 1; i <= n; i++)
{
    printf("%d\t", x[i]);
}
}
int max(int x, int y)
{
    if (x > y)
    {
        return x;
    }
    else
    {
        return y;
    }
}

```

Output:

```
C:\Users\Admin\Desktop\1BM21CS047\ADA\Knapsack\bin\Debug\Knapsack.exe
Enter the weight of the each item:
2
1
3
2
Enter the profit of each item:
12
15
25
10
Enter the knapsack's capacity:
5
The output is:
0 0 0 0 0 0
0 0 12 12 12 12
0 15 15 27 27 27
0 15 15 27 40 40
0 15 15 27 40 40
The optimal solution is 40
The solution vector is:
0 1 1 0
```

```
Enter the no. of items:4
Enter the weight of the each item:2 1 3 2
Enter the profit of each item:12 10 20 15
Enter the knapsack's capacity:5
The output is:
0 0 0 0 0 0
0 0 12 12 12 12
0 10 12 22 22 22
0 10 12 22 30 32
0 10 15 25 30 37
The optimal solution is 37
The solution vector is:
1 1 0 1
```

8. Implement all pair shortest path problem using Floyd's Algorithm.

Code:

```
#include<stdio.h>
void main()
{
    int i,j,k,n,p[10][10],o[10][10];

    printf("Enter number of nodes \n");
    scanf("%d",&n);

    printf("Enter %dX%d adjacency matrix of \n",n,n);
    for(i=0;i<n;i++)
    {
        for(j=0;j<n;j++)
            scanf("%d",&p[i][j]);
    }

    for(i=0;i<n;i++)
    for(j=0;j<n;j++)
        o[i][j]=p[i][j];

    for(k=0;k<n;k++)
    for(i=0;i<n;i++)
    for(j=0;j<n;j++)
        if(p[i][j] > p[k][j]+p[i][k])
            p[i][j]=p[k][j]+p[i][k];

    printf("\nOriginal Adjacency Matrix \n");
    for(i=0;i<n;i++)
    {
        for(j=0;j<n;j++)
            printf("%d ",o[i][j]);
        printf("\n");
    }
    printf("\nUpdated Adjacency Matrix \n");
    for(i=0;i<n;i++)
    {
        for(j=0;j<n;j++)
            printf("%d ",p[i][j]);
        printf("\n");
    }
}
```

Output:

```
C:\Users\Admin\Desktop\IBM21CS047\ADA\Floyd's\bin\Debug\Floyd's.exe
Enter number of nodes
4
Enter 4X4 adjacency matrix of
0 1 999 4
999 0 999 999
8 2 0 999
999 6 5 0

Original Adjacency Matrix
0 1 999 4
999 0 999 999
8 2 0 999
999 6 5 0

Updated Adjacency Matrix
0 1 9 4
999 0 999 999
8 2 0 12
13 6 5 0

Process returned 4 (0x4)   execution time : 30.050 s
Press any key to continue.
```

9. Find Minimum Cost Spanning Tree of a given undirected graph using prims and kruskals Algorithm.

Prims Code:

```
#include<stdio.h>
float cost[10][10];
int vt[10],et[10][10],vis[10],j,n;
float sum=0;
int x=1;
int e=0;
void prims();

void main()
{
    int i;
    printf("Enter the number of vertices\n");
    scanf("%d",&n);
    printf("Enter the cost adjacency matrix\n");
    for(i=1;i<=n;i++)
    {
        for(j=1;j<=n;j++)
        {
            scanf("%f",&cost[i][j]);
        }
        vis[i]=0;
    }
    prims();
    printf("Edges of spanning tree\n");
    for(i=1;i<=e;i++)
    {
        printf("%d,%d\t",et[i][0],et[i][1]);
    }
    printf("weight=%f\n",sum);
}

void prims()
{
    int s,m,k,u,v;
    float min;
    vt[x]=1;
    vis[x]=1;
    for(s=1;s<n;s++)
    {
        j=x;
```

```

min=999;
while(j>0)
{
    k=vt[j];
    for(m=2;m<=n;m++)
    {
        if(vis[m]==0)
        {
            if(cost[k][m]<min)
            {
                min=cost[k][m];
                u=k;
                v=m;
            }
        }
    }
    j--;
}
vt[++x]=v;
et[s][0]=u;
et[s][1]=v;
e++;
vis[v]=1;
sum=sum+min;
}
}

```

Output:

```

C:\Users\Admin\Desktop\1BM21CS047\prims\bin\Debug\prims.exe
Enter the number of vertices
6
Enter the cost adjacency matrix
0 3 999 999 6 5
3 0 1 999 999 4
999 1 0 6 999 4
999 999 6 0 8 5
6 999 999 8 0 2
5 4 4 5 2 0
Edges of spanning tree
1,2    2,3    3,6    6,5    6,4    weight=15.000000
Process returned 17 (0x11)   execution time : 54.828 s
Press any key to continue.

```

Kruskals Code:

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

int find(int v,int parent[10])
{
    while(parent[v]!=v)
    {
        v=parent[v];
    }
    return v;
}

void union1(int i,int j,int parent[10])
{
    if(i<j)
        parent[j]=i;
    else
        parent[i]=j;
}

void kruskal(int n,int a[10][10])
{
    int count,k,min,sum,i,j,t[10][10],u,v,parent[10];
    count=0;
    k=0;
    sum=0;
    for(i=0;i<n;i++)
        parent[i]=i;
    while(count!=n-1)
    {
        min=999;
        for(i=0;i<n;i++)
        {
            for(j=0;j<n;j++)
            {
                if(a[i][j]<min && a[i][j]!=0)
                {
                    min=a[i][j];
                    u=i;
                    v = j;
                }
            }
        }
    }
}
```

```

    }
}
i=find(u,parent);
j=find(v,parent);
if(i!=j)
{
    union1(i,j,parent);
    t[k][0]=u;
    t[k][1]=v;
    k++;
    count++;
    sum=sum+a[u][v];
}
a[u][v]=a[v][u]=999;
}
if(count==n-1)
{
    printf("spanning tree\n");
    for(i=0;i<n-1;i++)
    {
        printf("%d %d\n",t[i][0]+1,t[i][1]+1);
    }
    printf("cost of spanning tree=%d\n",sum);
}
else
    printf("spanning tree does not exist\n");
}

```

```

void main()
{
    int n,i,j,a[10][10];

    printf("Enter the number of nodes\n");
    scanf("%d",&n);
    printf("Enter the adjacency matrix\n");
    for(i=0;i<n;i++)
        for(j=0;j<n;j++)
            scanf("%d",&a[i][j]);
    kruskal(n,a);
}

```


Output:

```
C:\Users\Admin\Desktop\18M21CS047\kruskal\bin\Debug\kruskal.exe
Enter the number of nodes
5
Enter the adjacency matrix
0 5 999 6 999
5 0 1 3 999
0 1 0 4 6
6 3 4 0 2
0 0 6 2 0
spanning tree
2 3
4 5
2 4
1 2
cost of spanning tree=11
Process returned 25 (0x19)   execution time : 27.891 s
Press any key to continue.
```

10. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's Algorithm

Code:

```
#include<stdio.h>
#include<conio.h>
void dijkstras();
int c[10][10],n,src;
void main()
{
    int i,j;
    printf("\nEnter number of vertices:");
    scanf("%d",&n);
    printf("\nEnter the adjacency matrix:\n");
    for(i=1;i<=n;i++)
    {
        for(j=1;j<=n;j++)
        {
            scanf("%d",&c[i][j]);
        }
    }
    printf("\nEnter the source node:\t");
    scanf("%d",&src);
    dijkstras();
    getch();
}

void dijkstras()
{
    int vis[10],dist[10],u,i,j,count,min;
    for(j=1;j<=n;j++)
    {
        dist[j]=c[src][j];
    }
    for(j=1;j<=n;j++)
    {
        vis[j]=0;
    }
    dist[src]=0;
    vis[src]=1;
    count=1;
    while(count!=n)
    {
```

```

min=9999;
for(j=1;j<=n;j++)
{
    if(dist[j]<min&&vis[j]!=1)
    {
        min=dist[j];
        u=j;
    }
}
vis[u]=1;
count++;
for(j=1;j<=n;j++)
{
    if(min+c[u][j]<dist[j]&&vis[j]!=1)
    {
        dist[j]=min+c[u][j];
    }
}
}
printf("\nThe shortest distance is:\n");
for(j=1;j<=n;j++)
{
    printf("\n%d to %d=%d ",src,j,dist[j]);
}
}

```

Output:

```

Enter number of vertices:6

Enter the adjacency matrix:
0 25 35 999 100 999
999 0 100 14 999 999
999 999 0 29 999 999
999 999 999 0 999 21
999 999 50 999 0 999
999 999 999 999 48 0

Enter the source node: 1

The shortest distance is:

1 to 1=0
1 to 2=25
1 to 3=35
1 to 4=39
1 to 5=100
1 to 6=60 █

```

11. Implement “N-Queen’s Problem” using backtracking

Code:

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

int board[20],count;

int main()
{
    int n,i,j;
    void queen(int row,int n);

    printf("\n\nEnter number of Queens:");
    scanf("%d",&n);
    queen(1,n);
    return 0;
}

void print(int n)
{
    int i,j;
    printf("\n\nSolution %d:\n\n",++count);

    for(i=1;i<=n;i++)
        printf(" %d",i);
    for(i=1;i<=n;i++)
    {
        printf("\n\n%d",i);
        for(j=1;j<=n;j++)
        {
            if(board[i]==j)
                printf(" Q");
            else
                printf(" -");
        }
    }
}

int place(int row,int column)
{
    int i;
    for(i=1;i<=row-1;i++)
```

```

{
    if(board[i]==column)
        return 0;
    else
        if(abs(board[i]-column)==abs(i-row))
            return 0;
}
return 1;
}
void queen(int row,int n)
{
    int column;
    for(column=1;column<=n;column++)
    {
        if(place(row,column))
        {
            board[row]=column;
            if(row==n)
                print(n);
            else
                queen(row+1,n);
        }
    }
}
}

```

Output:

```
Enter number of Queens:4
```

```
Solution 1:
```

```
1 2 3 4
```

```
1 - Q - -
```

```
2 - - - Q
```

```
3 Q - - -
```

```
4 - - Q -
```

```
Solution 2:
```

```
1 2 3 4
```

```
1 - - Q -
```

```
2 Q - - -
```

```
3 - - - Q
```

```
4 - Q - -
```