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

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CERTIFICATE

This is to certify that the Lab work entitled "**Analysis and Design of Algorithms**" carried out by **CHANCHAL BHATI(1BM21CS042),** 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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INDEX SHEET

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.

PROGRAM 1

Write program to do the following:
a. Print all the nodes reachable from a given starting node in a digraph using the BFS method.
b. Check whether a given graph is connected or not using the DFS method.

CODE:

BFS:

```
#include<stdio.h>
#include<conio.h>
void insert_rear(int q[],int *r, int item, int size)
{ if(*r==size)
   printf("Queue overflow!\n");
   else
   {
      *r=*r+1; q[*r]=item;
   }
}
int delete_front(int q[],int *r, int *f)
{ int del_item=-1;
   *f=*f+1;
   del_item=q[*f];


   return del_item;
}
int isEmpty(int q[], int *r, int *f)
{ if(*r==-1 || *r==*f)
   return     1;     else
   return 0;
}
void main()
{ int n,i,j,r=-1,f=-1;
   printf("Enter the
   number of
   vertices:\n");
   scanf("%d",&n);
   printf("Enter the adjacency matrix representing the graph:\n");
   int graph[n][n]; int vis[n],q[n]; for(int i=0;i<n;i++)
   { for(int j=0;j<n;j++)
```

```
        { scanf("%d",&graph[i][j]);
        } }
    for(int i=0;i<n;i++)
    {   vis[i]=0;   }   int   k=0;
    printf("%d   ",k);   vis[k]=1;
    insert_rear(q,&r,k,n);
    while(isEmpty(q,&r,&f)==0
    )
    { int node=delete_front(q,&r,&f);
      for(j=0;j<n;j++)
      { if(graph[node][j]==1 && vis[j]==0)
        { printf("%d ",j);
          vis[j]=1;
          insert_rear(q,&r,j,n)
          ;
        }
      }
    }
}
```

OUTPUT:

```
Enter the number of vertices:
6
Enter the adjacency matrix representing the graph:
0 1 1 0 0 0
0 0 0 1 1 0
0 0 0 0 0 1
0 1 0 0 0 0
0 1 0 0 0 0
0 0 1 0 0 0
0 1 2 3 4 5
```

DFS:

```
int graph[20][20]; void
  DFS(int i,int vis[],int n)
  {
     int j; printf("%d
     ",i);      vis[i]=1;
     for(j=0;j<n;j++)
     { if(graph[i][j]==1 && vis[j]==0)
        {
           DFS(j,vis,n);
        }
     }
  }         void
  main()
  { int n,i,j,top=-1;
     printf("Enter the number of vertices:\n");
     scanf("%d",&n);
     printf("Enter the adjacency matrix representing the graph:\n");
int  vis[n],st[n];  for(int
     i=0;i<n;i++)
     { for(int j=0;j<n;j++)
        { scanf("%d",&graph[i][j]);
        } }
     for(int i=0;i<n;i++)
     { vis[i]=0;
     }
     DFS(0,vis,n); }
```

OUTPUT:

```
Enter the number of vertices:
5
Enter the adjacency matrix representing the graph:
0 1 1 0 0
1 0 1 1 0
1 1 0 0 1
0 1 0 0 1
0 0 1 1 0
0 1 2 4 3
```

PROGRAM 2

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

CODE:

```
#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
5
enter the number of edges
6
enter an edge
1 2
enter an edge
2 3
enter an edge
1 3
enter an edge
3 4
enter an edge
4 5
enter an edge
3 5
topological sort
12345
```

PROGRAM 3

Implement Johnson Trotter algorithm to generate permutations.

CODE:

```
#include <stdio.h>

#define RIGHT_TO_LEFT 0
#define LEFT_TO_RIGHT 1
void swap(int *a, int *b) {
    int temp = *a; *a
    = *b;
    *b = temp; }
int searchArr(int a[], int n, int mobile) {
    for (int i = 0; i < n; i++) {
        if (a[i] == mobile) {
            return i + 1;
```

```
        } }
    return -1; // Mobile not found
}

int getMobile(int a[], int 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;
            }
        }

        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; // No mobile element found
    } else { return
        mobile;
    }
}

void printOnePerm(int a[], int dir[], int n) {
    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 (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 factorial(int n) {
    int res = 1;
```

```
    for (int i = 1; i <= n; i++) {
        res = res * i;3
    }
    return res;
}

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

int main() { int
    n;
    printf("Enter the value of n: ");
    scanf("%d", &n);

    printPermutation(n);

    return 0;
}
```

OUTPUT:

PROGRAM 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.

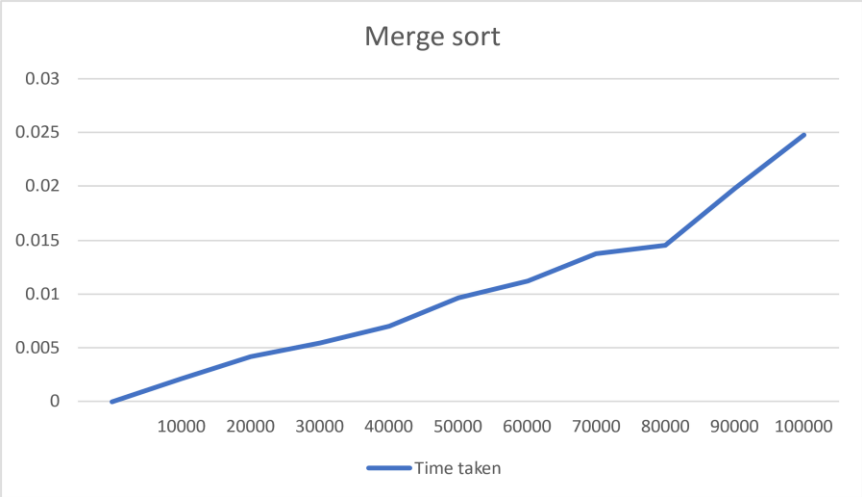
CODE:

```
#include<stdio.h>
#include<time.h>
void conquor(int arr[], int s,int mid,int e)
{ int merged[e-s+1];
   int   i1=s;   int
   i2=mid+1; int
   x=0;
   while(i1<=mid && i2<=e)
   { if(arr[i1]<=arr[i2])
      { merged[x]=arr[i1];
      x++; i1++; } else
      { merged[x]=arr[i2];
         x++; i2++;
      } }
   while(i1<=mid)
```

```
    { merged[x]=arr[i1];
    x++; i1++; }
    while(i2<=e)
    { merged[x]=arr[i2];
       x++;
       i2++; }
    for(int i=0;i<x;i++)
    { arr[i+s]=merged[i];
    }

}
void divide(int arr[], int s, int e)
{ if(s>=e) return; int
    mid=s+(e-s)/2;
    divide(arr,s,mid);
    divide(arr,mid+1,e);
    conquor(arr,s,mid,e)
    ;
}        void
main()
```

```
{ clock_t st,et;
  double ts; int
  n;
  printf("Enter the number of elements in the array:\n");
  scanf("%d", &n); int
  arr[n];
  printf("Enter %d elements of array:\n", n);
  for (int i = 0; i < n; i++) {
     scanf("%d", &arr[i]);
  }  st=clock();
divide(arr,0,n-1);
  et=clock(); ts=(double)((et-st)/CLOCKS_PER_SEC);
  for(int i=0;i<n;i++)
  { printf("%d ",arr[i]);
  }
  printf("\nThe time taken for merge sort is: %f\n",ts);}
```

GRAPH:



OUTPUT:

```
Enter the number of elements in the array:
5
Enter 5 elements of array:
34
65
12
87
16
12 16 34 65 87
The time taken for merge sort is: 0.000000
```

PROGRAM 5

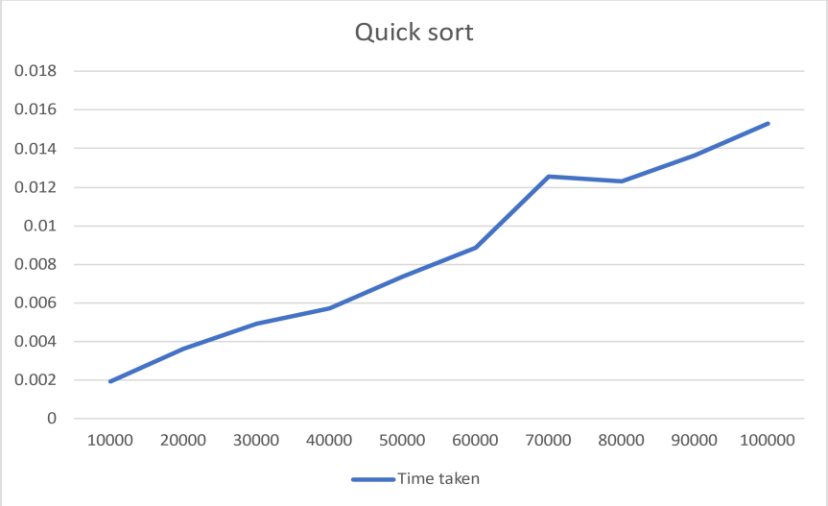
Sort a given set of N integer elements using Quick Sort technique and compute its time taken.

CODE:

```
#include<stdio.h>
#include<time.h>
int partition(int arr[], int low, int high) {
    int pivot = arr[low]; int i = low; int j
    = high + 1;
    int temp;

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

       if (i >= j)
       { break; }



       temp = arr[i];
    arr[i]   =   arr[j];
    arr[j] = temp; }



    temp = arr[low];
    arr[low] = arr[j];
    arr[j] = temp;
return j;
 }
void quickSort(int arr[], int low, int high) {
    if (low < high) {
       int pidx = partition(arr, low, high);
       quickSort(arr,   low,   pidx   -   1);
       quickSort(arr, pidx + 1, high);
    }
 }

 int main() {
```

```
    int n; clock_t
    st,et;  double
    ts;
    printf("Enter the number of elements in the array:\n");
    scanf("%d", &n); int
    arr[n];
    printf("Enter %d elements of array:\n", n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    } st=clock();
    quickSort(arr, 0, n - 1);
    et=clock(); ts=(double)((et-
    st)/CLOCKS_PER_SEC); printf("The
    sorted array is:\n"); for (int i = 0; i < n;
    i++) {
        printf("%d ", arr[i]);
    } printf("\n");
    printf("Time taken for quick sort:%f\n",ts);
    return 0;
}
```

GRAPH:



OUTPUT:

```
Enter the number of elements in the array:
5
Enter 5 elements of array:
43
75
12
32
69
The sorted array is:
12 32 43 69 75
Time taken for quick sort:0.000000
```

PROGRAM 6

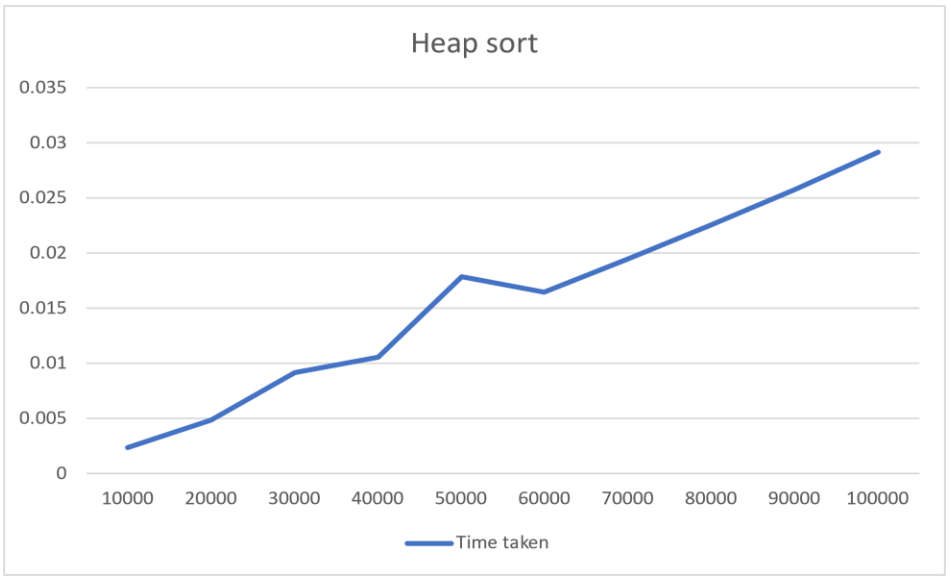
Sort a given set of N integer elements using Heap Sort technique and compute its time taken.

CODE:

```
#include <stdio.h>
#include <time.h>
void 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) { 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
    n;

    printf("Enter the number of elements: "); scanf("%d",
    &n);
int arr[n];
printf("Enter the elements:\n"); for
    (int i = 0; i < n; i++)
    scanf("%d", &arr[i]);
printf("Original array: "); for
    (int i = 0; i < n; i++)
    printf("%d ", arr[i]);
clock_t start_time = clock(); // Record the start time

    heapSort(arr, n); clock_t end_time = clock(); //

    Record the end time

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

    double time_taken = (double)(end_time - start_time) / CLOCKS_PER_SEC; printf("\nTime
    taken: %f seconds\n", time_taken);


    return 0;
  }
```

GRAPH:



OUTPUT:

```
Enter the number of elements: 5
Enter the elements:
54 12 34 60 23
Original array: 54 12 34 60 23
Sorted array: 12 23 34 54 60
Time taken: 0.000000 seconds
```

7

Implement 0/1 Knapsack problem using dynamic programming. **CODE:**

```
#include<stdio.h>
void main()
{     int      i,j,w[10],pft[10],x[10],n,cap;
   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],&pft[i]);
   }
   printf("enter the knapsack capacity\n"); scanf("%d",&cap);

   int arr[n + 1][cap + 1]; // Corrected the size of the 'arr' matrix

   for (i = 0; i <= n; i++)
   { for (j = 0; j <= cap; j++)
      { if (i == 0 || j == 0)
         arr[i][j] = 0;
         else if (j < w[i]) // Changed 'w[i-1]' to 'w[i]' arr[i][j]
            = arr[i - 1][j];
         else if (j >= w[i]) // Changed 'w[i-1]' to 'w[i]'
         { if (arr[i - 1][j] >= arr[i - 1][j - w[i]] + pft[i]) // Corrected the condition
            arr[i][j] = arr[i - 1][j];
            else arr[i][j] = arr[i - 1][j - w[i]] + pft[i]; // Added 'else'
         block }
      }
   }
   printf("\n Knapsack table\n"); for(i=0;i<=n;i++)
   { for(j=0;j<=cap;j++)
      { printf("%d\t",arr[i][j]);
      }
      printf("\n");
   }
   for(i=n;i>=1;i--)
   { if(arr[i][cap]!=arr[i-1][cap])
      { x[i]=1; cap
         -= w[i];
      } else
```

PROGRAM

```
        { 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 elements: 5
Enter the elements:
54 12 34 60 23
Original array: 54 12 34 60 23
Sorted array: 12 23 34 54 60
Time taken: 0.000000 seconds
```

8

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

CODE:

```
#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:

PROGRAM

```
enter the number of vertices
4
Enter the distance matrix for 4 vertices
0 999 3 999
2 0 999 999
999 7 0 1
6 999 999 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/Kruskal's algorithm.

KRUSKALS ALGORITHM

CODE:

```
#include <stdio.h>
#include <conio.h>
#include <stdlib.h>
int i, j, k, a, b, u, v, n, ne = 1;
int min, mincost = 0, cost[9][9], parent[9];
int find(int); int
uni(int, int);

void main()
{ printf("Kruskal's algorithm in C\n");
 printf("========================\n");

 printf("Enter the no. of vertices:\n"); scanf("%d",
 &n);

 printf("\nEnter the cost adjacency matrix:\n");
 for (i = 1; i <= n; i++)
 { for (j = 1; j <= n; j++)
  {                scanf("%d",
   &cost[i][j]); if (cost[i][j]
   == 0)
    cost[i][j] = 999;
  }
 }

 printf("The edges of Minimum Cost Spanning Tree are\n"); while
 (ne < n)
 {
  for (i = 1, min = 999; i <= n; i++)
  { for (j = 1; j <= n; j++)
   {  if  (cost[i][j]  <
    min)
```

PROGRAM

```
        {       min       =
         cost[i][j]; a = u
         = i; b = v = j;
        }
       }
      }

      u = find(u); v
      = find(v);
if (uni(u, v))
      { printf("%d edge (%d,%d) =%d\n", ne++, a, b, min);
        mincost += min;
      }

      cost[a][b] = cost[b][a] = 999;
    }

    printf("\nMinimum cost = %d\n", mincost);
    getch();
  }

  int find(int i)
  { while
    (parent[i]) i =
    parent[i]; return
    i;
  }

  int uni(int i, int j)
  { if (i  !=
    j)
     {
```

```
    parent[j] = i; return
     1;
   }

  return 0;
}
```

OUTPUT:

```
Enter the no. of vertices:
4

Enter the cost adjacency matrix:
0 1 3 4
1 0 2 999
3 2 0 5
4 999 5 0
The edges of Minimum Cost Spanning Tree are
1 edge (1,2) =1
2 edge (2,3) =2
3 edge (1,4) =4

Minimum cost = 7
```

PRIMS ALGORITHM

CODE:

```
#include<stdio.h>
#include<conio.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);
   getch();
}

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
4
enter the cost adjacency matrix
0 1 3 4
1 0 2 999
3 2 0 5
4 999 5 0
edges of spanning tree
1,2     2,3     1,4     weight=7
```

v

PROGRAM 10

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

CODE:

```
#include <stdio.h>
#define INFINITY 999 #define
MAX 10
void Dijkstra(int Graph[MAX][MAX], int n, int start);
void Dijkstra(int Graph[MAX][MAX], int n, int start) {
  int cost[MAX][MAX], distance[MAX], pred[MAX];
  int visited[MAX], count, mindistance, nextnode, i, j;

   // Creating cost matrix for
   (i = 0; i < n; i++) for (j =
   0; j < n; j++) if
   (Graph[i][j] == 0)
   cost[i][j] = INFINITY;
   else
       cost[i][j] = Graph[i][j];
for (i = 0; i < n; i++) {
    distance[i] = cost[start][i];
    pred[i] = start; visited[i] =
    0;
   }
distance[start] = 0;
   visited[start] = 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++;
    }

    // Printing the distance
    for (i = 0; i < n; i++) if
    (i != start) {
       printf("\nDistance from source to %d: %d", i, distance[i]); }
  } int main()
  {
     int Graph[MAX][MAX], i, j, n, u;
printf("Enter the number of nodes \n");
     scanf("%d", &n);

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

     printf("Enter the source vertex \n"); scanf("%d",
     &u);

     Dijkstra(Graph, n, u); return

     0;
```

OUTPUT:

```
Enter the number of nodes
6
Enter the adjacency matrix of the graph
0 25 100 35 999 999
999 0 999 27 14 999
999 999 0 50 999 999
999 999 999 0 29 999
999 999 999 999 0 21
999 999 48 999 999 0
Enter the source vertex
0

Distance from source to 1: 25
Distance from source to 2: 100
Distance from source to 3: 35
Distance from source to 4: 39
Distance from source to 5: 60
```

PROGRAM 11

Implement “N-Queens Problem” using Backtracking.

CODE:

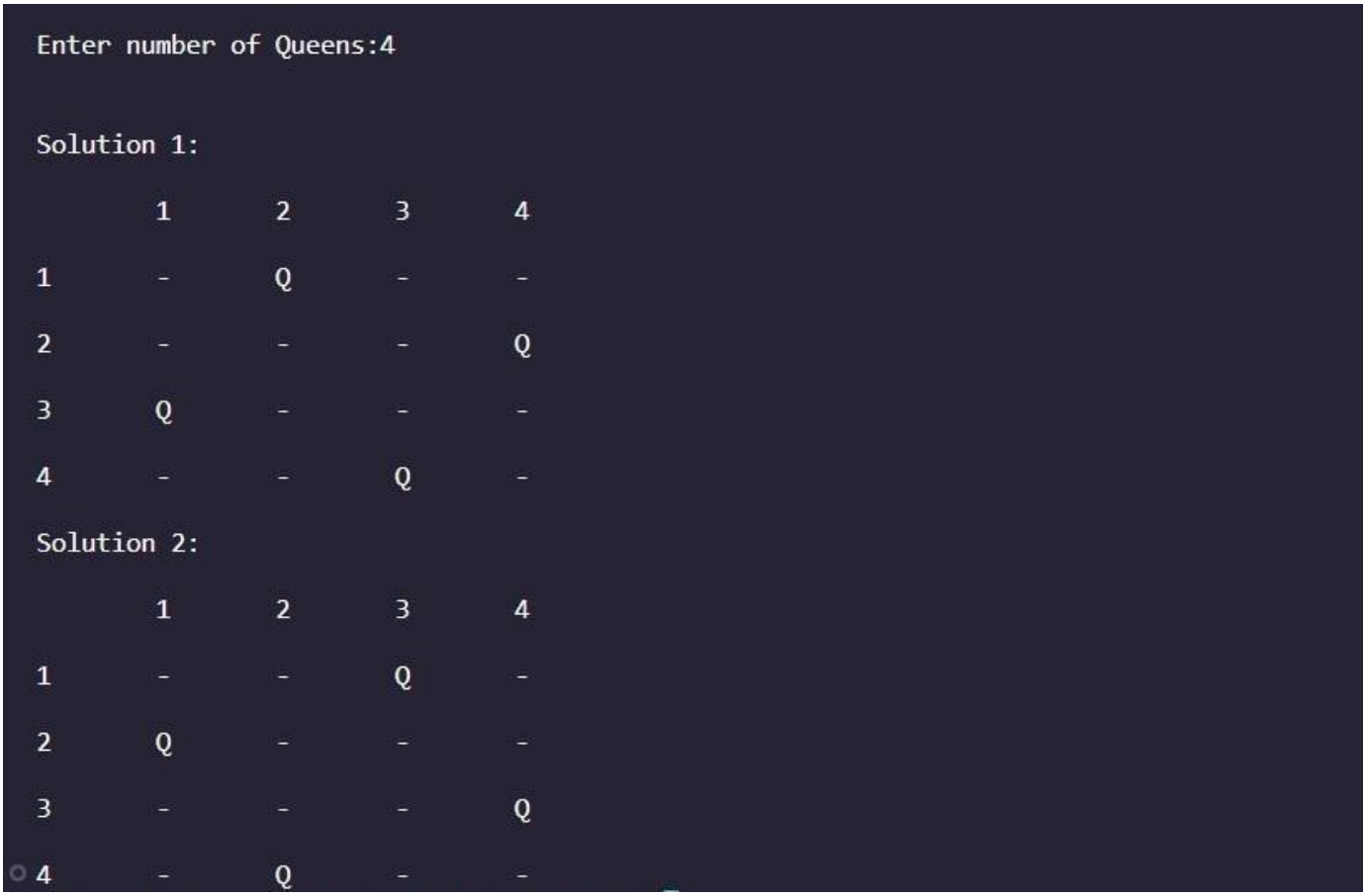
```
#include<stdio.h>

#include<math.h>

int board[20],count;

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

printf(" - N Queens Problem Using Backtracking -"); 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("\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
    }
  }
  }

  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;  //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:


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 - -