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 BENGALURU-560019 May-2023 to July-2023

(Autonomous Institution under VTU)

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 **Aditya Dua(1BM21CS006),** 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 an **Analysis and Design of Algorithms (22CS4PCADA)** work prescribed for the said degree.

Name of the Lab-In charge: Ms.Antara Roy Choudhury	**Dr. Jyothi S Nayak**
Assistant Professor	Professor and Head
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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.

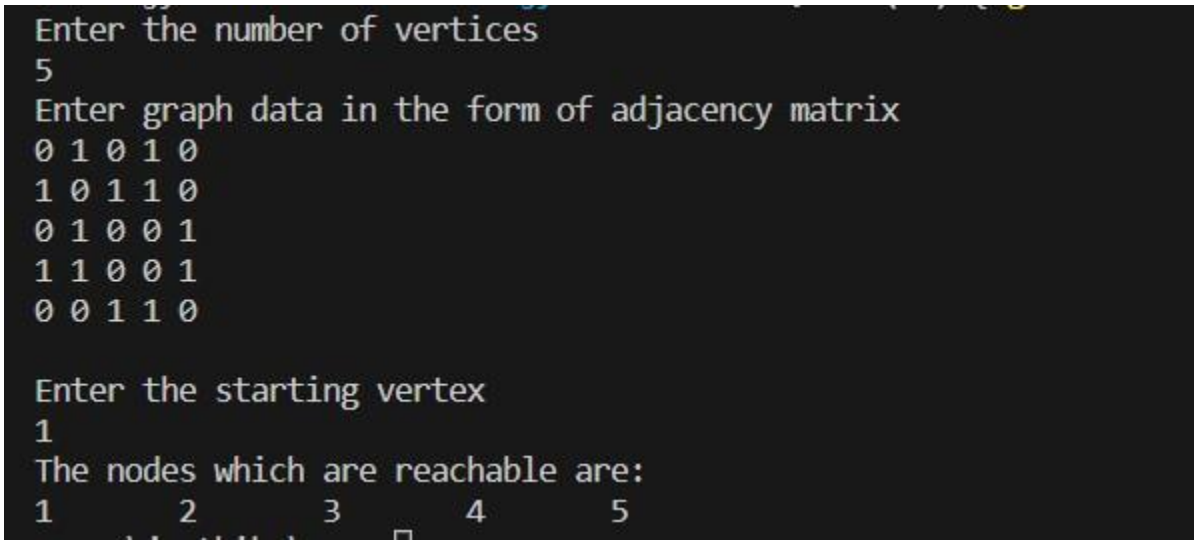
Write program to do the following:

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

```
#include<stdio.h> int
n,i,j,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++]);
                }
}
int main()
{

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

        bfs(v); printf("The nodes which are reachable
        are:\n"); for(i=1;i<=n;i++)
        { if(visited[i])
                {
                        printf("%d\t",i);
```

```
            }
            else
                {
                    printf("node not visited");
            }
        }

        return 1;
}
```

Output:



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

```
#include<stdio.h> int
a[20][20],visited[20],n;
void dfs(int v)
{ int i;
```

```
        visited[v]=1;
        for(i=0;i<n;i++)
        {
                if(a[v][i] && !visited[i])
                {
                        printf("\n%d->%d",v,i); dfs(i);
                }
        }
}
```

```
int main()
{
        int i,j,count=0; printf("Enter
        number of vertices ");
        scanf("%d",&n); for(i=0;i<n;i++)
        {
                for(j=0;j<n;j++)
```

```
                {
                        visited[i]=0; a[i][j]=0;
                }
        }
        for(i=0;i<n;i++)
        {
                for(j=0;j<n;j++)
                {
                        scanf("%d",&a[i][j]);
                }
        }
        dfs(0); for(i=0;i<n;i++)
        { if(visited[i])
                        count++;
        }
        if(count==n)
        {
                printf("\nGraph is connected\n");
        }
        else
        {
                printf("Graph is disconnected");
        }
        return 1;
}
```

Output:

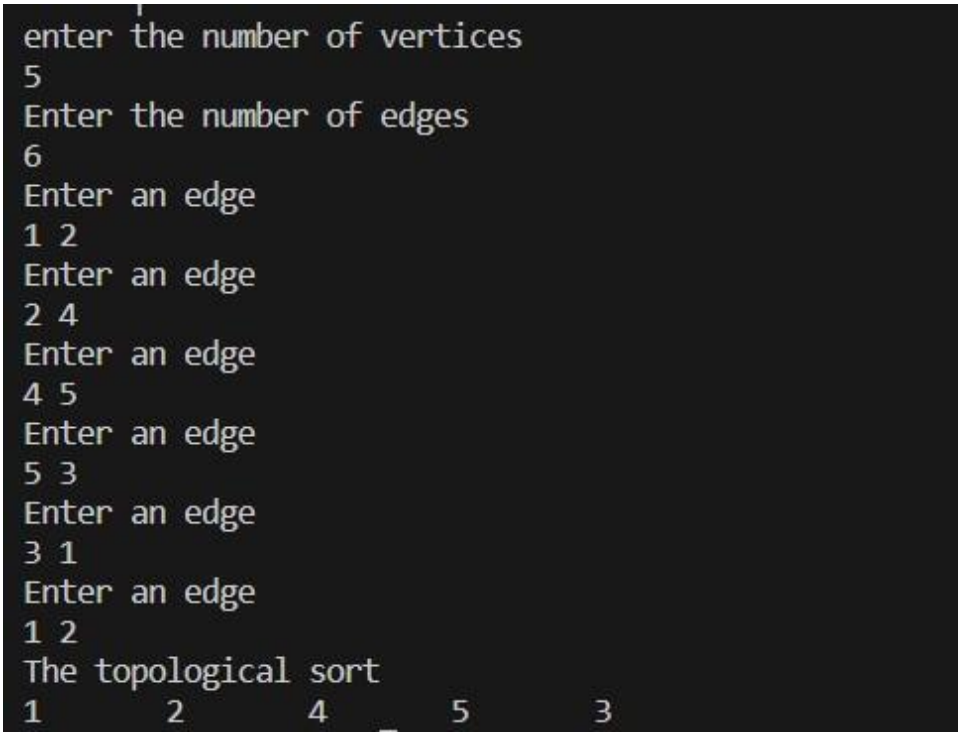
```
Enter number of vertices 5
0 1 0 1 0
1 0 1 1 0
0 1 0 0 1
1 1 0 0 1
0 0 1 1 0

0->1
1->2
2->4
4->3
Graph is connected
```

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

```
#include<stdio.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[j]=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("The topological sort\n"); for(i=n-1;i>=0;i--)
   {
      printf("%d\t",exp[i]);
   }
}
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:



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,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;
   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 fact(int n)
{

    int     i,     res=1;
    for(i=1;i<=n;i++
    )  res*=i;  return
    res;
}
void printPermutations(int n)
{
    int i, a[n]; int
    dir[n];
    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<fact(n);i++)
    {
        printOnePerm(a,dir,n);
    }

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

Output:

```
Enter the number of digits
4
Permutations of the seqeuence :1234
1243 1423 4123 4132 1432 1342 1324 3124 3142 3412 4312 4321 3421 3241 3214 2314 2341 2431 4231 4213 2413 2143 2134
```

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[200000],n,i;
    clock_t st,et; float
    ts;     printf("Enter
    the size of the
    array\n");
    scanf("%d",&n);
    for(i=0;i<n;i++)
    {
        arr[i]=rand();
    }
    if(n<=20)
    {
            printf("before sorting \n");
        print(arr,n);
            }
st=clock();
    mergesort(arr,0,n-1);
```

```
et=clock(); ts=(float)(et-
st)/CLOCKS_PER_SEC; if(n<=20)
{
        printf("\nafter sorting using mergesort\n");
   print(arr,n);
       }

//print(arr,n);
printf("\nTime taken \t %f ",ts);



}
```

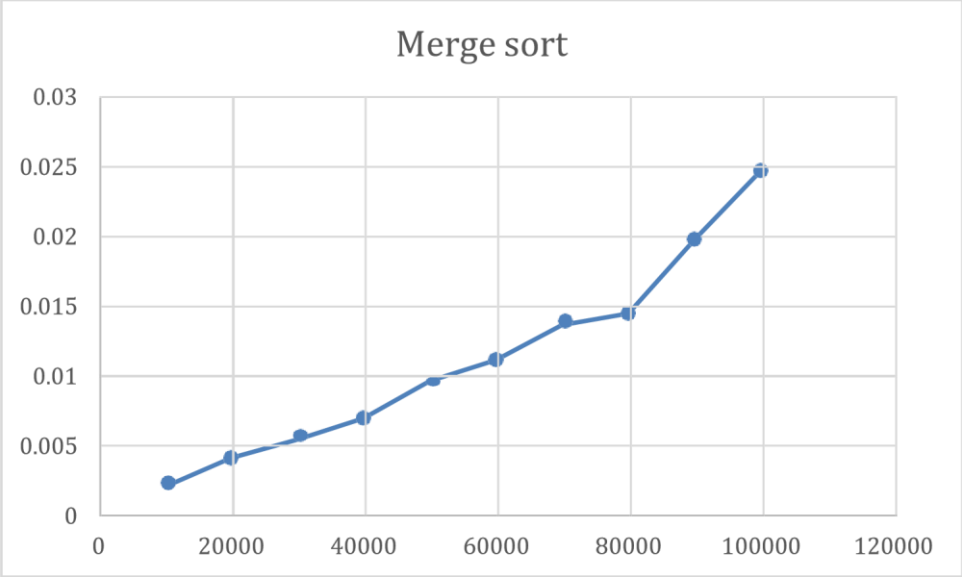
Output:

```
Enter the size of the array
6
before sorting
41      18467   6334    26500   19169   15724
after sorting using mergesort
41      6334    15724   18467   19169   26500   41      6334    15724   18467   19169   26500
```

Table of values:

Input size(n)	Time taken
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

Graph:



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);
}
 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;
   clock_t  st,et;  float
   ts;
   printf("Enter the size of the array\n");
   scanf("%d",&n);
   for(i=0;i<n;i++)
   {
      arr[i]=rand();
   }
   if(n<=20)
   {
         printf("before sorting \n");
      print(arr,n);
         }
   st=clock(); //print(arr,n);
   quicksort(arr,0,n-1); et=clock();
   ts=(float)(et-
   st)/CLOCKS_PER_SEC; if(n<=20)
   {
         printf("\nafter sorting using quicksort\n");
      print(arr,n);
         }
```

```
    printf("\nTime taken \t %f ",ts);


}
```

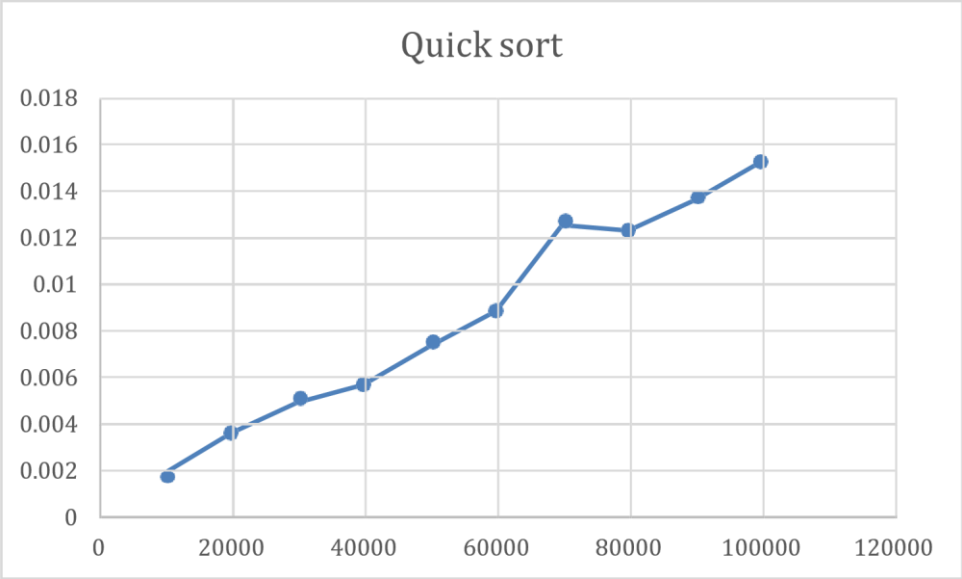
Output:

```
Enter the size of the array
5
before sorting
41      18467   6334    26500   19169
after sorting using quicksort
41      6334    18467   19169   26500
```

Table of values:

Input size(n)	Time taken
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

Graph:



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

```
#include <stdio.h>

#include <time.h>

#include <stdlib.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 + 1, r = 2 * i + 2; 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 = 0; 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 - 1; i >= 0; i--) { heapify(a,
      n, i);
   }

   // Sort using deletion
   for (i = n - 1; i >= 0; i--) {
      swap(&a[0], &a[i]);
      heapify(a, i, 0);
   }
}
```

```
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;
}
```

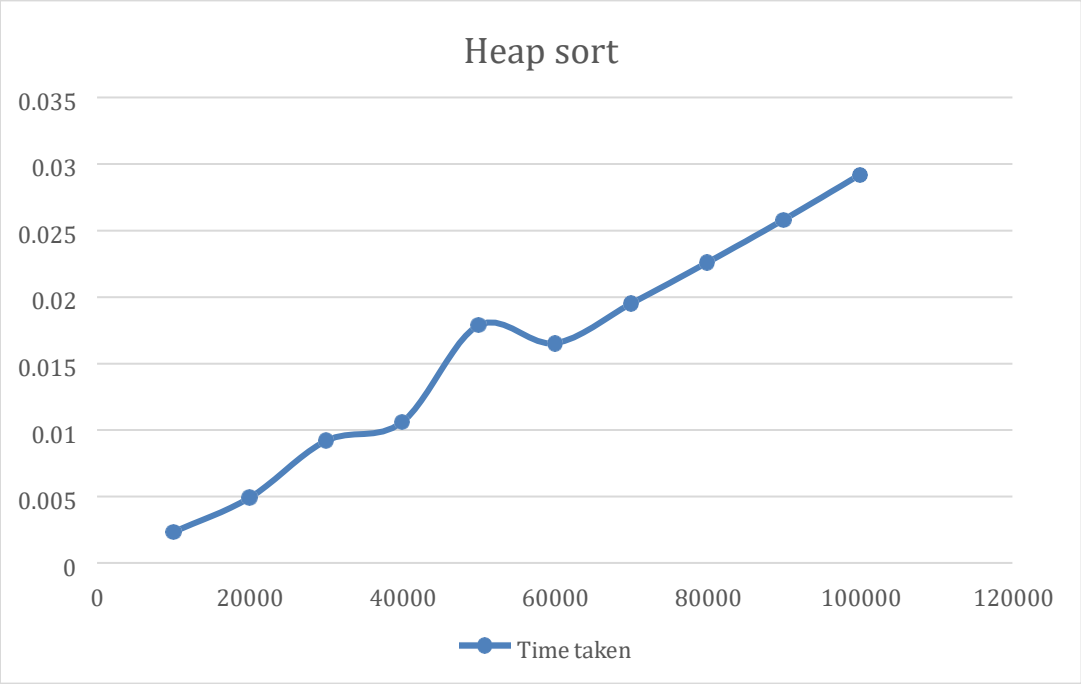
Output:

```
Enter the number of elements
5

After sorting elements are
41      6334    18467   19169   26500
```

Table of values:

Input size(n)	Time taken
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

Graph:


Heap sort
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
20000
40000
60000
80000
100000
120000
Time taken

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
```

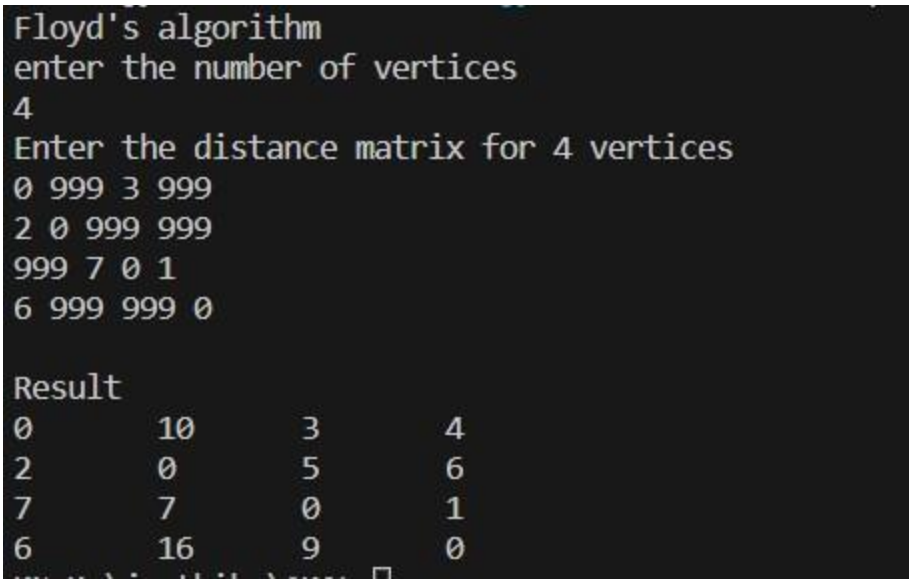
Implement All Pair Shortest paths problem using Floyd's algorithm.

```
#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:



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

Prim's algorithm:

```
#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
```

Kruskal's algorithm:

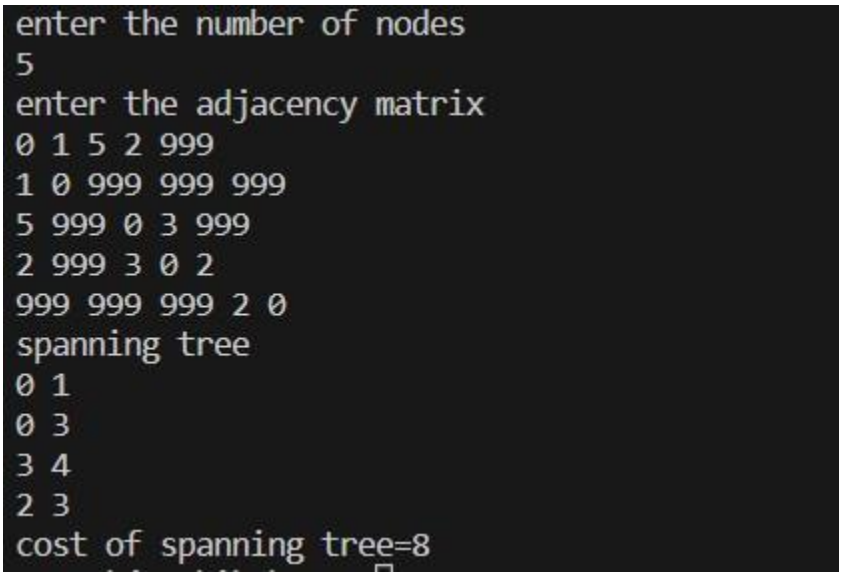
```
#include <stdio.h>

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);

}
```

Output:



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

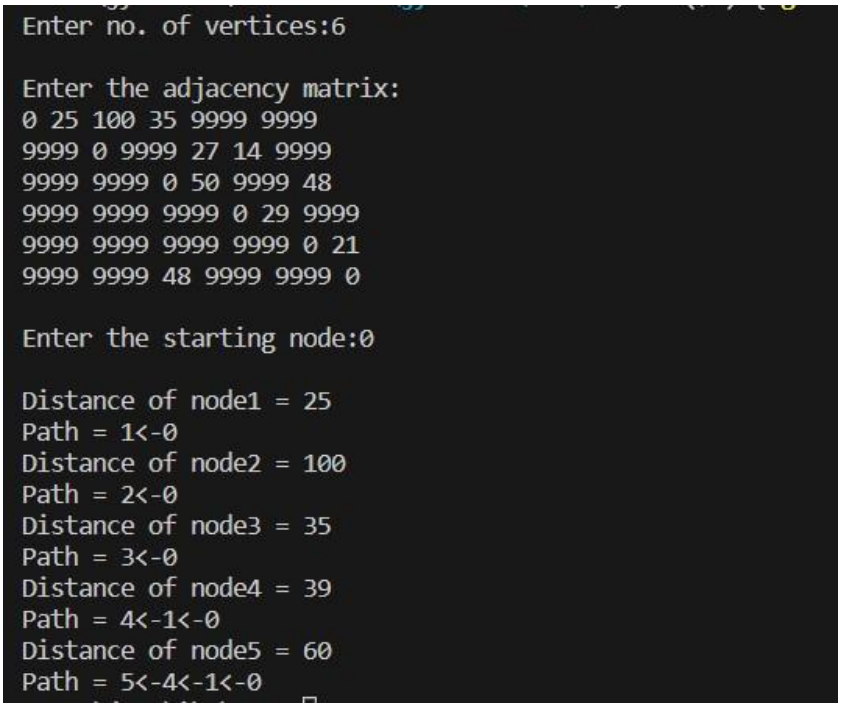
```
#include <stdio.h>

#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:



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       -       -
```