

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



LAB REPORT on

Analysis and Design of Algorithms

Submitted by

G MOHAMMED AWAIZ (1BM21CS060)

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



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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 **G Mohammed Awaiz(1BM21CS060)**, 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.

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;
}

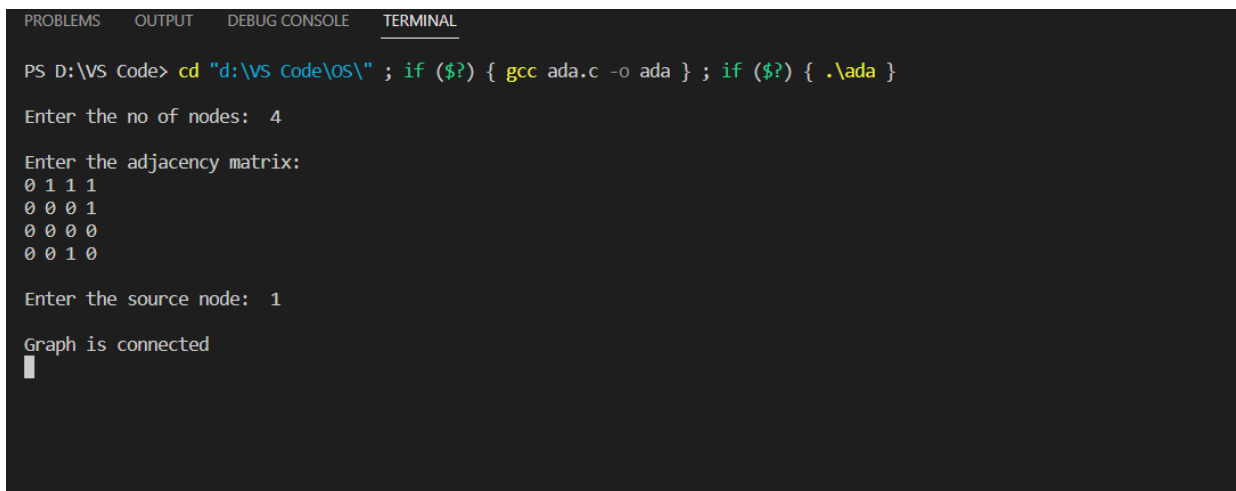
void main()
{
    int i,j,root,ans;
    for(j=1;j<=n;j++)
        vis[j]=0;
    printf("\nEnter the no of nodes:\t");
    scanf("%d",&n);
    printf("\nEnter the adjacency matrix:\n");
    for(i=1;i<=n;i++)
        for(j=1;j<=n;j++)
            scanf("%d",&a[i][j]);

```



```
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:



```
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:

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
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:

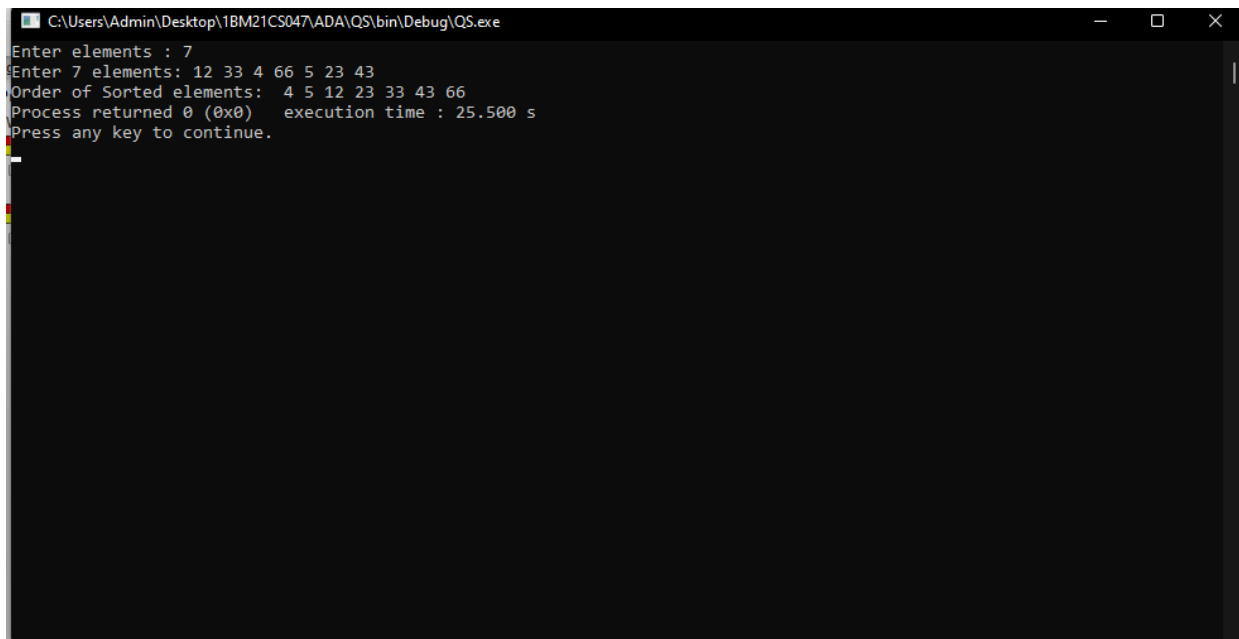
```
#include <stdio.h>
void quicksort(int number[25], int first, int last)
{
    int i, j, pivot, temp;
    if (first < last)
    {
        pivot = first;

        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>

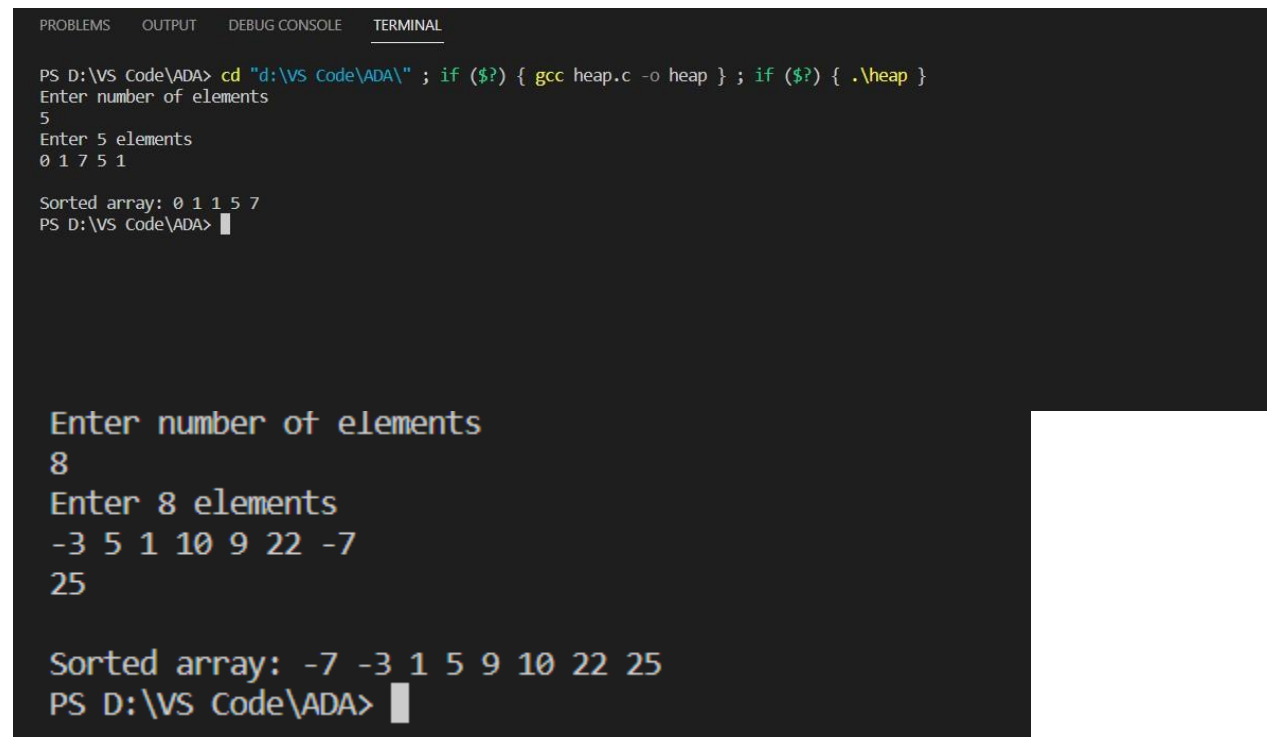
void heapify(int arr[], int n, int i) {
    int largest = i, left = 2 * i + 1, right = 2 * i + 2;
    if (left < n && arr[left] > arr[largest])
        largest = left;
    if (right < n && arr[right] > arr[largest])
        largest = right;
    if (largest != i) {
        int temp = arr[i];
        arr[i] = 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\TBM21CS047\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\IBM21CS047\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 - -

```