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 JIGAR D PATEL(1BM21CS081), 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 May-2023 to July-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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11	Implement “N-Queens Problem” using Backtracking.	38-40

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. a.

```
#include<stdio.h> int
i,j,n,visited[10],queue[10],front=0,rear=-1; int
adj[10][10];

void bfs(int v)
{
        for(i=1;i<=n;i++)
        if(adj[v][i] && !visited[i])
queue[++rear]=i;              if(front<=rear)

        visited[queue[front]]=1;
        bfs(queue[front++]);
                }
}

void main()
{
        int v;
  printf("Enter the number of vertices\n");
scanf("%d",&n);
        for(i=0;i<n;i++)
        {
        queue[i]=0;
        visited[i]=0;
        }
        printf("Enter the graph data in adjacent matrix form \n");
        for(i=1;i<=n;i++)
        {
                for(j=1;j<=n;j++)
```

```
                {
                        scanf("%d",&adj[i][j]);
                }
        }

        printf("Enter the starting
vertex\n");   scanf("%d",&v);
        bfs(v);
        printf("Traversal:.....");
        for(i=1;i<=n;i++)
        {
                if(visited[i])
printf("%d\t",i);
                else
                {
                  printf("BFS not possible\n");
                  break;
           }
        }

}
```

OUTPUT:

```
Enter the number of vertices
5
Enter the graph data in adjacent matrix form
0 1 0 1 0
1 0 1 1 0
0 1 0 0 1
1 1 0 0 1
0 0 1 1 0
Enter the starting vertex
1
Traversal:.....1        2       3       4       5
```

b.

```
#include<stdio.h> int
a[20][20],reach[20],n; void
dfs(int v)
{  int i;
 reach[v]=1;
for(i=1;i<=n;i++)   if(a[v][i]
&& !reach[i])
  {
   printf("\n %d->%d",v,i);
dfs(i);    }
}


void main()
{
 int  i,j,count=0;    printf("\n  Enter
number          of          vertices:");
scanf("%d",&n);  for(i=1;i<=n;i++)
 {
  reach[i]=0;
for(j=1;j<=n;j++)    a[i][j]=0;
 }
 printf("\n Enter the adjacency matrix:\n");
for(i=1;i<=n;i++)   for(j=1;j<=n;j++)
scanf("%d",&a[i][j]);  dfs(1);  printf("\n");
for(i=1;i<=n;i++)
 {
if(reach[i])
count++;
 }
 if(count==n)
 {
  printf("\n Graph is connected");
 }
 else
  {
```

```
    printf("\n Graph is not connected");
   }
}
```

OUTPUT:

```
 Enter number of vertices:5

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

 1->2
 2->3
 3->5
 5->4

 Graph is connected
```

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

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

void dfs(int); int
a[10][10],vis[10],exp[10],n,j,m;


void main()
{    int i,x,y;     printf("enter the
number of vertices\n");
scanf("%d",&n);
for(i=1;i<=n;i++)
  {
     for(j=1;j<=n;j++)
     {
      a[i][j]=0;
     }
vis[i]=0;
   }
   printf("enter the number of edges\n");
scanf("%d",&m);     for(i=1;i<=m;i++)
   {
      printf("enter an edge\n");
scanf("%d %d",&x,&y);        a[x][y]=1;
```

```
    }      j=0;
for(i=1;i<=n;i++)
{
if(vis[i]==0)
      dfs(i);
    }
    printf("topological sort\n");     for(i=n-
1;i>=0;i--)
    {
       printf("%d",exp[i]);
    }
    getch();
}

void dfs(int v)
{    int i;
   vis[v]=1;    for(i=1;i<=n;i++)
   {
      if(a[v][i]==1 && vis[i]==0)
dfs(i);
   }
   exp[j++]=v;
}
```

OUTPUT:

```
enter the number of vertices
4
enter the number of edges
5
enter an edge
1 2
enter an edge
1 4
enter an edge
2 4
enter an edge
4 3
enter an edge
1 3
topological sort
1243
```

3.Implement Johnson Trotter algorithm to generate permutations.

```
#include <stdio.h>

#define RIGHT_TO_LEFT 0
#define LEFT_TO_RIGHT 1

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

int getMobile(int a[], int dir[], int n)
{  int
i;
   int mobile_prev = 0, mobile = 0;
   for (i = 0; i < n; i++) {          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;
          }
       }

       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;
          }
       }
   }

   return mobile;
}

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

void printOnePerm(int a[], int dir[], int n) {
int i;
   int mobile = getMobile(a, dir, n);    int
pos = searchArr(a, n, mobile);

   if (dir[a[pos - 1] - 1] ==
RIGHT_TO_LEFT)        swap(&a[pos - 1],
&a[pos - 2]);    else if (dir[a[pos - 1] - 1] ==
LEFT_TO_RIGHT)        swap(&a[pos],
&a[pos - 1]);
     for (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 (i = 0; i < n;
i++)        printf("%d", a[i]);
printf("
");
}
  int factorial(int n) {
int i,res = 1;     for ( i
= 1; i <= n; i++)
res *= i;      return
res;
}

void printPermutation(int n) {
    int a[n];     int
dir[n]; int
i;       for (i = 0; i < n;
i++) {        a[i] = i + 1;
```

```
printf("%d", a[i]);     }
printf("\n");
      for (i = 0; i < n; i++)
dir[i] = RIGHT_TO_LEFT;
      for (i = 1; i < factorial(n);
i++)         printOnePerm(a, dir,
n);
}

int main() {      int n;
printf("Enter the value of n: ");
scanf("%d", &n);
printf("Permutations:\n");
printPermutation(n);
    return 0;
}
```

OUTPUT:

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.

```
#include<stdio.h>
#include<time.h>
#include<stdlib.h> void merge(int
arr[],int l,int r,int m)
{    int i,j,k;
   int n1=m-l+1;     int n2=r-
m;     int left[n1], right[n2];
for(i=0;i<n1;i++)
   {        left[i]=arr[l+i];
   }
   for(j=0;j<n2;j++)
   {
      right[j]=arr[m+1+j];
   }     i=0;     j=0;
k=l;      while(i<n1 &&
j<n2)
   {
if(left[i]<=right[j])
{            arr[k]=left[i];
i++;        }
else
      {
arr[k]=right[j];
j++;
      }        k++;
   }
   while(i<n1)
   {        arr[k]=left[i];
i++;        k++;
   }
   while(j<n2)
   {
      arr[k]=right[j];
j++;        k++;
```

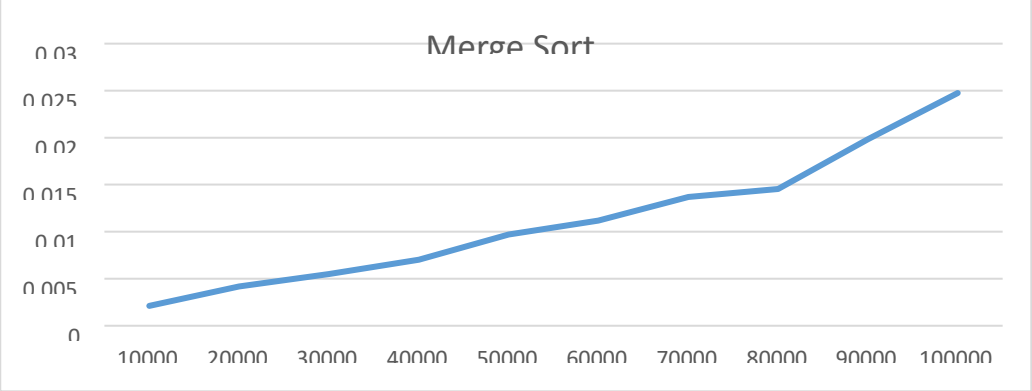
```
    }
}  void mergesort(int arr[], int l, int
r)
{     int mid;
if(l<r)      {
mid=l+(r-l)/2;
mergesort(arr,l,mid);
mergesort(arr,mid+1,r);
merge(arr,l,r,mid);
    }  }  void print(int
arr[],int n)
{     int i;
    for(i=0;i<n;i++)
    {
printf("%d\t",arr[i]);
    }
}

void main()
{      int arr[100000],n,i;
float
time_taken;     clock_t st,et;     printf("Enter
the size of the array\n");
scanf("%d",&n);     for(i=0;i<n;i++)
    {
        arr[i]=rand()%100;
    }
    printf("before sorting \n");     print(arr,n);     st=clock();
mergesort(arr,0,n-1);     et=clock();     printf("\nafter sorting
using mergesort\n");     print(arr,n);     time_taken
= ((float)(et-st)/CLOCKS_PER_SEC); // in seconds

    printf("\nthe time taken is: %f Clocks per cycle",time_taken);  }
```

OUTPUT:

```
Enter the size of the array
5
before sorting
83      86      77      15      93
after sorting using mergesort
15      77      83      86      93
the time taken is: 0.000002 Clocks per cycle
```

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.

```
#include<stdio.h>
#include<time.h>
#include<stdlib.h> void
swap(int *a,int
*b)  {      int
temp;
temp=*a;
*a=*b;
    *b=temp;
} int partition(int arr[],int l,int r)
{
    //ascending order
int pivot=arr[r];     int
i=l-1,j;
for(j=l;j<=r-1;j++)
    {
if(arr[j]<pivot)
        {            i++;
            swap(&arr[i],&arr[j]);
        }
    }
    swap(&arr[i+1],&arr[r]);
return (i+1);

    //descending order
    // int pivot=arr[l];
    // int i=l,j=r+1;
    // for(i=l;i<r;i++)
    // {
    //     if(arr[i]>pivot)
    //     {
    //         j--;
    //         swap(&arr[i],&arr[j]);
    //     }
```

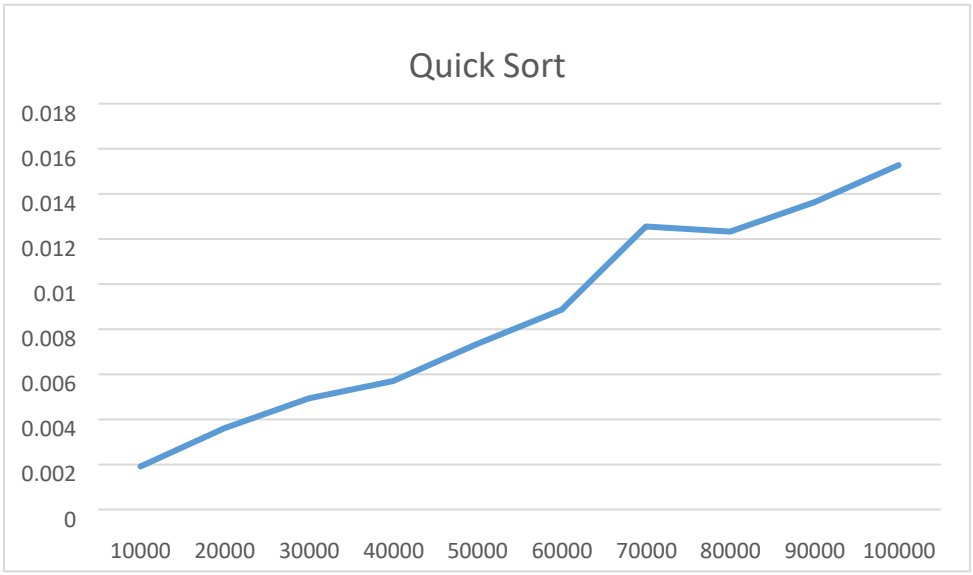
```
    // }
    // swap(&arr[j],&arr[l]);
    // return (j);
}  void quicksort(int arr[],int l,int
r)
{     int split;     if(l<r)      {
split=partition(arr,l,r);
quicksort(arr,l,split-1);
quicksort(arr,split+1,r);
    }  }  void print(int
arr[],int n)
{     int i;
    for(i=0;i<n;i++)
    {
printf("%d\t",arr[i]);
    }
}
void main()
{      int arr[200000],n,i;     float
time_taken;     clock_t st,et;
printf("Enter the size of the array\n");
scanf("%d",&n);     for(i=0;i<n;i++)
    {
       arr[i]=rand()%100;
    }
    printf("before sorting \n");
print(arr,n);     st=clock();
quicksort(arr,0,n-1);
et=clock();
    printf("\nafter sorting using quicksort\n");      print(arr,n);
time_taken  =  ((float)(et-st)/CLOCKS_PER_SEC);  //  in
seconds

    printf("\nthe time taken is: %f Clocks per cycle",time_taken);

}
```

OUTPUT:

```
Enter the size of the array
6
before sorting
83      86      77      15      93      35
after sorting using quicksort
15      35      77      83      86      93
the time taken is: 0.000001 Clocks per cycle
```

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.

```
#include<stdio.h>
#include<time.h> void
swap(int *a,int
*b)
{
   int temp=*a;     *a=*b;
   *b=temp;
}  void heapify(int a[],int
n,int i)
{
   int largest=i,l=2*i,r=2*i+1;
while(l<n && a[l]>a[largest])
   {
largest=l;
   }
   while (r<n && a[r]>a[largest])
   {
largest=r;
   }
if(largest!=i)
   {
      swap(&a[i],&a[largest]);
heapify(a,n,largest);
   }

}  void print(int a[],int
n)
{    int i;
   for(i=1;i<=n;i++)
   {
printf("%d\t",a[i]);
   }
   printf("\n");
}
void heapsort(int a[],int n)
```

```
{    int i;
   //create max heap     for(i=n/2;i>=1;i--)
   {
      heapify(a,n,i);
   }

   //sort using deletion     for(i=n;i>=1;i--)
   {
      swap(&a[1],&a[i]);        heapify(a,i,1);
   }
}

int main() {
int n, i;
clock_t st, et;
float ts;
   printf("Enter the number of elements\n");
scanf("%d", &n);

   // Dynamically allocate the array
int *a = (int *)malloc(n * sizeof(int));     if
(a == NULL) {        printf("Memory
allocation failed.\n");        return 1;
   }

   // Generate random values and place them in the array
for (i = 0; i < n; i++) {        a[i] = rand();
   }
     st = clock();     heapsort(a, n);     et =
clock();      ts = (float)(et - st) /
CLOCKS_PER_SEC;

   if (n <= 20) {        printf("\nAfter sorting
elements are\n");        print(a, n);
   }

   // Free dynamically allocated memory
free(a);
```

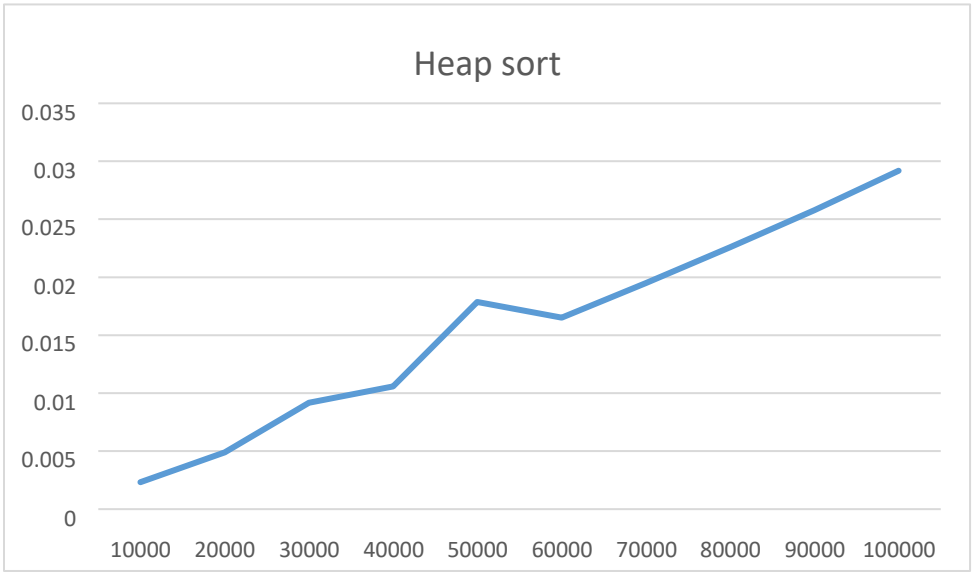
```
    printf("\nTime taken: %f seconds\n", ts);
return 0;
}
```

OUTPUT:

```
Enter the number of elements
5

After sorting elements are
846930886       1681692777      1714636915      1804289383      1957747793

Time taken: 0.000002 seconds
```

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


Heap sort
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000

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

```
#include<stdio.h> void
main()
{
   int i,j,w[10],p[10],opt[10][10],x[10],n,m;
printf("Enter the number of items\n");
scanf("%d",&n);     printf("enter the weight and profit
of each item\n");     for(i=1;i<=n;i++)
   {
      scanf("%d %d",&w[i],&p[i]);
   }
   printf("enter the knapsack
capacity\n");     scanf("%d",&m);
for(i=0;i<=n;i++)
   {
      for(j=0;j<=m;j++)
      {             if(i==0
|| j==0)
         {               opt[i][j]=0;
         }             else
if(j-w[i]<0)
         {
opt[i][j]=opt[i-1][j];
         }            else
         {                              opt[i][j]=opt[i-1][j-w[i]]+p[i]>(opt[i-1][j])?opt[i-1][j-
w[i]]+p[i]:(opt[i-1][j]);             }
      }
   }
   //output     printf("\nknapsack
table\n");     for(i=0;i<=n;i++)
   {
      for(j=0;j<=m;j++)
      {
printf("%d\t",opt[i][j]);
      }
      printf("\n");
   }
```

```
    for(i=n;i>=1;i--)
    {         if(opt[i][m]!=opt[i-
1][m])
        {           x[i]=1;
m=m-w[i];
        }       else
{           x[i]=0;
        }
    }
    printf("\nitems selected are designated 1\n");     for(i=1;i<=n;i++)
    {
        printf("%d ",x[i]);
    }


}
```

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
```

8.Implement All Pair Shortest paths problem using Floyd's algorithm.

```
#include<stdio.h> void
main()
{    int adj[10][10],n,i,j,k;    int result[10][10];
printf("Floyd's algorithm\n");    printf("enter the
number of vertices\n");    scanf("%d",&n);
printf("Enter the distance matrix for %d vertices\n",n);
for(i=0;i<n;i++)
   {
for(j=0;j<n;j++)
      {
         scanf("%d",&adj[i][j]);
result[i][j]=adj[i][j];
      }
   }
   for(k=0;k<n;k++)
   {
for(j=0;j<n;j++)
      {
for(i=0;i<n;i++)
         {
result[i][j]=result[i][j]<(result[i][k]+result[k][j])?result[i][j]:(result[i][k]+result[k][j]);          }
      }
   }
   printf("\nResult\n");
for(i=0;i<n;i++)
   {
for(j=0;j<n;j++)
      {
printf("%d\t",result[i][j]);
      }
      printf("\n");
   }

}
```

OUTPUT:

```
Floyd's algorithm
enter the number of vertices
4
Enter the distance matrix for 4 vertices
0 9999 3 9999
2 0 9999 9999
9999 7 0 1
6 9999 9999 0

Result
0       10      3       4
2       0       5       6
7       7       0       1
6       16      9       0
```

9.Find Minimum Cost Spanning Tree of a given undirected graph using Prim's and Kruskal's algorithm.

```
//prims
#include <stdio.h>

int cost[10][10], vt[10], et[10][10], vis[10], j,
n; int 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("%d", &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=%d\n", sum);
}

void prims()
{     int s, min, m, k,
u, v;    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:

```
enter the number of vertices
5
enter the cost adjacency matrix
0 1 5 2 999
1 0 999 999 999
5 999 0 3 999
2 999 3 0 2
999 999 999 2 0
edges of spanning tree
1,2     1,4     4,5     4,3     weight=8
```

```
//kruskals
#include<stdio.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],t[i][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);
    getch();

    }
```

Output:

```
enter the number of nodes
5
enter the adjacency matrix
0 5 999 6 999
5 0 1 3 999
999 1 0 4 6
6 3 4 0 2
999 999 6 2 0
spanning tree
1 2
3 4
1 3
0 1
cost of spanning tree=11
```

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

```
#include <stdio.h>
#define INFINITY 9999
#define MAX 10

void dijkstra(int G[MAX][MAX], int n, int startnode);

int main()
{
   int G[MAX][MAX], i, j, n, u;
printf("Enter no. of vertices:");
scanf("%d", &n);     printf("\nEnter the
adjacency matrix:\n");     for (i = 0; i < n;
i++)         for (j = 0; j < n; j++)
scanf("%d", &G[i][j]);     printf("\nEnter the
starting node:");     scanf("%d", &u);
dijkstra(G, n, u);     return 0;
}

void dijkstra(int G[MAX][MAX], int n, int startnode)
{

   int cost[MAX][MAX], distance[MAX],
pred[MAX];     int visited[MAX], count,
mindistance, nextnode, i, j;
     for (i = 0; i < n; i++)
for (j = 0; j < n; j++)
if (G[i][j] == 0)
cost[i][j] = INFINITY;
else                cost[i][j] =
G[i][j];
     for (i = 0; i < n;
i++)
   {                    distance[i]  =
cost[startnode][i];         pred[i] =
startnode;         visited[i] = 0;
```

```
   }
   distance[startnode] =
0;    visited[startnode] =
1;    count = 1;    while
(count < n - 1)
   {
      mindistance = INFINITY;
       for (i = 0; i < n; i++)          if
(distance[i] < mindistance && !visited[i])
         {
            mindistance =
distance[i];              nextnode = i;
         }
        visited[nextnode] = 1;       for (i = 0; i < n;
i++)
if (!visited[i])              if (mindistance +
cost[nextnode][i] < distance[i])
            {
               distance[i] = mindistance + cost[nextnode][i];
pred[i] = nextnode;
            }
      count++;
   }
    for (i = 0; i <
n;
i++)       if (i !=
startnode)
      {
         printf("\nDistance of node%d = %d", i, distance[i]);
printf("\nPath = %d", i);
         j = i;           do
{              j = pred[j];
printf("<-%d", j);
         } while (j != startnode);
      }
}
```

OUTPUT:

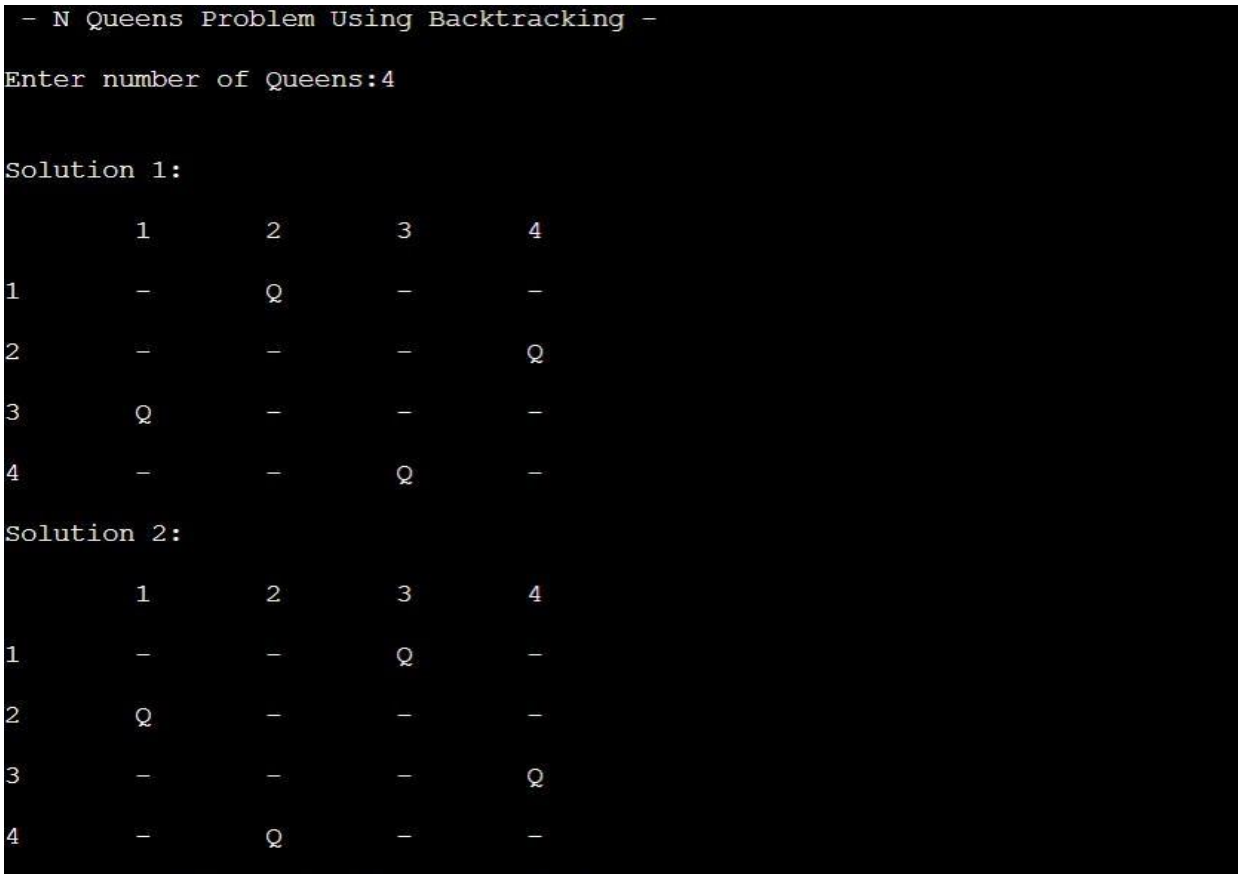
```
Enter no. of vertices:6

Enter the adjacency matrix:
0 25 100 35 9999 9999
9999 0 9999 27 14 9999
9999 9999 0 50 9999 9999
9999 9999 9999 0 29 9999
9999 9999 9999 9999 0 21
9999 9999 48 9999 9999 0

Enter the starting node:0

Distance of node1 = 25
Path = 1<-0
Distance of node2 = 100
Path = 2<-0
Distance of node3 = 35
Path = 3<-0
Distance of node4 = 39
Path = 4<-1<-0
Distance of node5 = 60
Path = 5<-4<-1<-0
```

11.Implement “N-Queens Problem” using Backtracking.

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

int board[20],count;

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

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



//function for printing the solution
void print(int n)
{ int i,j;
printf("\n\nSolution %d:\n\n",++count);

for(i=1;i<=n;++i)   printf("\t%d",i);

for(i=1;i<=n;++i)
{    printf("\n\n%d",i);
for(j=1;j<=n;++j) //for nxn board
  {     if(board[i]==j)
printf("\tQ"); //queen at i,j
position    else     printf("\t-");
//empty slot
  }
}
}
```

```
/*funtion to check conflicts
If no conflict for desired postion returns 1 otherwise returns
0*/ int place(int row,int column)
{ int i;
for(i=1;i<=row-1;++i)
{
  //checking column and digonal
conflicts   if(board[i]==column)    return
0;   else
if(abs(board[i]column)==abs(i-row))
return 0;
}

return 1; //no conflicts
}




//function to check for proper positioning of queen
void queen(int row,int n)
{
int column;
for(column=1;column<=n;++column)
{
  if(place(row,column))
  {
   board[row]=column; //no conflicts so place
queen    if(row==n) //dead end     print(n);
//printing the board configuration    else //try
queen with next position     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 - -