VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Analysis and Design of Algorithms

Submitted by

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

B.M.S. COLLEGE OF 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 **Bharat J (1BM21CS038),** 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.

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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.

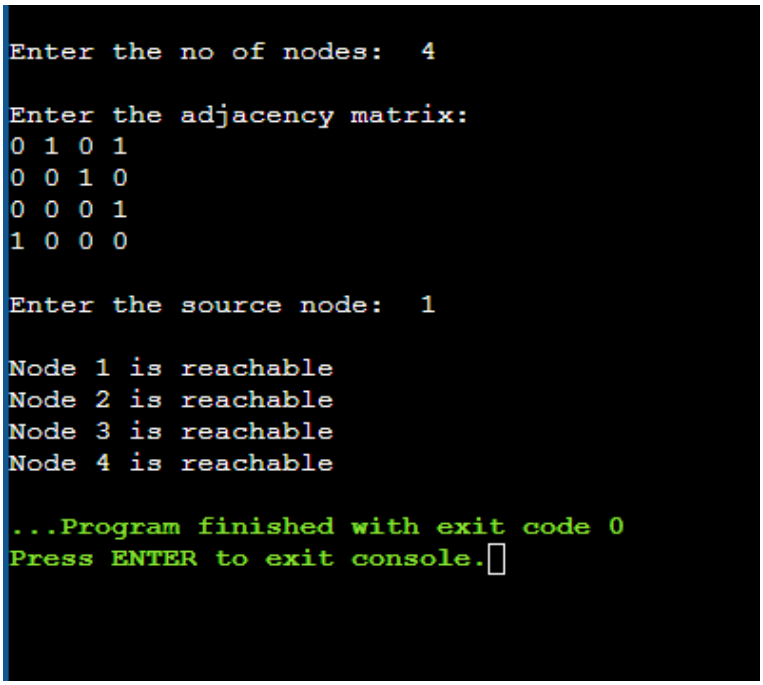
b. Check whether a given graph is connected or not using DFS method.

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:

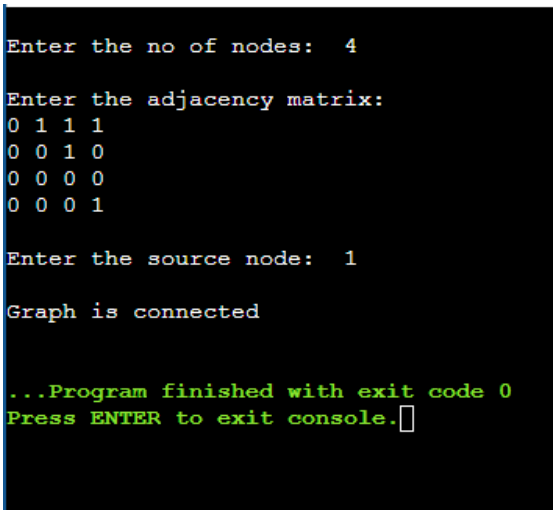

Enter the no of nodes: 4
Enter the adjacency matrix:
0 1 0 1
0 0 1 0
0 0 0 1
1 0 0 0
Enter the source node: 1
Node 1 is reachable
Node 2 is reachable
Node 3 is reachable
Node 4 is reachable
...Program finished with exit code 0
Press ENTER to exit console.

B.

```
#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:



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

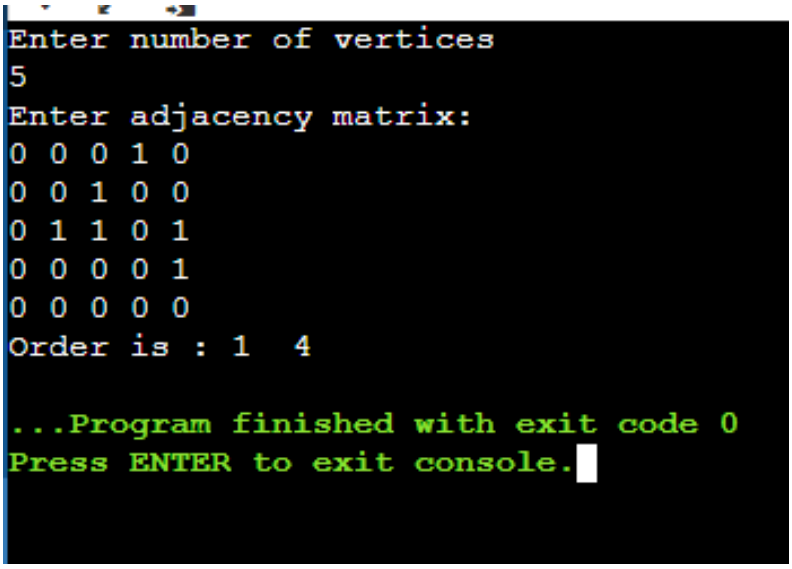
Code:

```
#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:


Enter number of vertices
5
Enter adjacency matrix:
0 0 0 1 0
0 0 1 0 0
0 1 1 0 1
0 0 0 0 1
0 0 0 0 0
Order is : 1 4
...Program finished with exit code 0
Press ENTER to exit console.

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] - 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] - 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:

```
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


...Program finished with exit code 0
Press ENTER to exit console.
```

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:

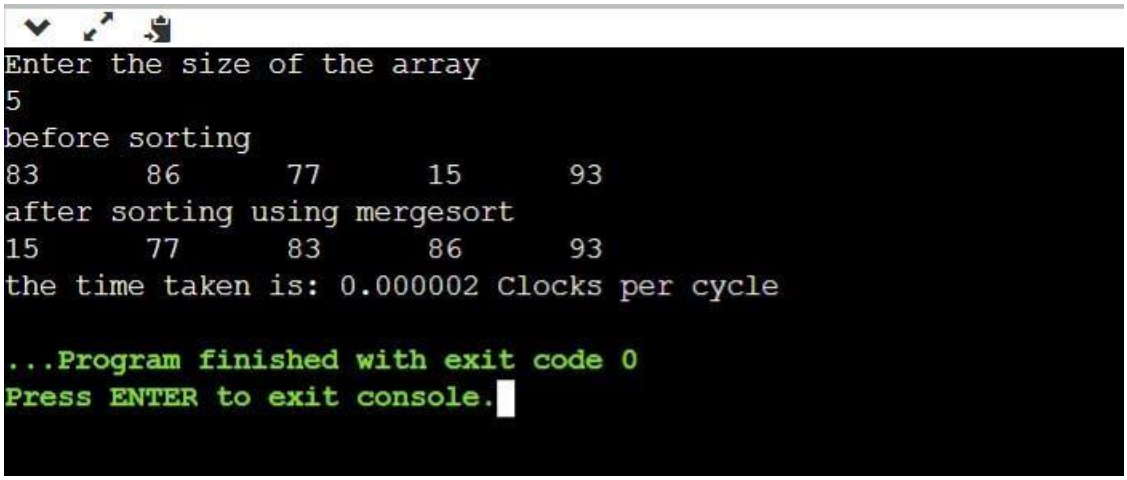
```
#include<stdio.h>
#include<time.h>
int n;
void merge_sort(int a[],int low,int high)
{
   int mid;
   if(low<high)
   {
      mid = (low+high)/2;
      merge_sort(a,low,mid);
      merge_sort(a,mid+1,high);
      merge(a,low,mid,high);
   }

}
void merge(int a[],int low,int mid,int high)
{
   int i,j,k,b[n];
   i = low;
   k = low;
   j = mid+1;

   while(i<=mid && j<=high)
   {
      if(a[i] < a[j])
      {
         b[k] = a[i];
         i++;
         k++;
      }
      else{
         b[k] = a[j];
```

```
            j++;
            k++;
        }
    }
    while(i<=mid)
    {
        b[k] = a
        i++;
        k++;
    }
    while(j<=high)
    {
        b[k] = a[j];
        j++;
        k++;
    }
    for(int i=low; i<=high; i++)
    {
        a[i]=b[i];
    }

}

int main()
{
    int low, high,n;
    printf("Enter size of array: ");
    scanf("%d", &n);
    int a[n];
    printf("Enter array elements: ");
    for(int i=0; i<n; i++){
     // scanf("%d",&a[i]);

     a[i] = rand()%10000;
     printf("%d\t",a[i]);
    }

    low =0;
    high = n-1;
    clock_t start,end;

    start = clock();
    merge_sort(a,low,high);
    end = clock();
```

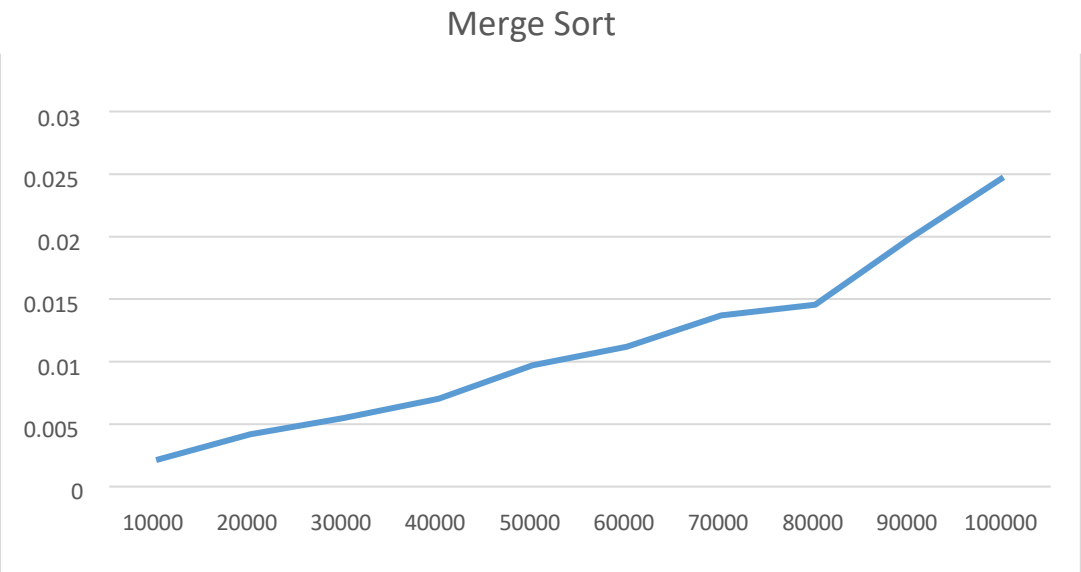
```
 printf("\nSorted array elements: ");
 for(int i=0; i<n; i++)
 printf("%d\t",a[i]);
printf("\nStart time: %f", (double)start);
printf("\nEnd time: %f",(double)end);
printf("\nTime take is %f ", (double)(end-start)/CLOCKS_PER_SEC );
```

Output:

Graph



sizeofarray	timetaken
10000	0.002114
20000	0.00418
30000	0.005486
40000	0.007019
50000	0.00969
60000	0.011191
70000	0.013704
80000	0.014539
90000	0.019828
100000	0.024749



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

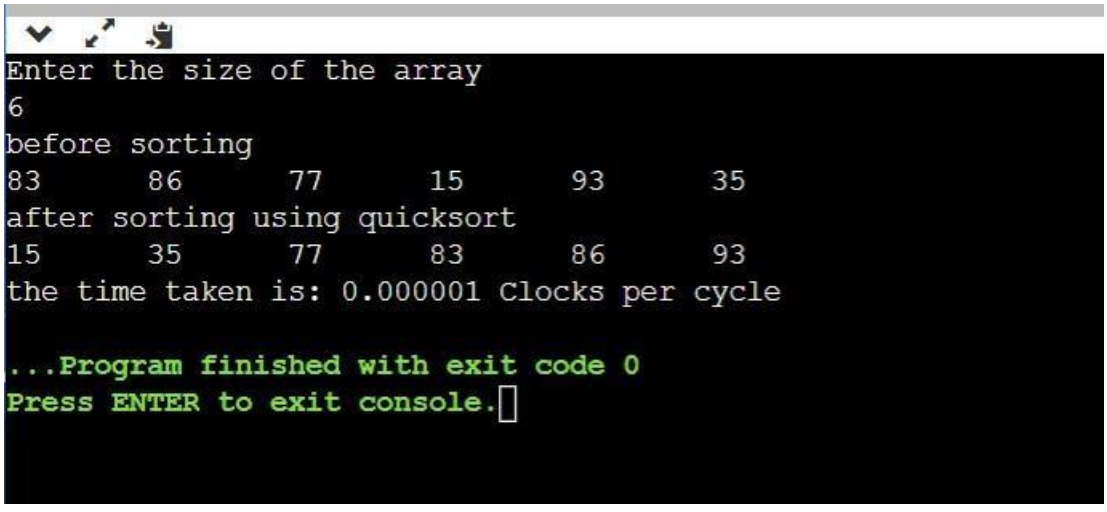
Code:

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

void quick_sort(int a[],int low,int high)
{
    int j;
   if(low<high)
   {
      j = partition(a,low,high);
      quick_sort(a,low,j-1);
      quick_sort(a,j+1,high);
   }
```

```
}

int partition(int a[],int low,int high)
{
  int i,j,pivot;

   i = low;
   j= high+1;
   pivot = a[low];
   while(i<=j)
   {
      do
      {
         i++;
      }while(pivot>=a[i]);

      do
      {
         j--;
      }while(pivot<a[j]);

      if(i<j)
         swap(&a[i],&a[j]);
   }
   swap(&a[low],&a[j]);
   return j;
}

void swap(int *a, int *b)
{
   int temp;
   temp = *a;
   *a = *b;
   *b= temp;
}

int main()
{
   int n;
   printf("Enter size of array: ");
   scanf("%d", &n);
    int a[n], low, high;
   printf("Enter array elements: ");
```

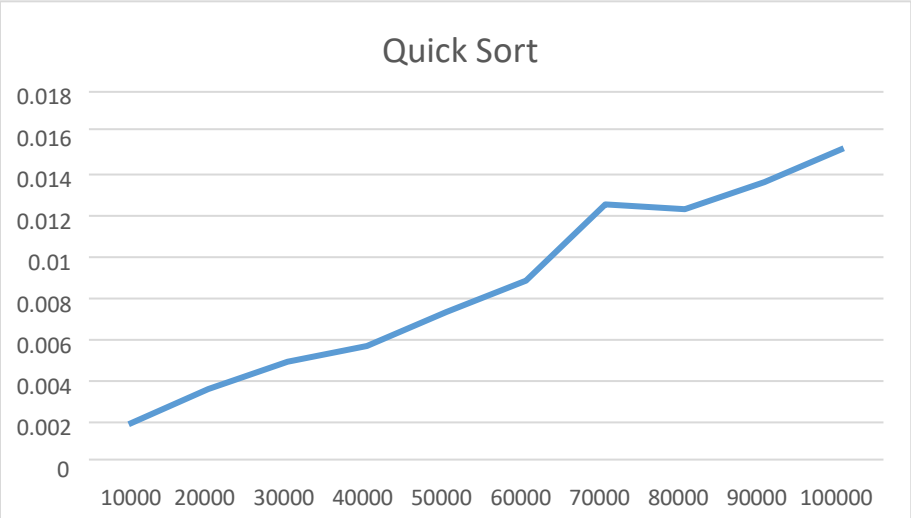
```
   for(int i=0; i<n; i++){
    // scanf("%d",&a[i]);

    a[i] = rand()%10000;
   //  printf("%d\t",a[i]);
    }

   low =0;
   high = n-1;

   clock_t start,end;

   start = clock();
   quick_sort(a,low,high);
   end = clock();

  //  printf("\nSorted array elements: ");
  //  for(int i=0; i<n; i++)
 //  printf("%d\t",a[i]);
   printf("\nStart time: %f", (double)start);
   printf("\nEnd time: %f",(double)end);
   printf("\nTime take is %f ", (double)(end-start)/CLOCKS_PER_SEC );
}
```

Output:



Graph

sizeofarray	timetaken
10000	0.001908
20000	0.003618
30000	0.004931
40000	0.005698
50000	0.00735
60000	0.008865
70000	0.012559
80000	0.012323
90000	0.013631
100000	0.015273



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

Code

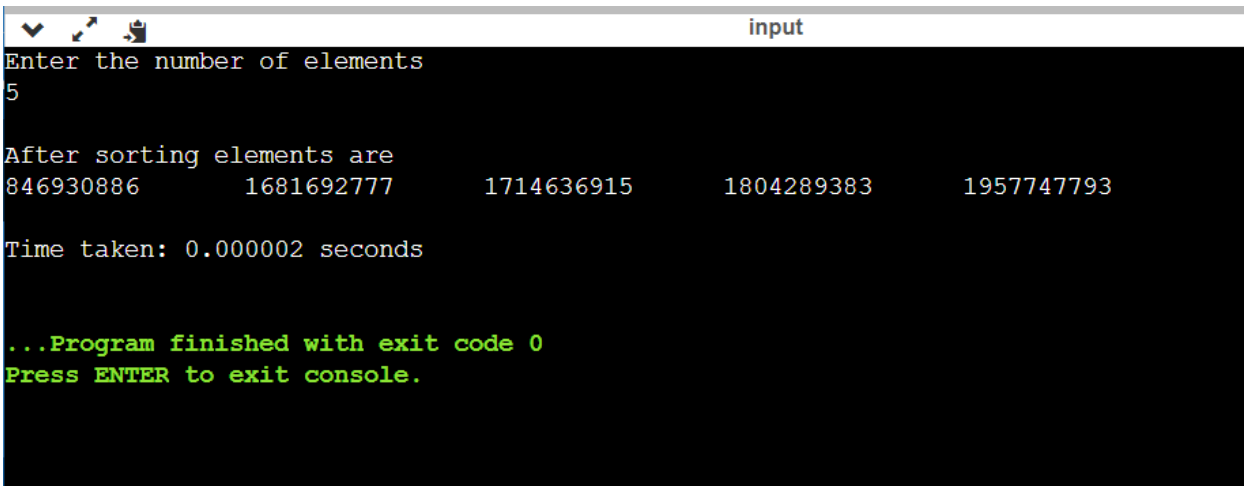
```
#include <stdio.h>
#include<time.h>
void swap(int* a, int* b)
{

        int temp = *a;
        *a = *b;
        *b = temp;
}
void heapify(int arr[], int N, int i)
{
        int largest = i;
       int left = 2 * i + 1;
       int 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) {

                swap(&arr[i], &arr[largest]);
                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--) {

                swap(&arr[0], &arr[i]);
                heapify(arr, i, 0);}
}
void printArray(int arr[], int N)
{
        for (int i = 0; i < N; i++)
                printf("%d ", arr[i]);
        printf("\n");
}
int main()
{

        int N;
        printf("Enter no of nodes: ");
        scanf("%d",&N);
        int arr[N];
        printf("Enter elements: ");
for (int i = 0; i < N; i++)
   {
    arr[i] = rand()%10000;
    printf("%d\t",arr[i]);
   }
```

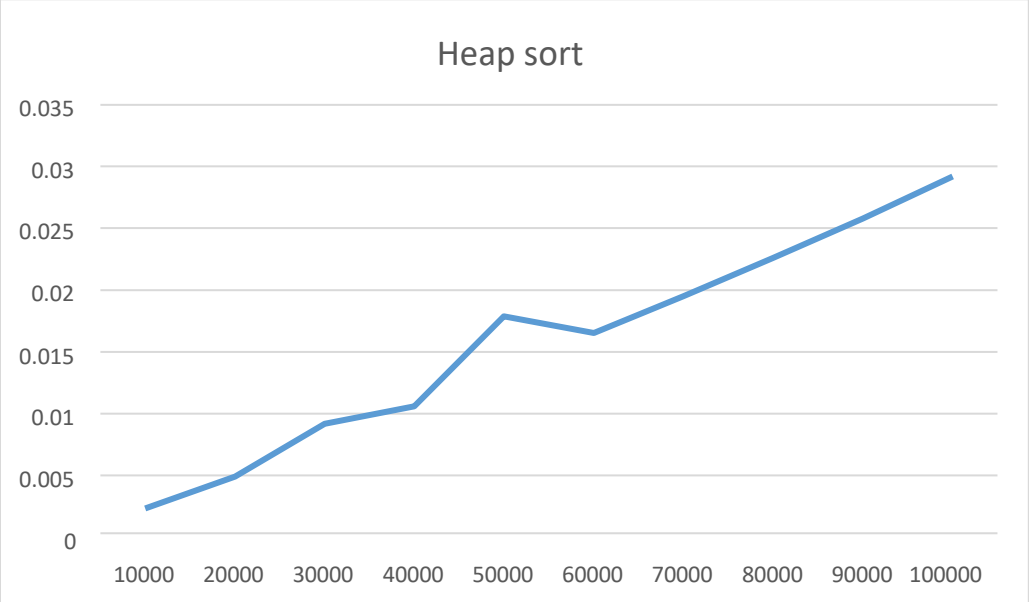
```
    clock_t start,end;
    start = clock();
    heapSort(arr, N);
    end = clock();

            printf("\nSorted array is\n");
            printArray(arr, N);

            printf("\nStart time: %f", (double)start);
    printf("\nEnd time: %f",(double)end);
    printf("\nTime take is %f ", (double)(end-start)/CLOCKS_PER_SEC );
}
```

Output

Graph



sizeofarray	timetaken
10000	0.002324
20000	0.004903
30000	0.009185
40000	0.010584
50000	0.017871
60000	0.016515
70000	0.019496
80000	0.022587
90000	0.025799
100000	0.029185



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

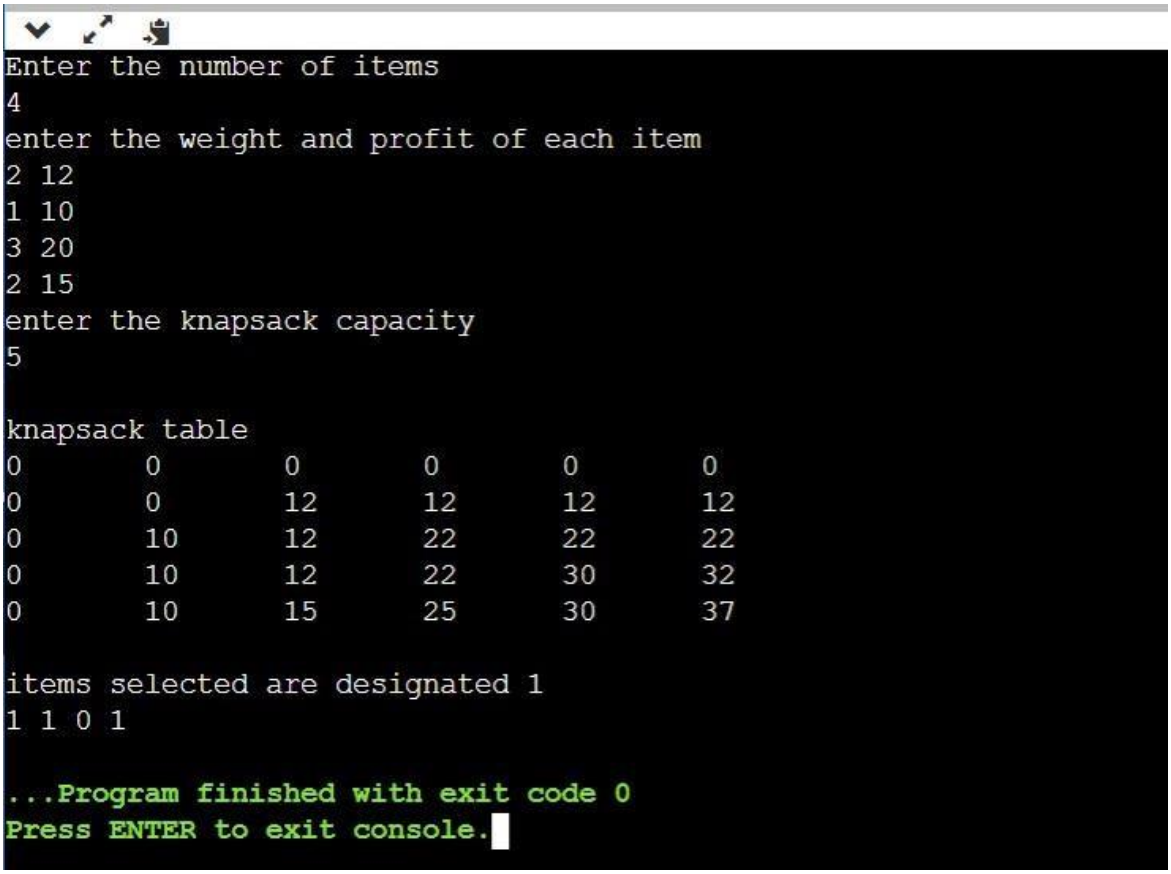
Code:

```
#include<stdio.h>
int n,m;
int max(int a,int b){
 if(a>b){
   return a;
 }
 else{
   return b;
}
}

void selectObj(int v[n+1][m+1],int w[n],int n){
 int i,j,x[n];
 for(i=1;i<=n;i++){
   x[i]=0;
```

```
 }
 i=n;
 j=m;
 while(i!=0 && j!=0){
   if(v[i][j]!=v[i-1][j]){
      x[i]=1;
      j=j-w[i];
   }
   i--;
 }
 for(i=1;i<=n;i++){
   if(x[i]==1){
      printf("\n%d is selected",i);
   }
   else{
      printf("\n%d not selected",i);
   }
 }
}

int* knapsack(int v[n+1][m+1],int w[n],int p[n]){
int i,j;

 for(i=0;i<=n;i++){
   for(j=0;j<=m;j++){
      if(i==0 || j==0){
         v[i][j]=0;
      }
       else if(w[i]>j){
         v[i][j]=v[i-1][j];
      }
      else {
         int x,y;
         x=v[i-1][j];
         y=v[i-1][j-w[i]]+p[i];
         v[i][j]=max(x,y);
      }
 }
 }
 printf("\n");
  for(i=0;i<=n;i++){
  for(j=0;j<=m;j++){
         printf("%d\t",v[i][j]);
         }
```

```
   printf("\n");
  }
  printf("\nOptimal solution: %d",v[n][m]);
  return v[n+1][m+1];
}

void main(){
  int i,j;
  printf("\n enter no. of items: ");
  scanf("%d",&n);
  int w[n],p[n];
  for(int i=1;i<=n;i++){
  printf("\n enter weight and value of %d: ",i);
  scanf("%d%d",&w[i],&p[i]);
  }
  printf("\n enter knapsack capacity: ");
  scanf("%d",&m);
  int v[n+1][m+1];
v[n+1][m+1]=knapsack(v,w,p);
selectObj(v,w,n);
}
```

Output:


Enter the number of items
4
enter the weight and profit of each item
2 12
1 10
3 20
2 15
enter the knapsack capacity
5
knapsack table
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
items selected are designated 1
1 1 0 1
...Program finished with exit code 0
Press ENTER to exit console.

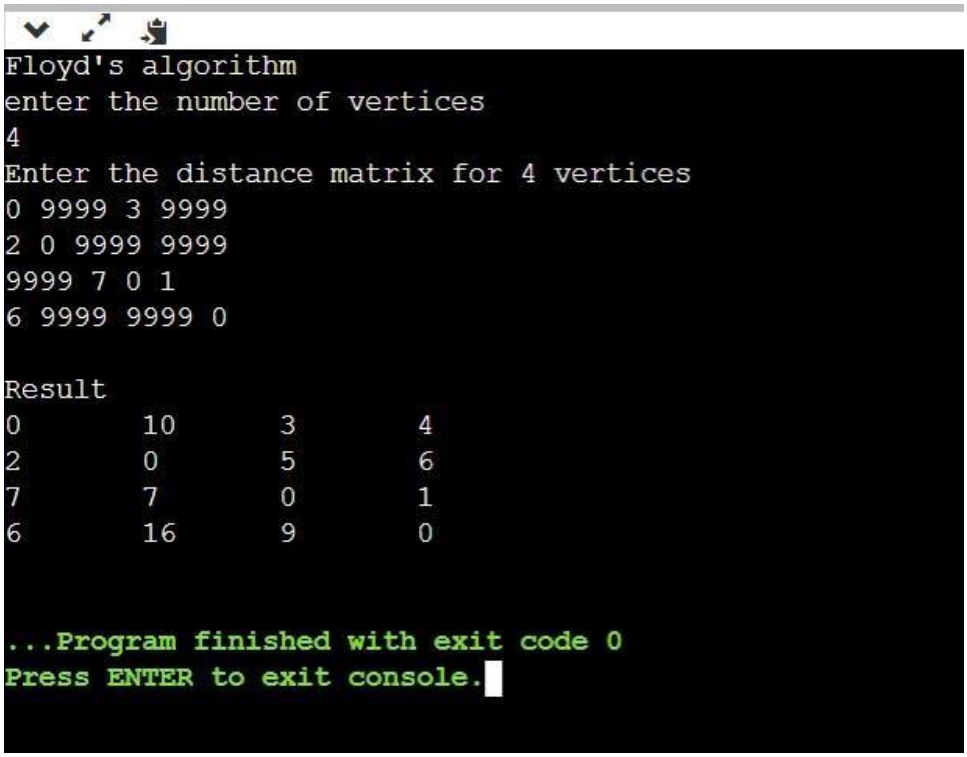
8. Implement all pair shortest path problem using Floyd's Algorithm.

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("\nOringinal 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:



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:

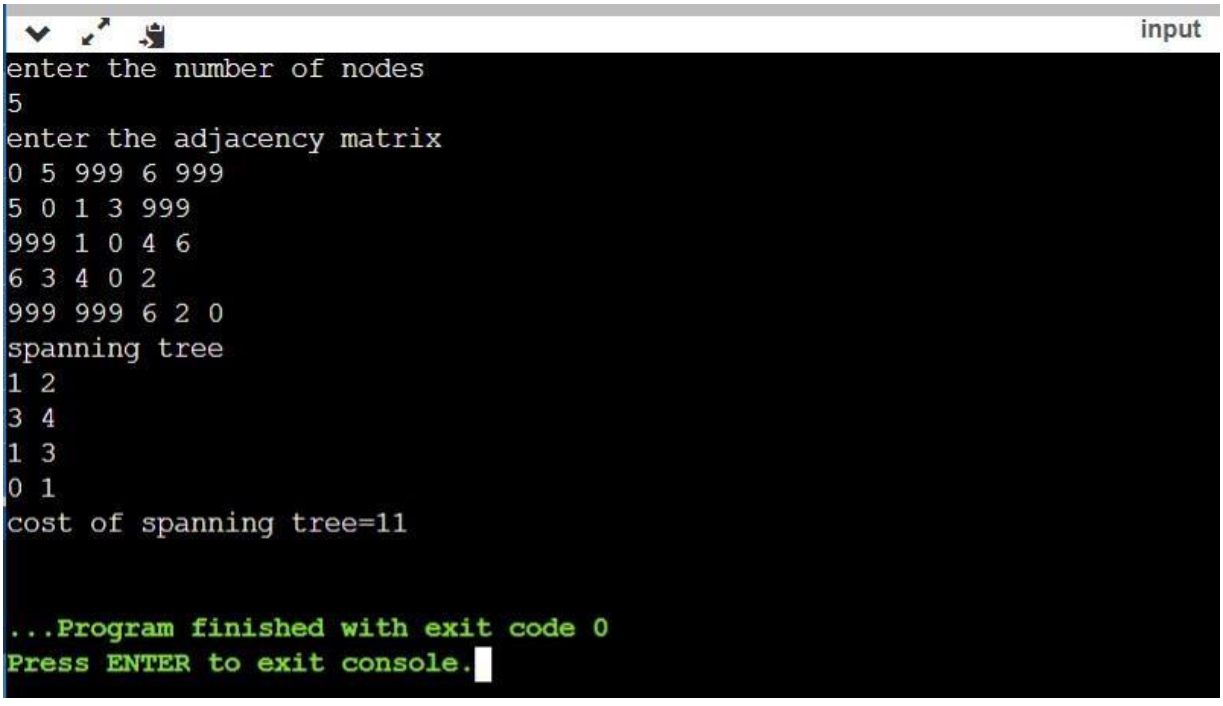
Kruskals Code:

```
#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(“Kruskal’s Algorithm”);
   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:



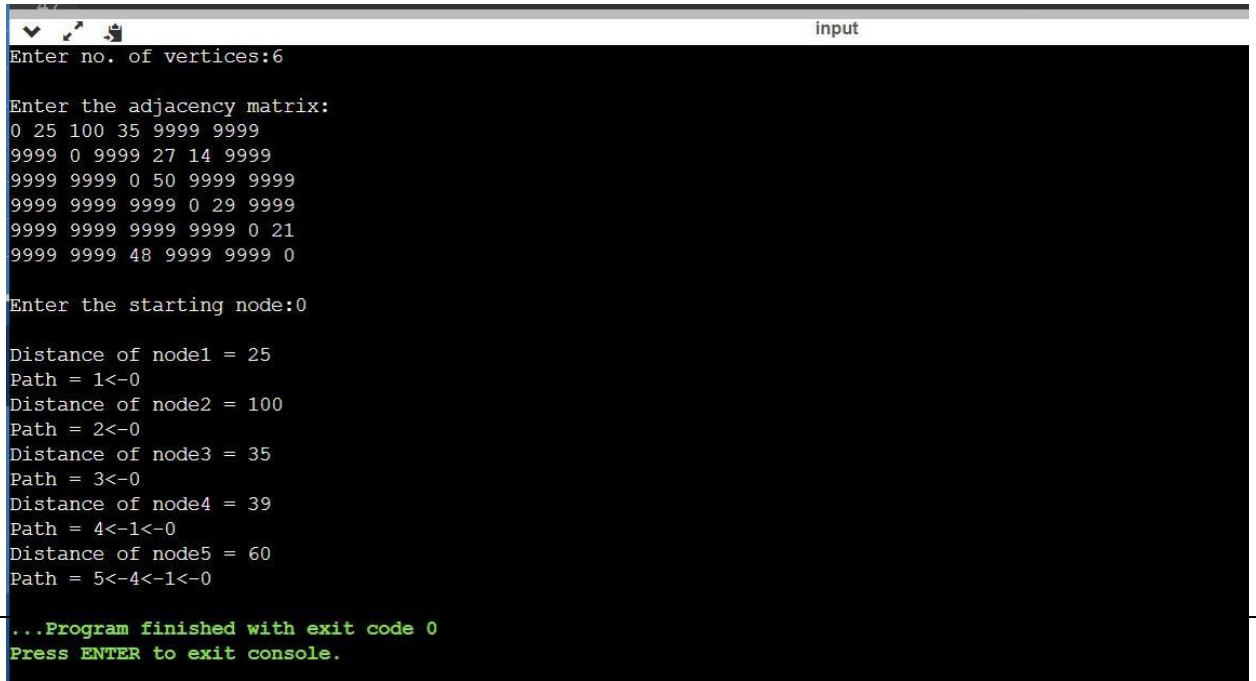
10. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstra's Algorithm

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:



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:

```
 - N Queens Problem Using Backtracking -

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       -       -

...Program finished with exit code 0
Press ENTER to exit console.
```