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
(Autonomous Institution under VTU)
BENGALURU-560019
June-2023 to Sep-2023
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 **Snehal Bandi (1BM21CS214),** 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 Sep-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 BFS method.

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

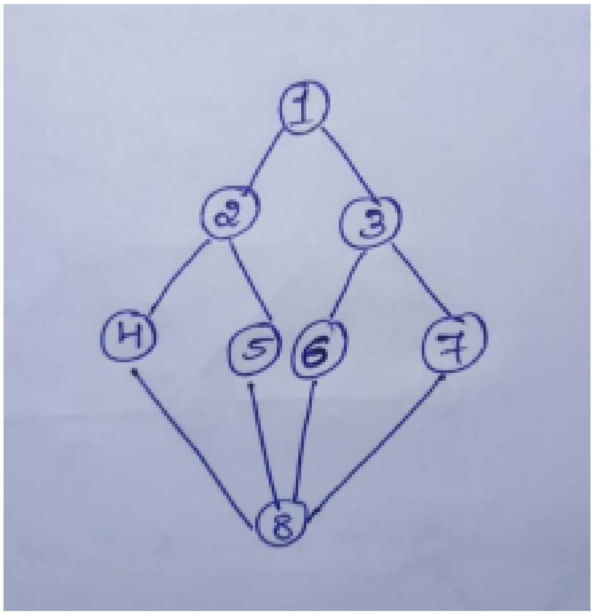
DFS

```
#include <stdio.h>

void DFS(int);

int isConnected();

int A[10][10], vis[10], n;

int main()

{

 printf("Enter the number of vertices: ");

 scanf("%d", &n);

 printf("Enter Adjacency Matrix\n");

 for (int i = 1; i <= n; i++)

 {

 for (int j = 1; j <= n; j++)

 {

 scanf("%d", &A[i][j]);

 }
 }
 printf("DFS Traversal\n");
 for (int i = 1; i <= n; i++)
 {
 vis[i] = 0;
 }
 DFS(1);
 if(isConnected()==1){
```

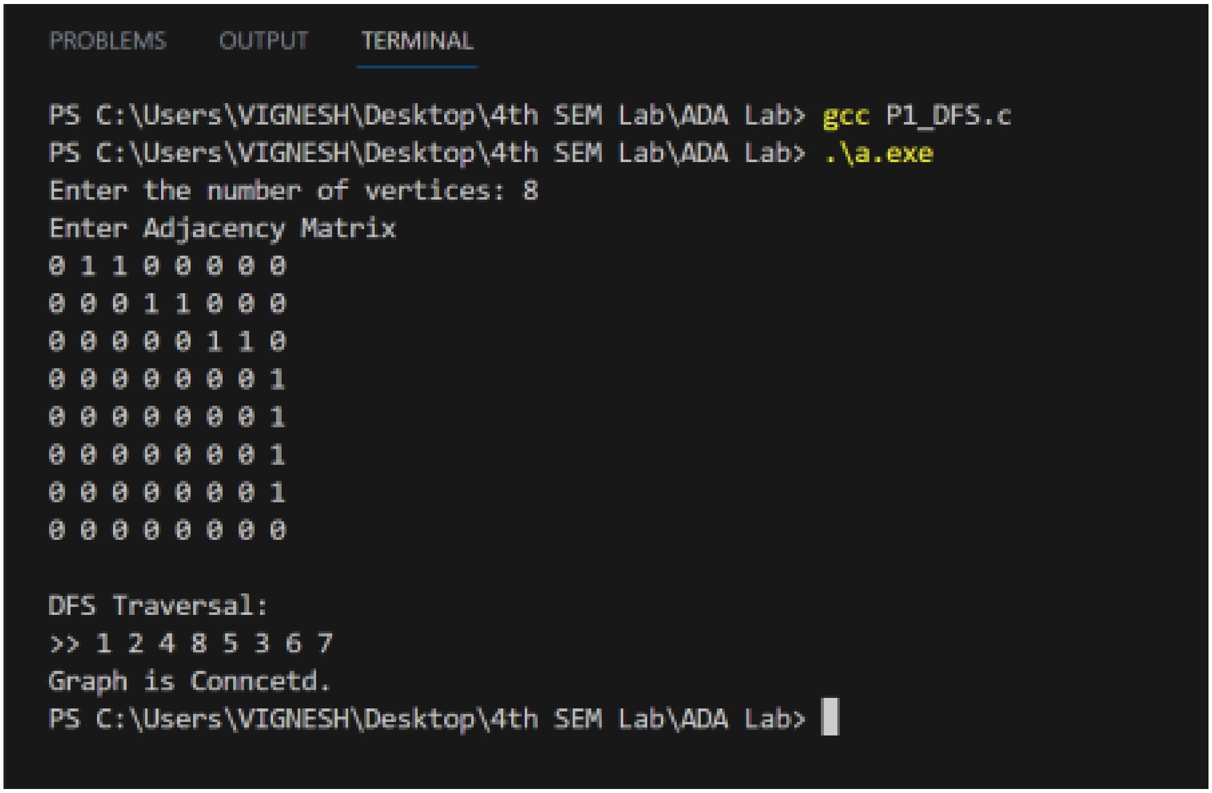
```
 printf("\nGraph is Conncetd.");  }
 else{
 printf("\nGraph is Not Conncetd.");  }
 return 0;
}
void DFS(int v)
{
 vis[v] = 1;
 printf("%d ", v);
 for (int i = 1; i <= n; i++)
 {
 if (A[v][i] == 1 && vis[i] == 0)  {
 DFS(i);
 }
 }
}
int isConnected()
{
 for (int i = 1; i <= n; i++)
```

```
{
if (vis[i] == 0)
return 0;
}
return 1;
}
```

GRAPH:



OUTPUT:



```
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> gcc P1_DFS.c
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> .\a.exe
Enter the number of vertices: 8
Enter Adjacency Matrix
0 1 1 0 0 0 0 0
0 0 0 1 1 0 0 0
0 0 0 0 0 1 1 0
0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0

DFS Traversal:
>> 1 2 4 8 5 3 6 7
Graph is Conncetd.
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> 
```

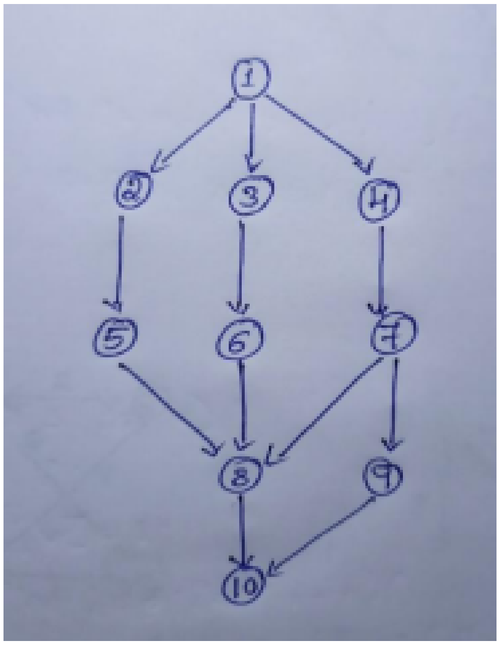
BFS

```
#include<stdio.h>

void BFS(int);


int Q[10],F=-1,R=-1;

int A[10][10],vis[10];

int n,m;


int main(){

 int v,u,st;

 printf("Enter the number of vertices\n");

scanf("%d",&n);

 for(int i=1;i<=n;i++){

 for(int j=1;j<=n;j++){

 A[i][j]=0;
 }
 }

 printf("Enter the number of edges\n");
scanf("%d",&m);
 printf("Enter the edges\n");
 for(int i=1;i<=m;i++){
 scanf("%d %d",&u,&v);
 A[u][v]=1;
 }

 for(int i=1;i<=n;i++){
 vis[i]=0;
```

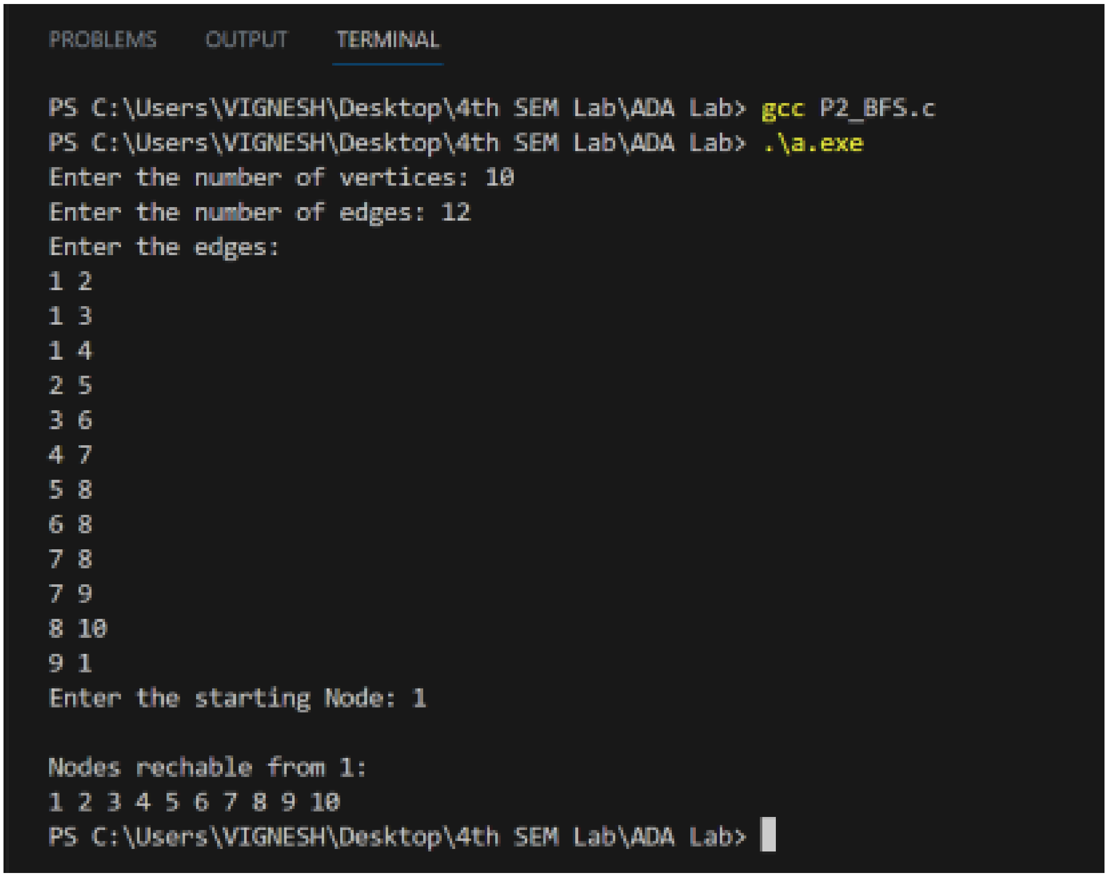
```
 }

 printf("Enter the starting Node\n");
scanf("%d",&st);
 printf("Nodes rechable from %d\n",st);

 BFS(st);
 return 0;
 }
void BFS(int v){
 int u;
 vis[v]=1;
 Q[++R]=v;
```

```
while(F<=R){
u=Q[++F];
printf("%d ",u);
for(int i=1;i<=n;i++){
if(A[u][i]==1 && vis[i]==0){
Q[++R]=i;
vis[i]=1;
}
}

}
}
```

GRAPH:



OUTPUT:



```
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> gcc P2_BFS.c
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> .\a.exe
Enter the number of vertices: 10
Enter the number of edges: 12
Enter the edges:
1 2
1 3
1 4
2 5
3 6
4 7
5 8
6 8
7 8
7 9
8 10
9 1
Enter the starting Node: 1

Nodes rechable from 1:
1 2 3 4 5 6 7 8 9 10
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab>
```

PROGRAM-2

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

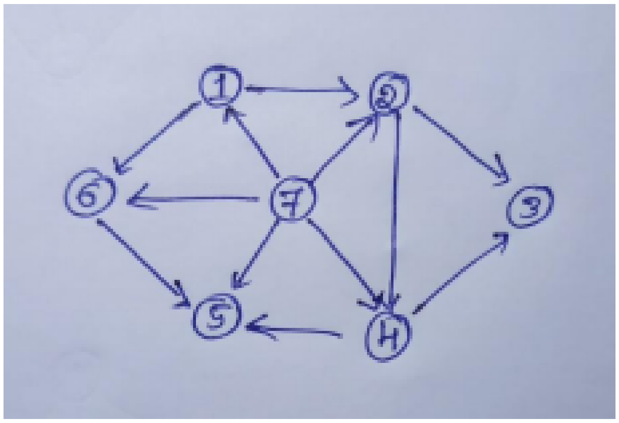
```
#include <stdio.h>

void DFS(int);

int A[10][10], vis[10], EXP[10], J = 0;

int n, m;

int main()

{

 int v, u;

 printf("Enter the number of vertices\n");

 scanf("%d", &n);

 for (int i = 1; i <= n; i++)

 {
```

```
for (int j = 1; j <= n; j++)
{
A[i][j] = 0;
}
}
printf("Enter the number of edges\n");
scanf("%d", &m);
printf("Enter the edges\n");
for (int i = 1; i <= m; i++)
{
scanf("%d %d", &u, &v);
A[u][v] = 1;
}
for (int i = 1; i <= n; i++)
```

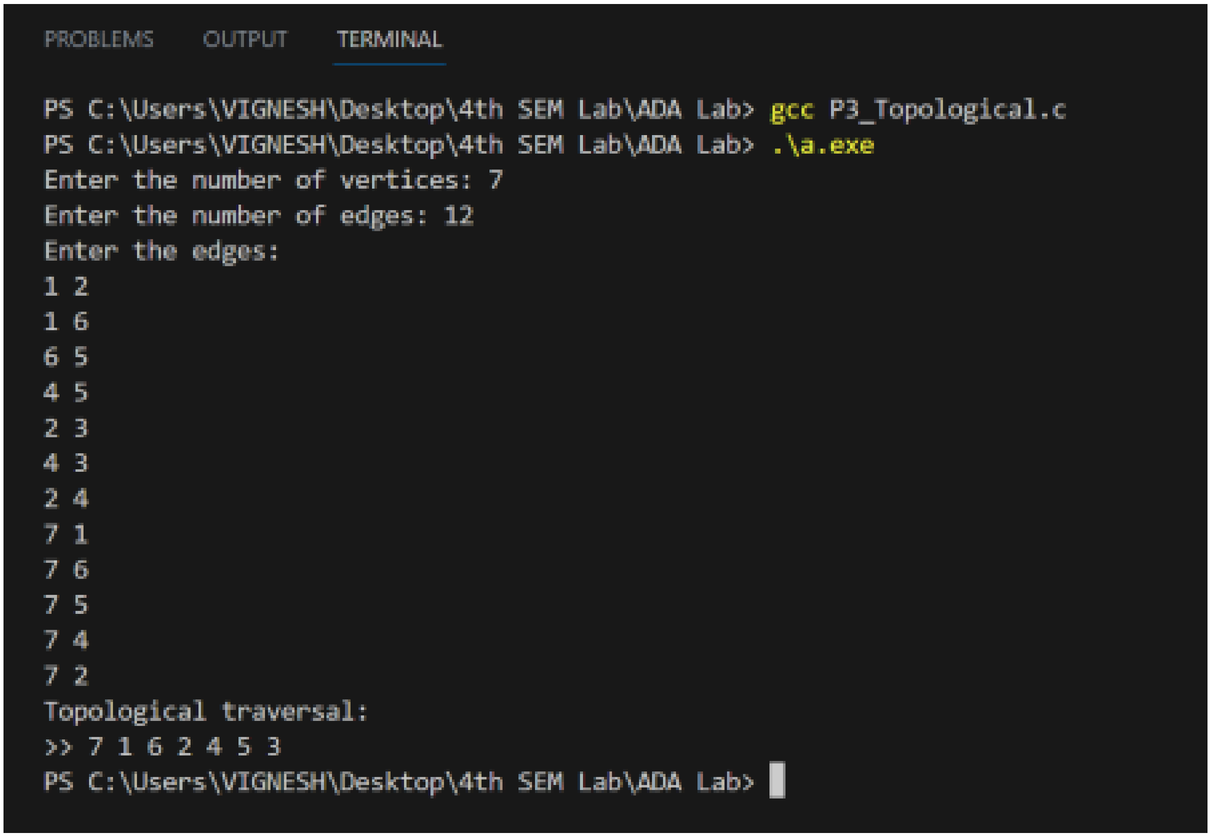
```
vis[i] = 0;
for (int i = 1; i <= n; i++)
{
if (vis[i] == 0)
{
DFS(i);
}
}
printf("Topological traversal\n");
for (int i = n - 1; i >= 0; i--)  {
printf("%d ", EXP[i]);
}
}
```

```
void DFS(int v)
{
 int i;
 vis[v] = 1;
 for (int i = 1; i <= n; i++)
{
 if (A[v][i] == 1 && vis[i] == 0)  {
 DFS(i);
 }
 }
 EXP[J++] = v;
}
```

GRAPH:



OUTPUT:



```
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> gcc P3_Topological.c
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab> .\a.exe
Enter the number of vertices: 7
Enter the number of edges: 12
Enter the edges:
1 2
1 6
6 5
4 5
2 3
4 3
2 4
7 1
7 6
7 5
7 4
7 2
Topological traversal:
>> 7 1 6 2 4 5 3
PS C:\Users\VIGNESH\Desktop\4th SEM Lab\ADA Lab>
```

PROGRAM-3

Implement Johnson Trotter algorithm to generate permutations.

```
#include <stdio.h>

#include <conio.h>


int LEFT_TO_RIGHT = 1;

int RIGHT_TO_LEFT = 0;

int searchArr(int a[], int n, int mobile)

{

 for (int i = 0; i < n; i++)

 if (a[i] == mobile)

 return i + 1;

}
```

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

```

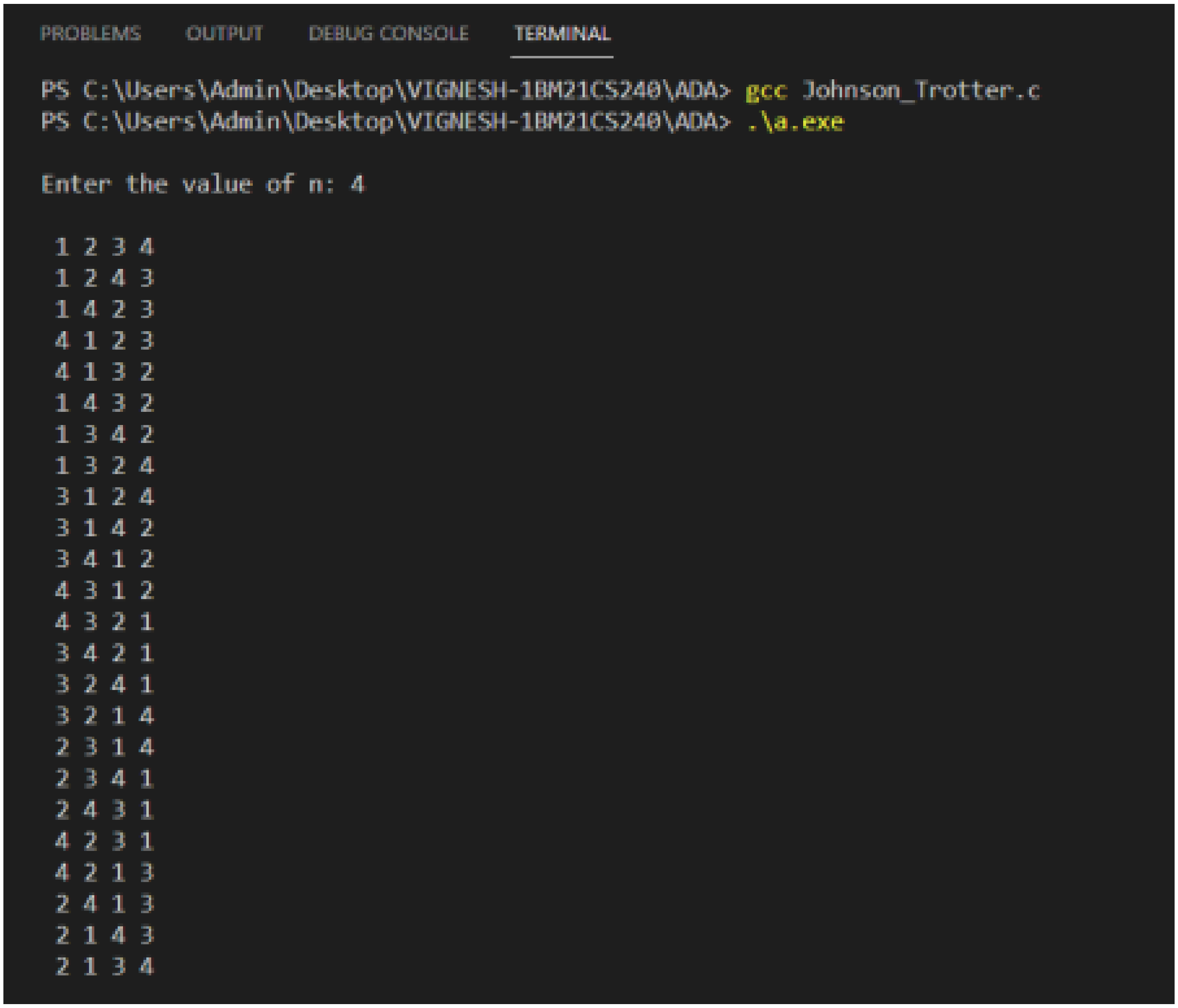
```
 }
 if (dir[a[i] - 1] == LEFT_TO_RIGHT && i != n - 1)  {

 if (a[i] > a[i + 1] && a[i] > mobile_prev)  {
 mobile = a[i];
 mobile_prev = mobile;
 }
 }
  }

 if (mobile == 0 && mobile_prev == 0)
 return 0;
 else
 return mobile;
 }

int 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)
{
 printf("\n");
 int temp;
 temp = a[pos - 1];
```

```
 a[pos - 1] = a[pos - 2];
 a[pos - 2] = temp;
 }

 else if (dir[a[pos - 1] - 1] == LEFT_TO_RIGHT)
{
 printf("\n");
 int temp;
 temp = a[pos];
 a[pos] = a[pos - 1];
 a[pos - 1] = temp;
 }
 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]);
}
```

```
int fact(int n)
{
 int res = 1;
 int i;
 for (i = 1; i <= n; i++)
 res = res * i;
 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]);
 }
 for (int i = 0; i < n; i++)  dir[i] =
RIGHT_TO_LEFT;  for (int i =
1; i < fact(n); i++)
printOnePerm(a, dir, n);
printf("\n");
}

int main()
```

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

OUTPUT:



```
PS C:\Users\Admin\Desktop\VIGNESH-1BM21CS240\ADA> gcc Johnson_Trotter.c
PS C:\Users\Admin\Desktop\VIGNESH-1BM21CS240\ADA> .\a.exe

Enter the value of n: 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-4

Sort a given set of N integer elements using the 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 <stdlib.h>

#include <time.h>


void merge(int arr[], int l, int m, int r)

{

 int i, j, k;

 int n1 = m - l + 1;
int n2 = r - m;

int L[n1], R[n2];

for (i = 0; i < n1; i++)
L[i] = arr[l + i];
for (j = 0; j < n2; j++)
R[j] = arr[m + 1 + j];

i = 0;
j = 0;
k = l;
while (i < n1 && j < n2)
{
if (L[i] <= R[j])
{
arr[k] = L[i];
```

```
i++;
}
else
{
arr[k] = R[j];
j++;
}
k++;
}

while (i < n1)
```

```
 {
 arr[k] = L[i];
 i++;
 k++;
 }

 while (j < n2)
 {
 arr[k] = R[j];
 j++;
 k++;
 }
 }

void mergeSort(int arr[], int l, int r)
{
 if (l < r)
```

```
 {
 int m = l + (r - l) / 2;

 mergeSort(arr, l, m);
 mergeSort(arr, m + 1, r);
 merge(arr, l, m, r);
 }
 }

int main()
```

```
{

 int ch;
 int n;
 int A[100];
 clock_t start_time, end_time;
 printf("\n1.For manual entry of N value and array elements\n2.For Random Values of
N\n3.Exit");

 while (1)
 {
 printf("\nEnter your choice: ");
 scanf("%d", &ch);
 switch (ch)
 {
 case 1:

 printf("\nEnter the number of elements: ");
 scanf("%d", &n);
```

```
 printf("Enter array elements\n");
 for (int i = 0; i < n; i++)
 {
 scanf("%d", &A[i]);
 }

 printf("Array Elements: \n");
 for (int i = 0; i < n; i++)
 {
```

```
printf("%d ", A[i]);
}

start_time = clock();

mergeSort(A, 0, n - 1);

end_time = clock();
double taken_time = (double)(end_time - start_time) / CLOCKS_PER_SEC;

printf("\nSorted Array: \n");
for (int i = 0; i < n; i++)
{
printf("%d ", A[i]);
}

printf("\nTime taken: %f seconds\n", taken_time);
break;
```

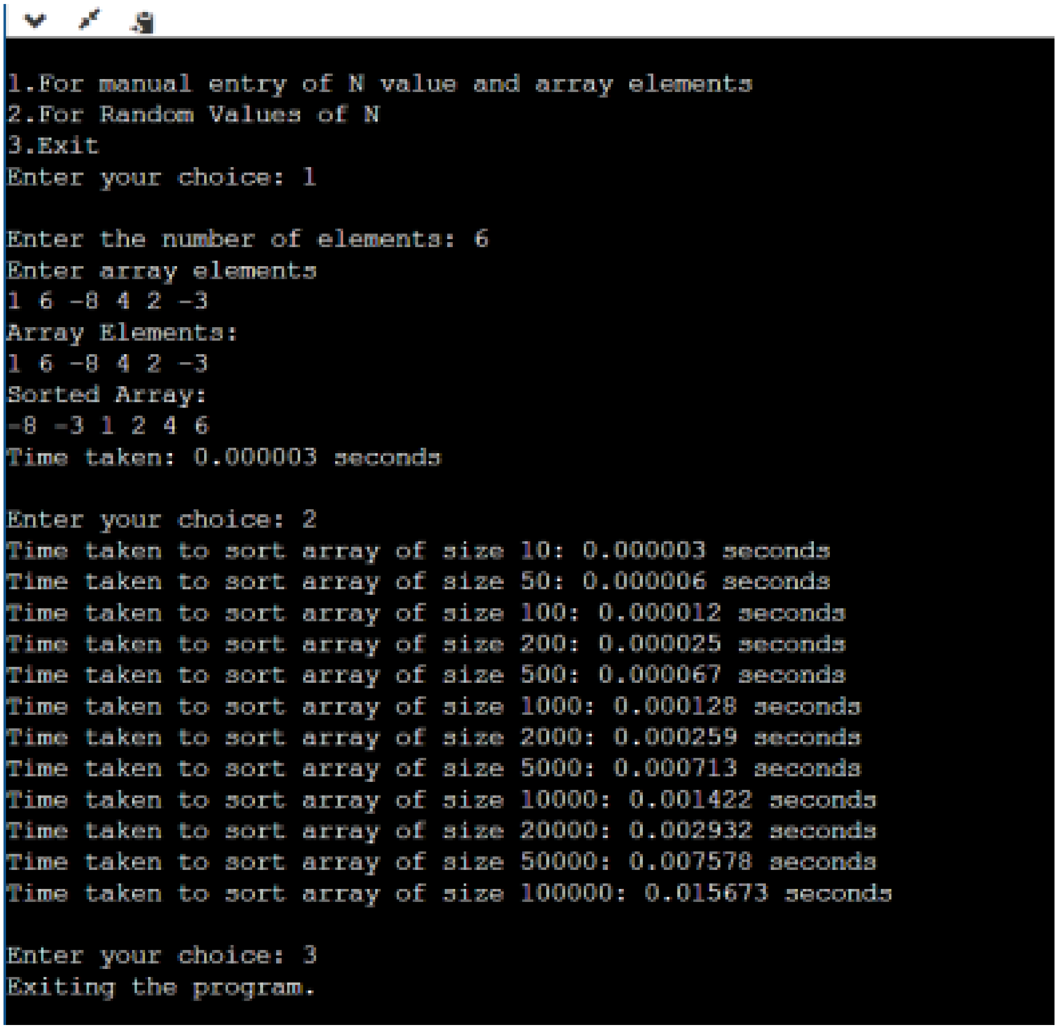
```
case 2:
srand(time(NULL));

int sizes[] = {10, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000};  int
num_sizes = sizeof(sizes) / sizeof(sizes[0]);

for (int i = 0; i < num_sizes; i++)
{
```

```
int N = sizes[i];
int arr[N];

for (int j = 0; j < N; j++)
{
arr[j] = rand() % 1000;
}

clock_t start = clock();
mergeSort(arr, 0, N - 1);
clock_t end = clock();

double time_taken = ((double)(end - start)) / CLOCKS_PER_SEC;

printf("Time taken to sort array of size %d: %lf seconds\n", N, time_taken);  }
break;

case 3:
printf("Exiting the program.\n");
```

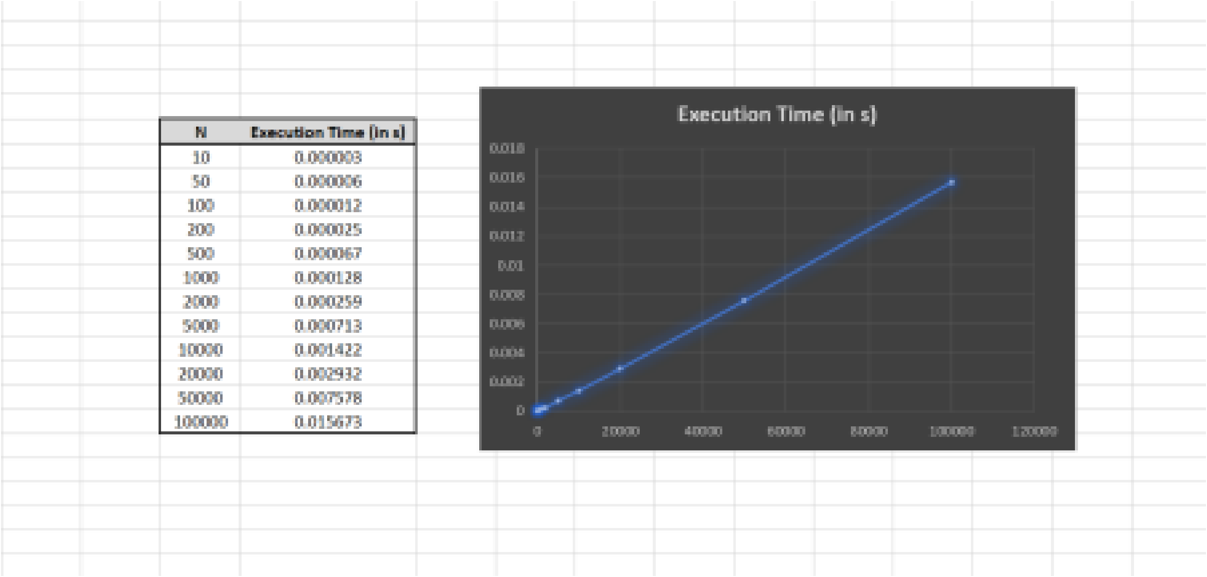
```
exit(0);

default:
printf("Invalid choice");
break;
}
}
```

```
return 0;
}
```

OUTPUT:



```
1.For manual entry of N value and array elements
2.For Random Values of N
3.Exit
Enter your choice: 1

Enter the number of elements: 6
Enter array elements
1 6 -8 4 2 -3
Array Elements:
1 6 -8 4 2 -3
Sorted Array:
-8 -3 1 2 4 6
Time taken: 0.000003 seconds

Enter your choice: 2
Time taken to sort array of size 10: 0.000003 seconds
Time taken to sort array of size 50: 0.000006 seconds
Time taken to sort array of size 100: 0.000012 seconds
Time taken to sort array of size 200: 0.000025 seconds
Time taken to sort array of size 500: 0.000067 seconds
Time taken to sort array of size 1000: 0.000128 seconds
Time taken to sort array of size 2000: 0.000259 seconds
Time taken to sort array of size 5000: 0.000713 seconds
Time taken to sort array of size 10000: 0.001422 seconds
Time taken to sort array of size 20000: 0.002932 seconds
Time taken to sort array of size 50000: 0.007578 seconds
Time taken to sort array of size 100000: 0.015673 seconds

Enter your choice: 3
Exiting the program.
```



N	Execution Time (in s)
10	0.000003
50	0.000006
100	0.000012
200	0.000025
500	0.000067
1000	0.000128
2000	0.000259
5000	0.000713
10000	0.001422
20000	0.002932
50000	0.007578
100000	0.015673

PROGRAM-5

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

taken.

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

int partition(int arr[], int low, int high)
{
 int pivot = arr[high];
 int i = (low - 1);

 for (int j = low; j <= high - 1; j++)
 {
 if (arr[j] < pivot)
 {
 i++;
 int temp = arr[i];
 arr[i] = arr[j];
 arr[j] = temp;
 }
 }

 int temp = arr[i + 1];
 arr[i + 1] = arr[high];
 arr[high] = temp;

 return (i + 1);

}
```

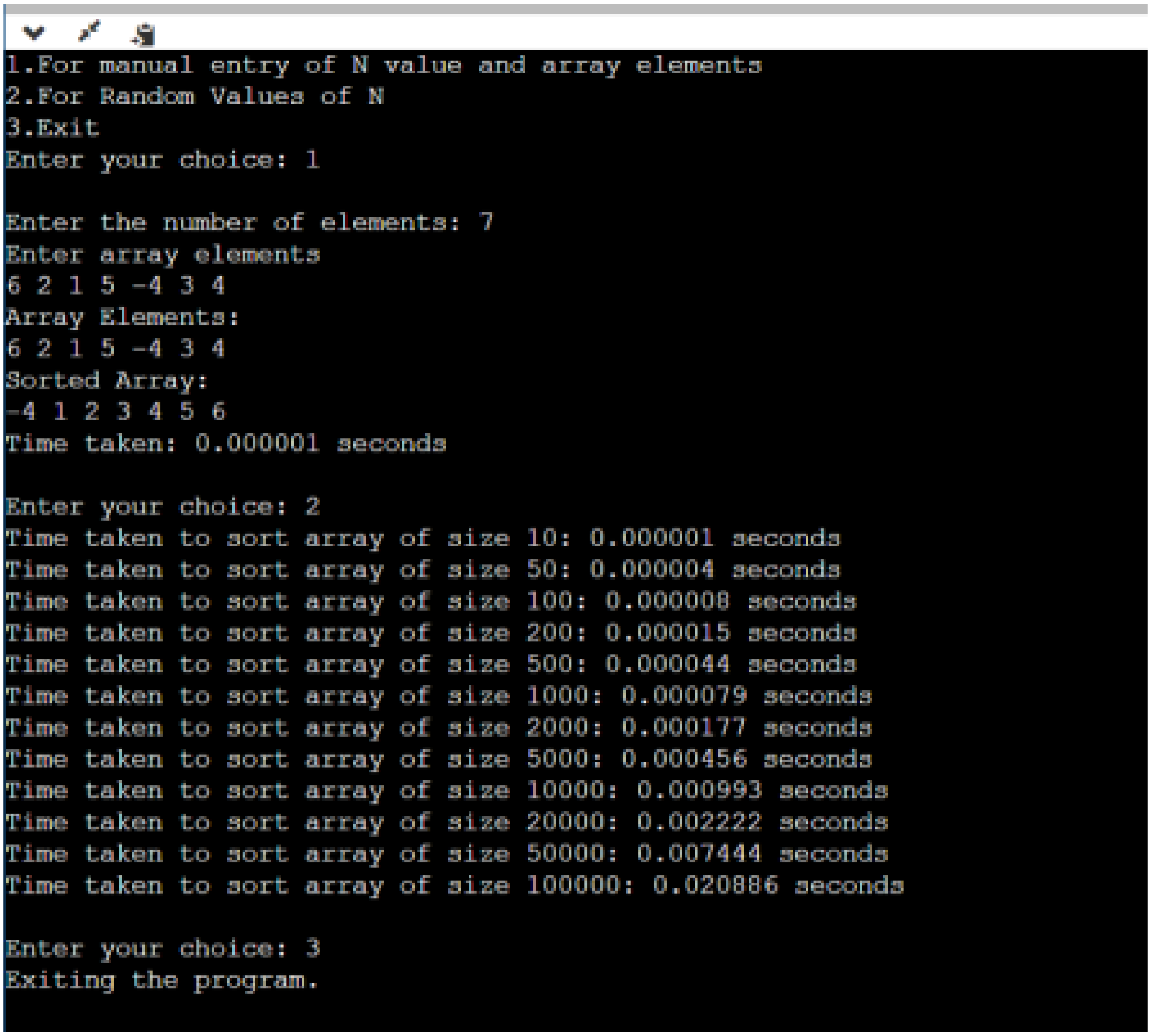
```
void quickSort(int arr[], int low, int high)
{
 if (low < high)
 {
 int pi = partition(arr, low, high);

 quickSort(arr, low, pi - 1);
 quickSort(arr, pi + 1, high);
 }
}

int main()
{
 int ch;
 int n;
 int A[100];
 clock_t start_time, end_time;

 printf("\n1.For manual entry of N value and array elements\n2.For Random Values of
N\n3.Exit");

 while (1)
 {
 printf("\nEnter your choice: ");
 scanf("%d", &ch);

 switch (ch)
```

```
{
case 1:
printf("\nEnter the number of elements: ");
scanf("%d", &n);
printf("Enter array elements\n");
for (int i = 0; i < n; i++)
{
scanf("%d", &A[i]);
}

printf("Array Elements: \n");
for (int i = 0; i < n; i++)
{
printf("%d ", A[i]);
}

start_time = clock();
quickSort(A, 0, n - 1);
end_time = clock();

printf("\nSorted Array: \n");
for (int i = 0; i < n; i++)
{
printf("%d ", A[i]);
}

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

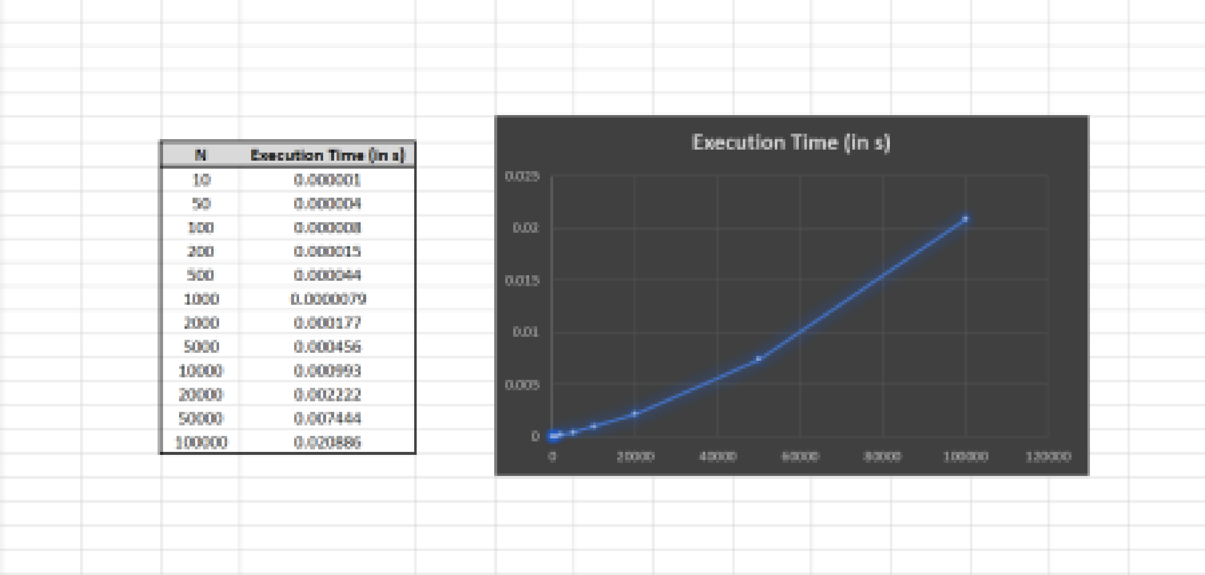
```
break;

case 2:
srand(time(NULL));

int sizes[] = {10, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000};  int
num_sizes = sizeof(sizes) / sizeof(sizes[0]);

for (int i = 0; i < num_sizes; i++)
{
int N = sizes[i];
int arr[N];

for (int j = 0; j < N; j++)
{
arr[j] = rand() % 1000;
}

clock_t start = clock();
quickSort(arr, 0, N - 1);
clock_t end = clock();

printf("Time taken to sort array of size %d: %lf seconds\n", N, ((double)(end - start)) /
CLOCKS_PER_SEC);
}
break;

case 3:
```

```
printf("Exiting the program.\n");

exit(0);


default:
printf("Invalid choice\n");
break;
}
}

return 0;
}
```

OUTPUT:



```
1.For manual entry of N value and array elements
2.For Random Values of N
3.Exit
Enter your choice: 1

Enter the number of elements: 7
Enter array elements
6 2 1 5 -4 3 4
Array Elements:
6 2 1 5 -4 3 4
Sorted Array:
-4 1 2 3 4 5 6
Time taken: 0.000001 seconds

Enter your choice: 2
Time taken to sort array of size 10: 0.000001 seconds
Time taken to sort array of size 50: 0.000004 seconds
Time taken to sort array of size 100: 0.000008 seconds
Time taken to sort array of size 200: 0.000015 seconds
Time taken to sort array of size 500: 0.000044 seconds
Time taken to sort array of size 1000: 0.000079 seconds
Time taken to sort array of size 2000: 0.000177 seconds
Time taken to sort array of size 5000: 0.000456 seconds
Time taken to sort array of size 10000: 0.000993 seconds
Time taken to sort array of size 20000: 0.002222 seconds
Time taken to sort array of size 50000: 0.007444 seconds
Time taken to sort array of size 100000: 0.020886 seconds

Enter your choice: 3
Exiting the program.
```



N	Execution Time (in s)
10	0.000001
50	0.000004
100	0.000008
200	0.000015
500	0.000044
1000	0.0000079
2000	0.000177
5000	0.000456
10000	0.000993
20000	0.002222
50000	0.007444
100000	0.020886

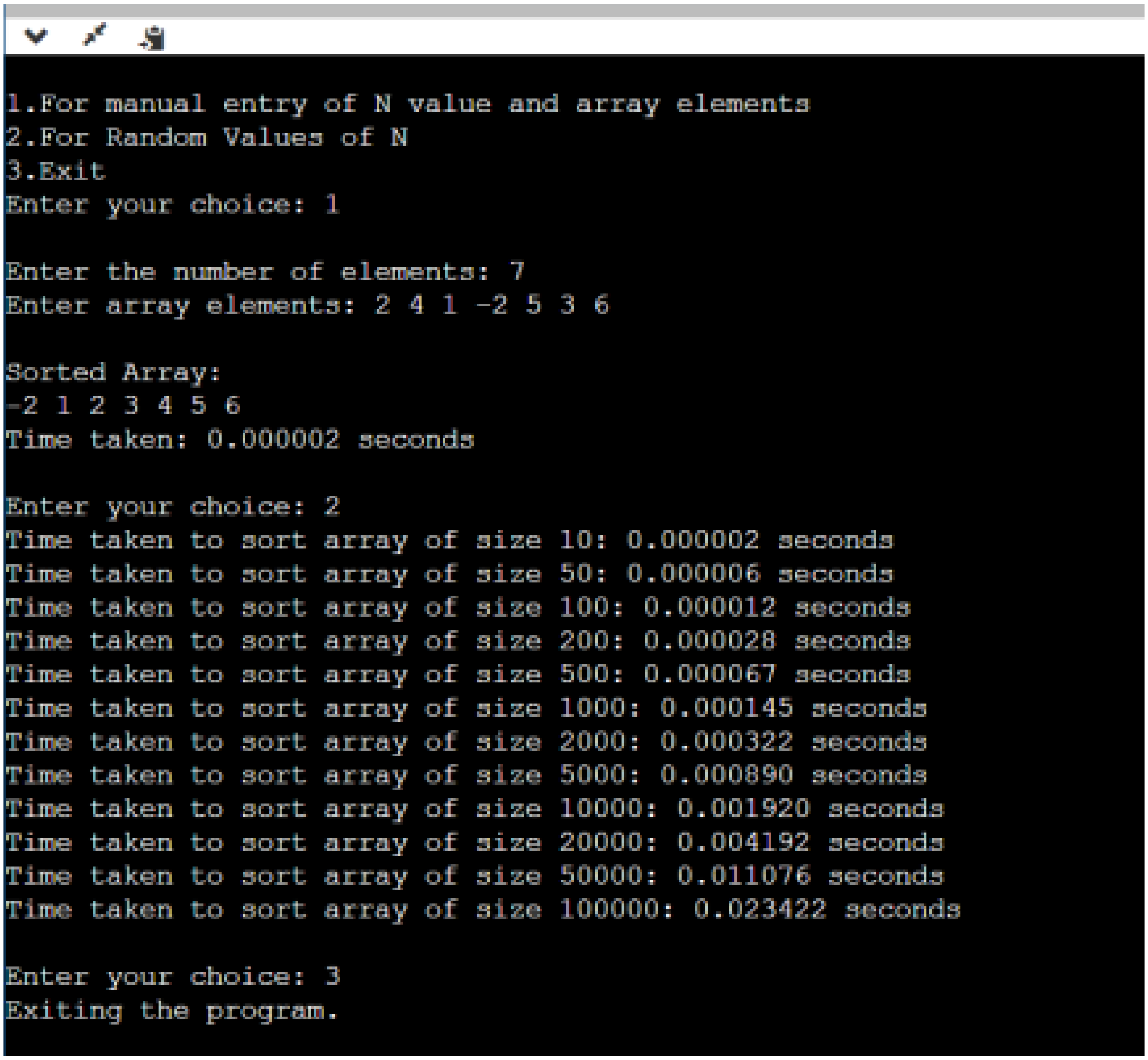
PROGRAM-6

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

```
#include <stdio.h>
#include <stdlib.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)
 {
 // Swap arr[i] and arr[largest]
 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--)
{
 // Swap arr[0] and arr[i]  int
temp = arr[0];
 arr[0] = arr[i];
 arr[i] = temp;

 heapify(arr, i, 0);
 }
 }

int main()
{
 int ch;
 int n;
 int arr[100];
 clock_t start_time, end_time;

 printf("\n1.For manual entry of N value and array elements\n2.For Random Values of
N\n3.Exit");

 while (1)
 {
 printf("\nEnter your choice: ");
 scanf("%d", &ch);

 switch (ch)
 {
 case 1:

 printf("\nEnter the number of elements: ");
 scanf("%d", &n);

 printf("Enter array elements: ");
 for (int i = 0; i < n; i++)
 {
 scanf("%d", &arr[i]);
 }

 start_time = clock();
 heapSort(arr, n);
 end_time = clock();

 printf("\nSorted Array: \n");
```

```
 for (int i = 0; i < n; i++)
 {
 printf("%d ", arr[i]);
 }

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

 case 2:
 srand(time(NULL));

 int sizes[] = {10, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000};  int
num_sizes = sizeof(sizes) / sizeof(sizes[0]);

 for (int i = 0; i < num_sizes; i++)
 {
 int N = sizes[i];
 int arr[N];

 for (int j = 0; j < N; j++)
 {
 arr[j] = rand() % 1000;
 }

 clock_t start = clock();
 heapSort(arr, N);
 clock_t end = clock();
 printf("Time taken to sort array of size %d: %lf seconds\n", N, ((double)(end - start)) /
CLOCKS_PER_SEC);
 }
 break;


 case 3:
 printf("Exiting the program.\n");
 exit(0);


 default:
 printf("Invalid choice\n");
 break;
 }
 }


 return 0;
 }
```

OUTPUT:



```
1.For manual entry of N value and array elements
2.For Random Values of N
3.Exit
Enter your choice: 1

Enter the number of elements: 7
Enter array elements: 2 4 1 -2 5 3 6

Sorted Array:
-2 1 2 3 4 5 6
Time taken: 0.000002 seconds

Enter your choice: 2
Time taken to sort array of size 10: 0.000002 seconds
Time taken to sort array of size 50: 0.000006 seconds
Time taken to sort array of size 100: 0.000012 seconds
Time taken to sort array of size 200: 0.000028 seconds
Time taken to sort array of size 500: 0.000067 seconds
Time taken to sort array of size 1000: 0.000145 seconds
Time taken to sort array of size 2000: 0.000322 seconds
Time taken to sort array of size 5000: 0.000890 seconds
Time taken to sort array of size 10000: 0.001920 seconds
Time taken to sort array of size 20000: 0.004192 seconds
Time taken to sort array of size 50000: 0.011076 seconds
Time taken to sort array of size 100000: 0.023422 seconds

Enter your choice: 3
Exiting the program.
```

PROGRAM-7

Implement 0/1 Knapsack problem using dynamic programming.

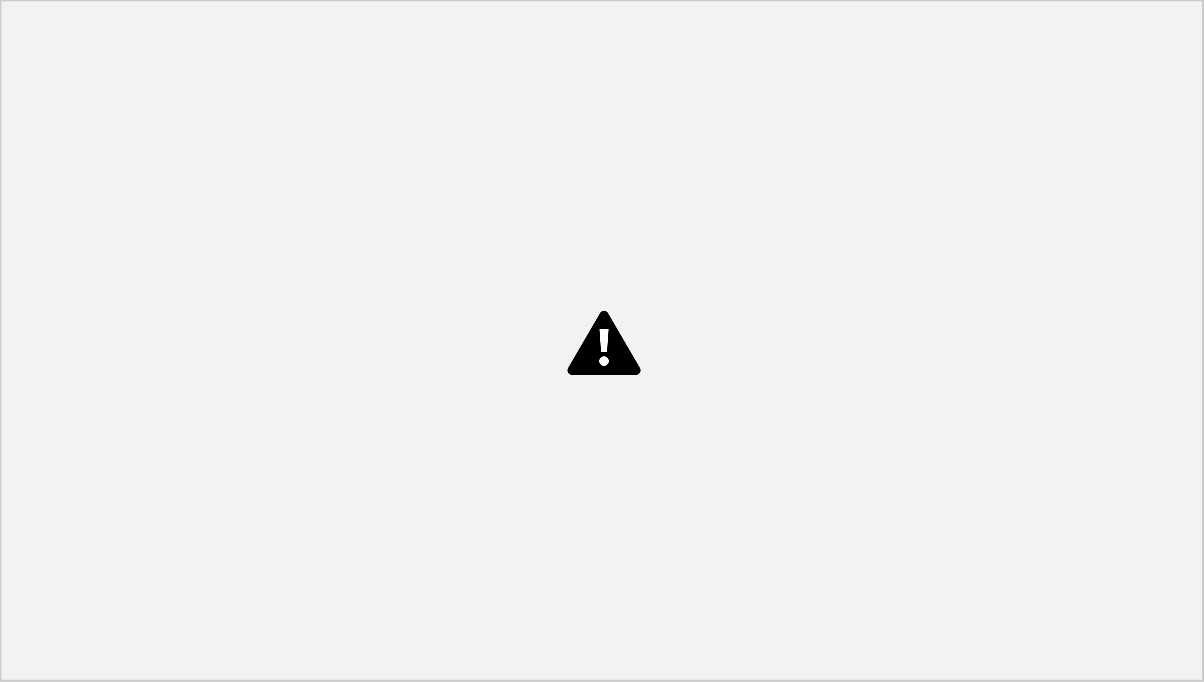
```
#include <stdio.h>
#include <stdlib.h>
int V[100][100];
int max(int a, int b)
{
 return a > b ? a : b;
}
int knapscak(int W, int N, int val[], int wt[])
{
 for (int i = 0; i <= N; i++)
 {
 for (int j = 0; j <= W; j++)
 {
 if (i == 0 || j == 0)
 {
 V[i][j] = 0;
 }
 else if (wt[i - 1] > j)
 {
 V[i][j] = V[i - 1][j];
 }
 else
 {
 V[i][j] = max(V[i - 1][j], V[i - 1][j - wt[i - 1]] + val[i - 1]);  }
```

```
 }
```

```
}
return V[N][W];
}
void object_selecetd(int N, int W, int wt[])
{
int X[N + 1];
for (int i = 1; i <= N; i++)
{
X[i] = 0;
}
int i = N;
int j = W;
while (i != 0 && j != 0)
{
if (V[i][j] != V[i - 1][j])
{
X[i] = 1;
j = j - wt[i - 1];
}
i--;
}

printf("\n");

for (int i = 1; i <= N; i++)
{
if (X[i] == 1)
```

```
 {
 printf("Object %d Selected\n", i);
 }
 }
 }

int main()
{
 int W, N;

 printf("\nEnter number of items: ");
 scanf("%d", &N);
 printf("Enter the Capcity of bag: ");
 scanf("%d", &W);

 int val[W], wt[N];

 for (int i = 0; i < N; i++)
 {
 printf("Enter profit and weight of item %d: ", i + 1);
scanf("%d%d", &val[i], &wt[i]);
 }

 int result = knapscak(W, N, val, wt);
 object_selecetd(N, W, wt);
 printf("\nMaxmimum profit is: %d", result); }
```

OUTPUT:



PROGRAM-8

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

```
#include <stdio.h>


int min(int, int);
void floyds(int p[10][10], int n)
{
 int i, j, k;
 for (k = 1; k <= n; k++)
 for (i = 1; i <= n; i++)
 for (j = 1; j <= n; j++)
 if (i == j)
 p[i][j] = 0;
 else
 p[i][j] = min(p[i][j], p[i][k] + p[k][j]);
 }

int min(int a, int b)
{
 if (a < b)
 return (a);
 else
 return (b);
 }

void main()
{
```

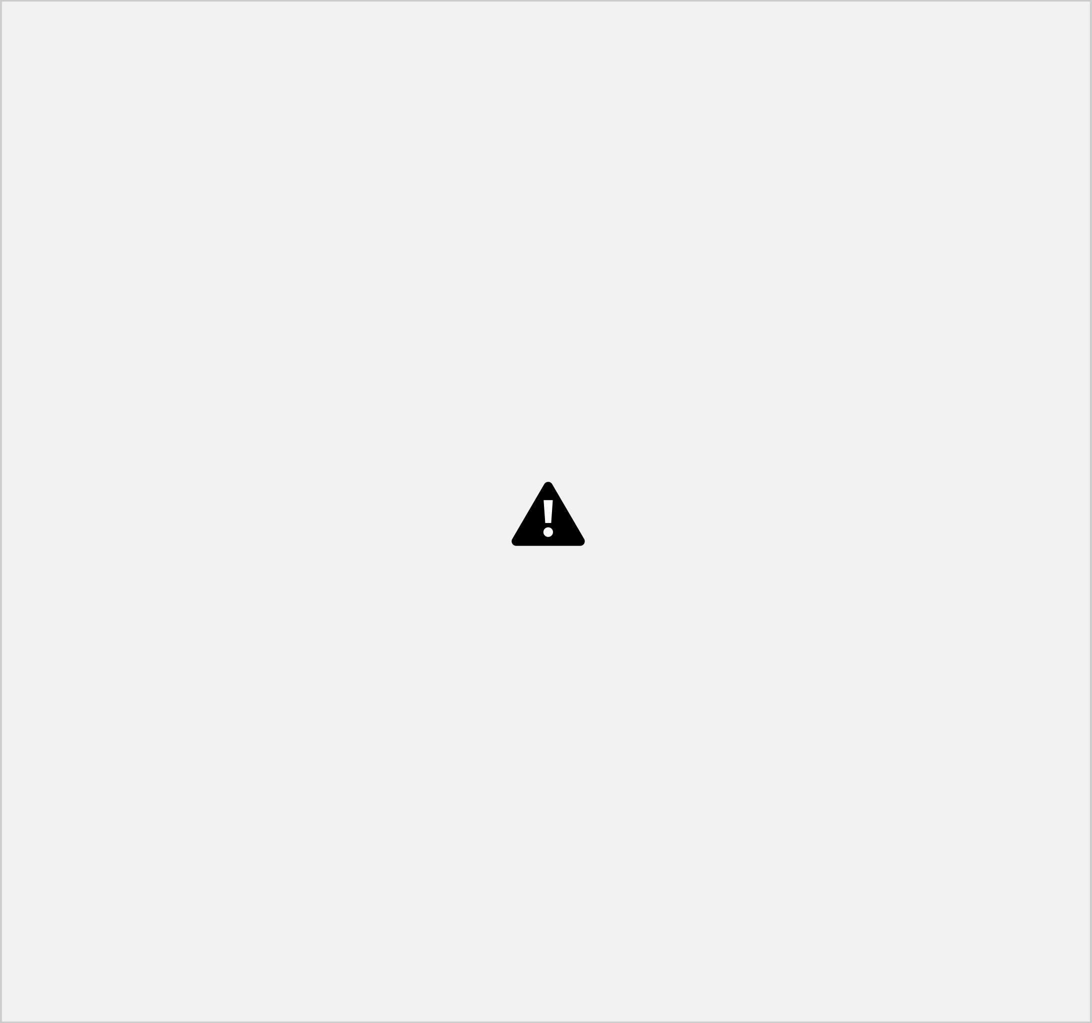
```
 int p[10][10], w, n, e, u, v, i, j;

 printf("\nEnter the number of vertices: ");
scanf("%d", &n);
 printf("Enter the number of edges: ");
 scanf("%d", &e);

 for (i = 1; i <= n; i++)
 {
 for (j = 1; j <= n; j++)
 p[i][j] = 999;
 }
 for (i = 1; i <= e; i++)
 {
 printf("\nEnter the end vertices of edge %d: ", i);
scanf("%d%d", &u, &v);
 printf("Enter Weight: ");
 scanf("%d",&w);
 p[u][v] = w;
 }

 printf("\nAdjacency Matrix: \n");
 for (i = 1; i <= n; i++)
 {
 for (j = 1; j <= n; j++)
 printf("%d \t", p[i][j]);
 printf("\n");

```

```
 }

 floyds(p, n);

 printf("\nPath Matrix: \n");
for (i = 1; i <= n; i++)  {
 for (j = 1; j <= n; j++)
printf("%d \t", p[i][j]);
printf("\n");
 }
```

```
}
```

GRAPH:

OUTPUT:



PROGRAM-9

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

Prim’s algorithm

```
#include <stdio.h>

int n, m, e = 0;

float sum = 0;

float costs[100][100];

int VT[100], ET[100][2], vis[20];
```

```
void prims()
{
int u, v;
int x = 1, j, K, min;
VT[x] = 1;
vis[x] = 1;
for (int i = 1; i < n; i++)
{
j = x;
min = 999;
while (j > 0)
{
K = VT[j];
for (int m = 2; m <= n; m++)
{
if (costs[K][m] < min && vis[m] == 0)
{
```

```
min = costs[K][m];
u = K;
v = m;
}
}
j--;
}
VT[++x] = v;
ET[i][0] = u;
ET[i][1] = v;
```

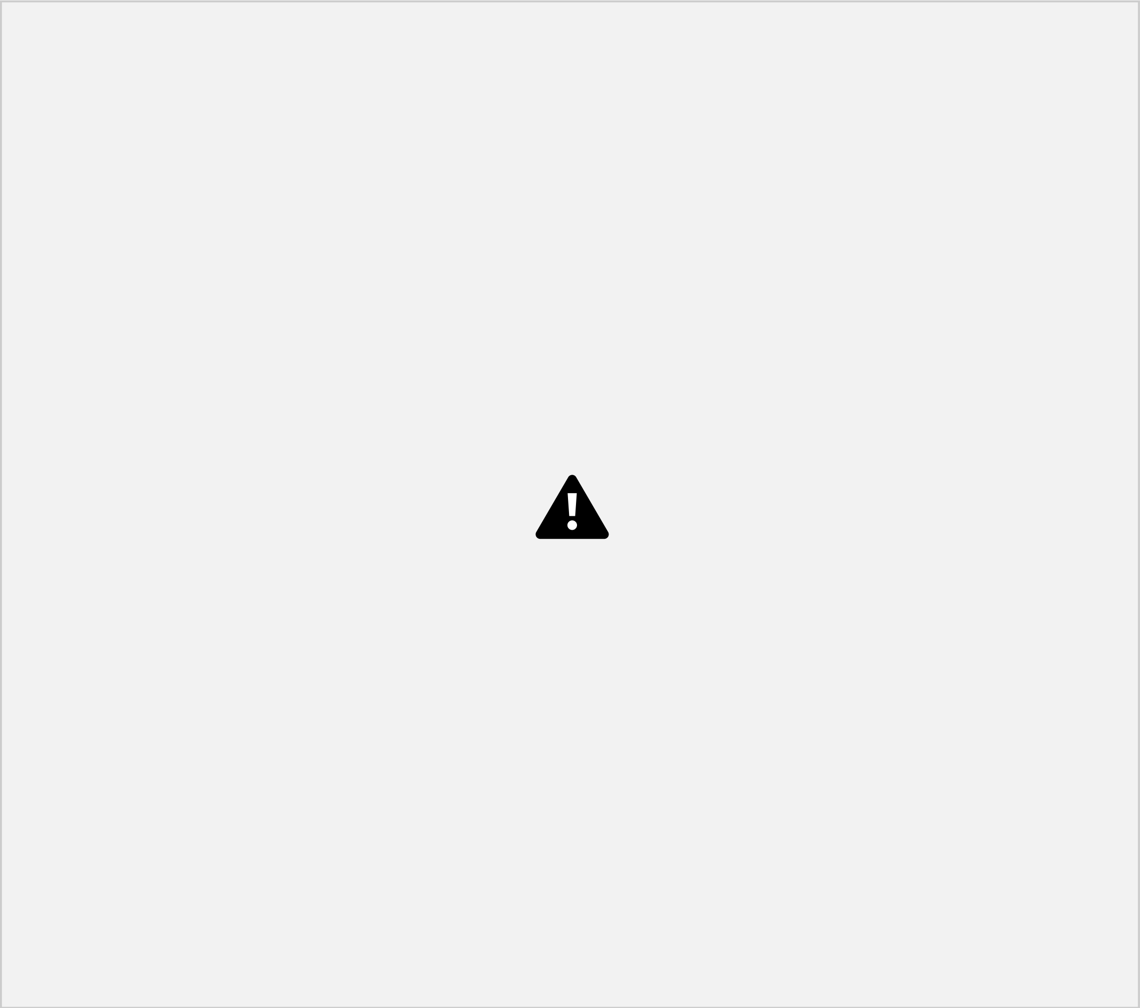
```
 e++;
 vis[v] = 1;
 sum += costs[u][v];
 }
 }

void main()
{
 printf("\n Prim's Algorithm\n");
printf(" ----------------------");  int u, v;
 float w;
 printf("\nEnter the number of vertices: ");
scanf("%d", &n);

 for (int i = 1; i <= n; i++)
 {
 for (int j = 1; j <= n; j++)
```

```
 {
 if (i == j)
 costs[i][j] = 0;
 else
 costs[i][j] = 999;
 }
 }
 printf("Enter the number of egdes: ");
scanf("%d", &m);
```

```
 printf("Enter vertices of edge with its weight: \n");
for (int i = 1; i <= m; i++)
 {
 scanf("%d%d%f", &u, &v, &w);
 costs[u][v] = costs[v][u] = w;
 }
 for (int i = 1; i <= n; i++)
 {
 vis[i] = 0;
 }
 prims();
 printf("\nMinimum Cost: %.2f\n", sum);
printf("\nEdges of Minimum spanning tree\n");
for (int i = 1; i <= e; i++)
 {
 printf("%d-->%d\n", ET[i][0], ET[i][1]);  }
 }
```

<u>GRAPH:</u>

OUTPUT:



Kruskal’s algorithm

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

int n, m,
parent[100]; int
count = 0;
int ET[100][2];
int
```

```
cost[100][100];
int sum = 0;

void unionn(int a, int b)
{
 if (a < b)
 parent[b] = a;
else
 parent[a] = b; }

int find(int a)
{
 while (parent[a] != a)
{
 a = parent[a];  }
 return a;
}
```

```
void kruskal()
{
 int k = 0;
 for (int i = 1; i <= n; i++)
 {
 parent[i] = i;
 }
 while (count != n - 1)
 {
```

```
int min = 999;
int u, v;
for (int i = 1; i <= n; i++)
{
for (int j = 1; j <= n; j++)
{
if (cost[i][j] < min && cost[i][j] != 0)  {
min = cost[i][j];
u = i;
v = j;
}
}
}

int x = find(u);
int y = find(v);

if (x != y)
```

```
{
ET[k][0] = u;
ET[k][1] = v;
k++;
count++;
sum += cost[u][v];
unionn(x, y);
}
```

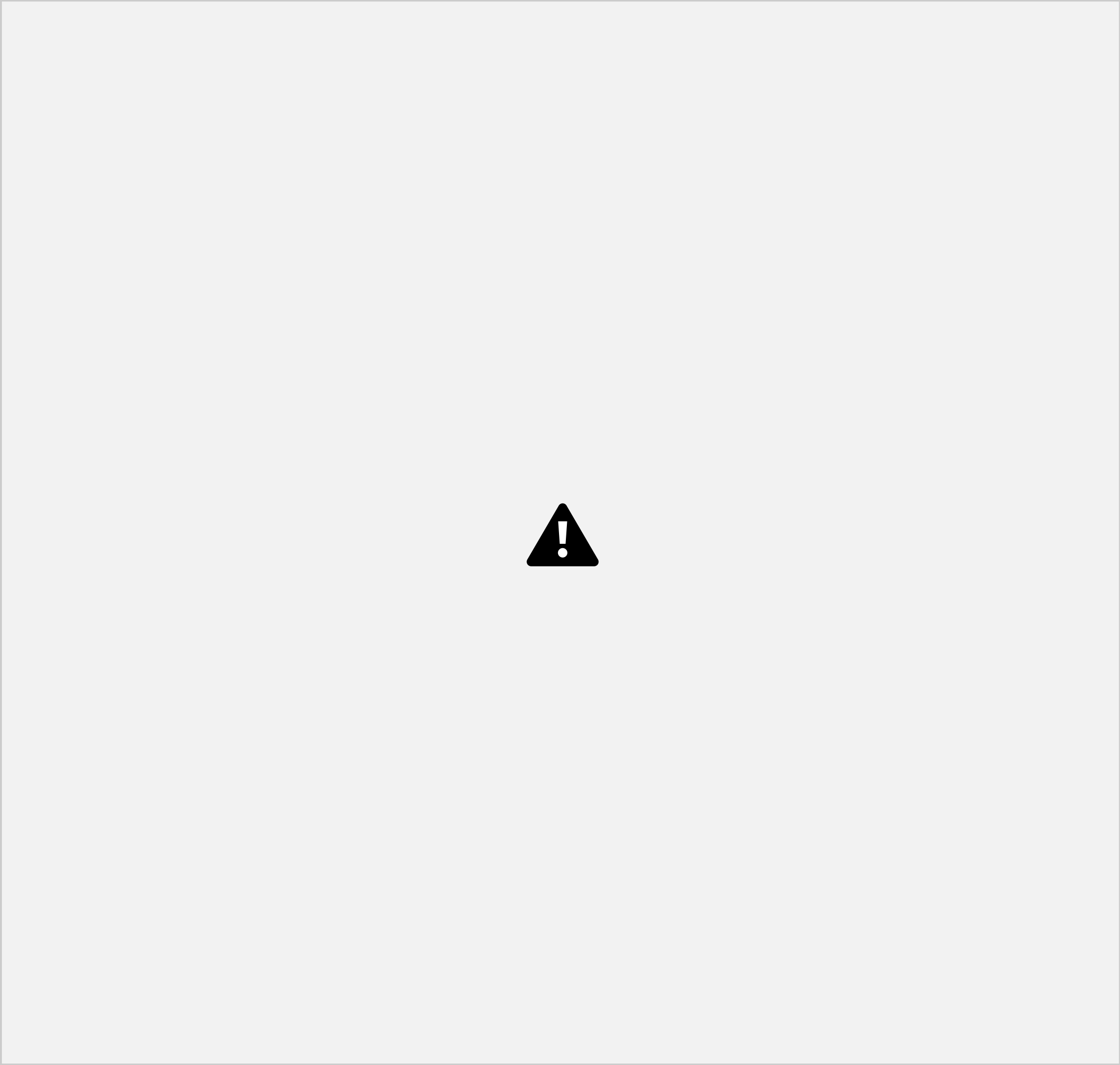
```
 cost[u][v] = cost[v][u] = 999;  }
 }

int main()
 {
 printf("\n Kruskal's algorithm\n");
printf(" -----------------------");  int u, v,
w;
 printf("\nEnter the number of vertices: ");
scanf("%d", &n);

 for (int i = 1; i <= n; i++)
 {
 for (int j = 1; j <= n; j++)
 {
 if (i == j)
 cost[i][j] = 0;
 else
```

```
 cost[i][j] = 999;
 }
 }

 printf("Enter the number of edges: ");
scanf("%d", &m);
```

```
 printf("Enter the egde with its weight: \n");
for (int i = 1; i <= m; i++)
 {
 scanf("%d%d%d", &u, &v, &w);
cost[u][v] = cost[v][u] = w;
 }

 kruskal();

 printf("\nMinimum cost = %d\n", sum);

 printf("Minimum spanning tree:\n");
for (int i = 1; i < count; i++)
 {
 printf("%d -> %d\n", ET[i][0], ET[i][1]);  }


 return 0;
}
```

GRAPH:

OUTPUT:



PROGRAM-10

From a given vertex in a weighted connected graph, find shortest paths to other vertices

using Dijkstra’s algorithm.

```
#include <stdio.h>
int dist[10], cost[100][100], n, vis[10], src;
void dijkstra()
{
 int count, min, u;
 for (int i = 1; i <= n; i++)
 {
 dist[i] = cost[src][i];
 vis[src] = 1;
 }
 count = 1;
 while (count < n)
 {
 min = 9999;
 for (int i = 1; i <= n; i++)
 {
 if (dist[i] < min && vis[i] == 0)
 {
 min = dist[i];
 u = i;
 }
 }
 vis[u] = 1;
 for (int i = 1; i <= n; i++)
 {
```

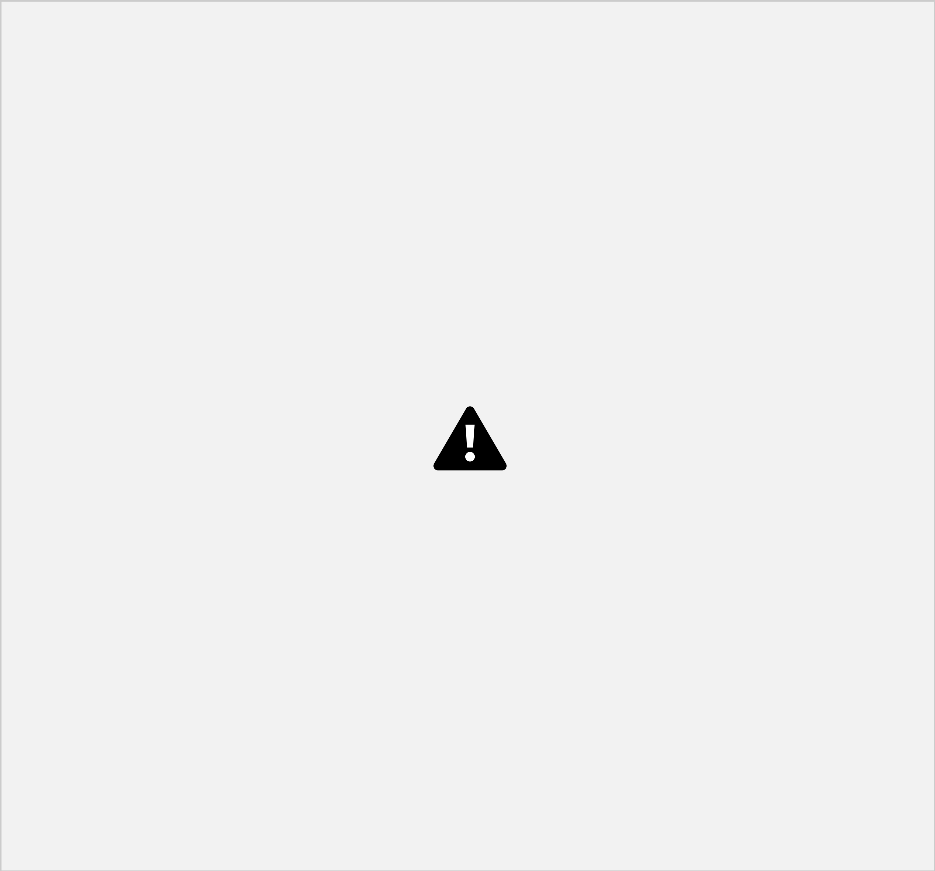
```
 if (dist[u] + cost[u][i] < dist[i] && vis[i] == 0)  {
```

```
 dist[i] = dist[u] + cost[u][i];
 }
 }
 count++;
 }
 }

void main()
{
 int m, u, v, w;
 printf("\n Dijkstra's Algorithm\n");
printf(" ------------------------");
 printf("\nEnter the number of vertices: ");
scanf("%d", &n);
 for (int i = 1; i <= n; i++)
 {
 for (int j = 1; j <= n; j++)
  {
 if (i == j)
 {
 cost[i][j] = 0;
 }
 else
 {
 cost[i][j] = 9999;
 }


 }
```

```
}
printf("Enter the number of edges: ");
scanf("%d", &m);
printf("Enter the edge with its weight\n");
for (int i = 1; i <= m; i++)
{
scanf("%d%d%d", &u, &v, &w);
cost[v][u] = cost[u][v] = w;
}
printf("Enter the source\n");
scanf("%d", &src);
dijkstra();

printf("\n");
for (int i = 2; i <= n; i++)
printf("The distance from %d --> %d is %d\n", src, i, dist[i]); }
```

GRAPH:

OUTPUT:



PROGRAM-11

Implement “N-Queens Problem” using Backtracking.

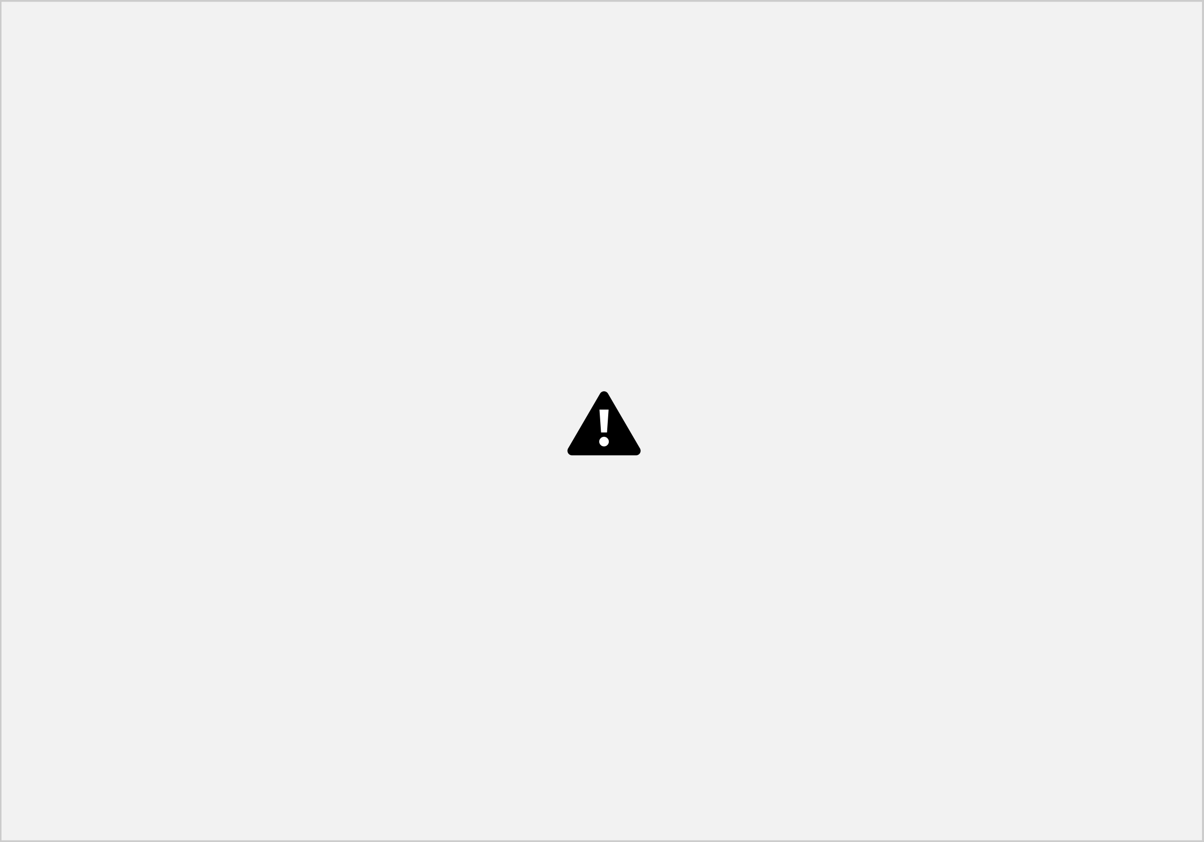
```
#include <stdio.h>
```

```
int n, count=0;

int isSafe(char board[n][n], int row, int col)
{
 for (int i = row - 1; i >= 0; i--)
 {
 if (board[i][col] == 'Q')
 {
 return 0;
 }
 }

 for (int i = row - 1, j = col - 1; i >= 0 && j >= 0; i--, j--)
{
 if (board[i][j] == 'Q')
 {
 return 0;
 }
 }

 for (int i = row - 1, j = col + 1; i >= 0 && j < n; i--, j++)
{
 if (board[i][j] == 'Q')
```

```
 {
 return 0;
 }
 }
 return 1;
 }

void printBoard(char
board[][n]) {
 printf("\n---Chess Board---\n");

 for (int i = 0; i < n; i++)
 {
 for (int j = 0; j < n; j++)
 {
 printf("%c ", board[i][j]);  }
 printf("\n");
 }
 }

void nQueens(char board[n][n], int
row) {
 if (row == n)
 {
 printBoard(board);
 count++;
 return;
```

```
 }
 for (int j = 0; j < n; j++)
 {
 if (isSafe(board, row, j) == 1)
 {
 board[row][j] = 'Q';
 nQueens(board, row + 1);
 board[row][j] = 'X';
 }
 }
}

int main()
{
 printf("Enter the size of the board: ");
scanf("%d", &n);
 char board[n][n];
 for (int i = 0; i < n; i++)
 {
 for (int j = 0; j < n; j++)
 {
 board[i][j] = 'X';
 }
 }
 nQueens(board, 0);
 printf("\nTotal Possible Solution: %d ",count); }
```

OUTPUT:



LeetCode Problems

1.

2.

2.

3.

3.

4.

4.