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
May-2023 to July-2023

(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 D GOWRI CHARAN (1BM21CS059), 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.

Radhika A D Dr. Jyothi S Nayak Assistant Professor Professor and Head Department of
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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.

1. Write program to do the following:

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

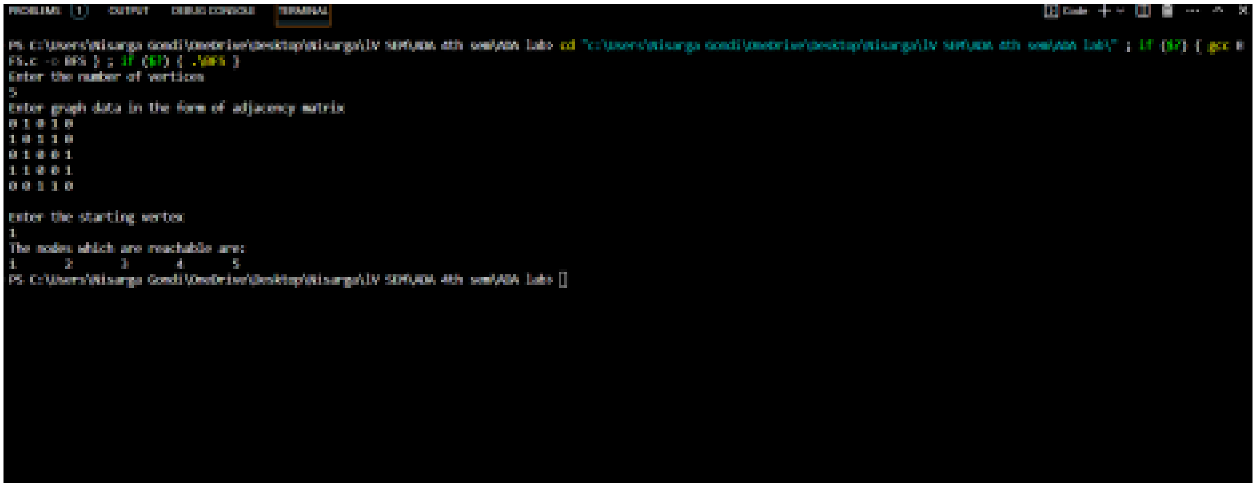
b. Check whether a given graph is connected or not using DFS method.

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

```
#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:

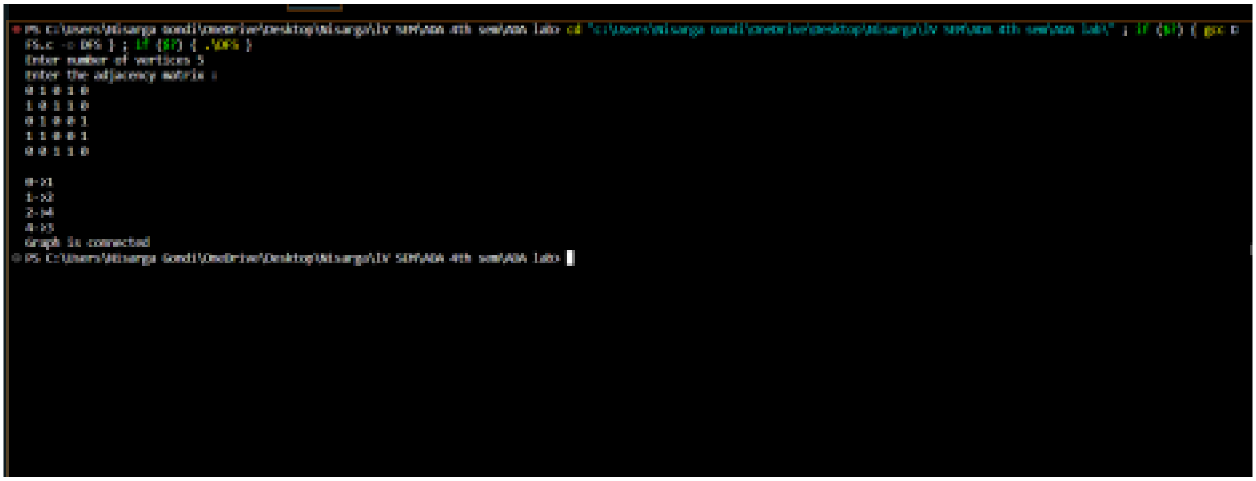


```
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc B
FS.c -o BFS } ; if ($?) { .\BFS }
Enter the number of vertices
5
Enter graph data in the form of adjacency matrix
0 1 0 1 0
1 0 1 1 0
0 1 0 0 1
1 1 0 0 1
0 0 1 1 0

Enter the starting vertex
1
The nodes which are reachable are:
1       2       3       4       5
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> []
```

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

```
#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:



```
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc D
FS.c -o DFS } ; if ($?) { .\DFS }
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

0->1
1->2
2->4
4->3
Graph is connected
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab>
```

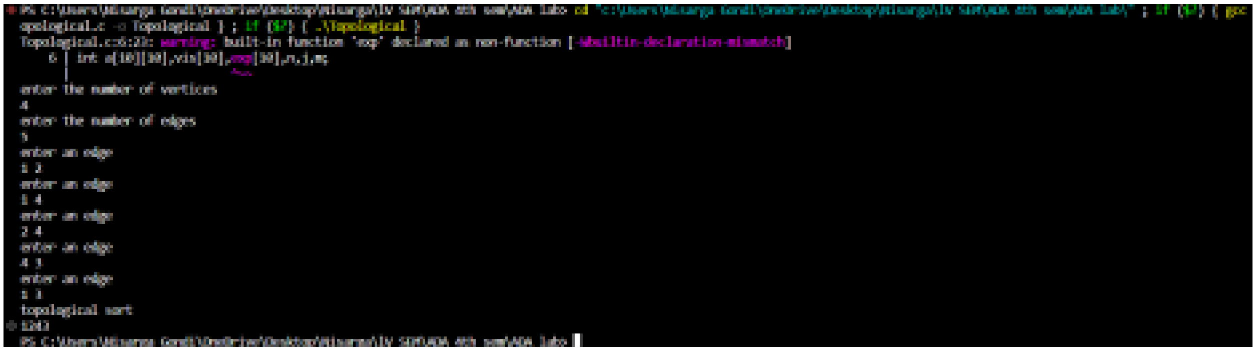
2.Write program to obtain the Topological ordering of vertices in a given

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:



```
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc
opological.c -o Topological } ; if ($?) { .\Topological }
Topological.c:6:23: warning: built-in function 'exp' declared as non-function [-Wbuiltin-declaration-mismatch]
    6 | int a[10][10],vis[10],exp[10],n,j,m;
      |                       ^~~
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
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab>
```

3.Implement Johnson Trotter algorithm to generate permutations.

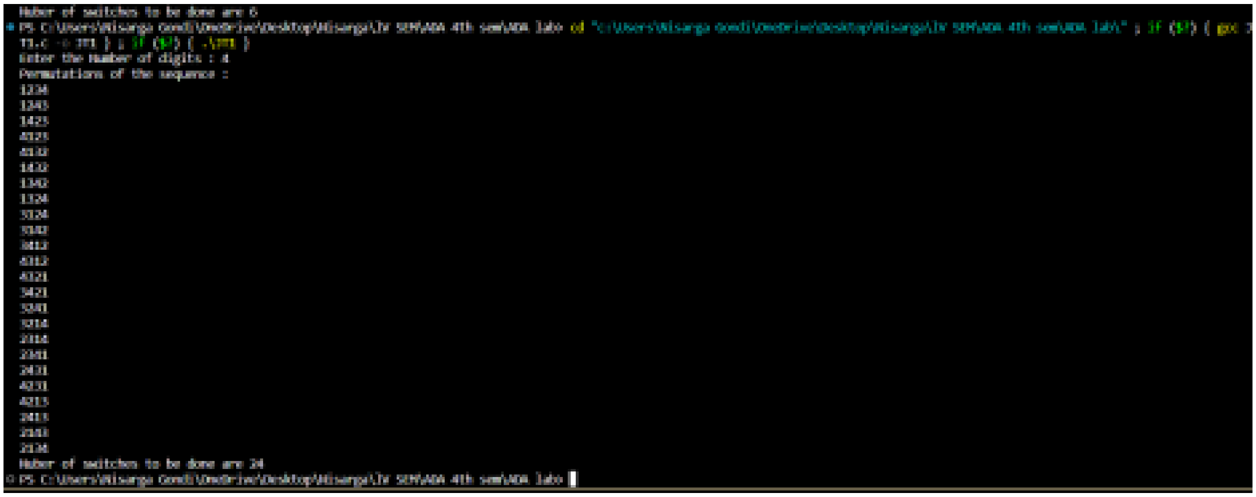
```
#include <stdio.h>


#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:



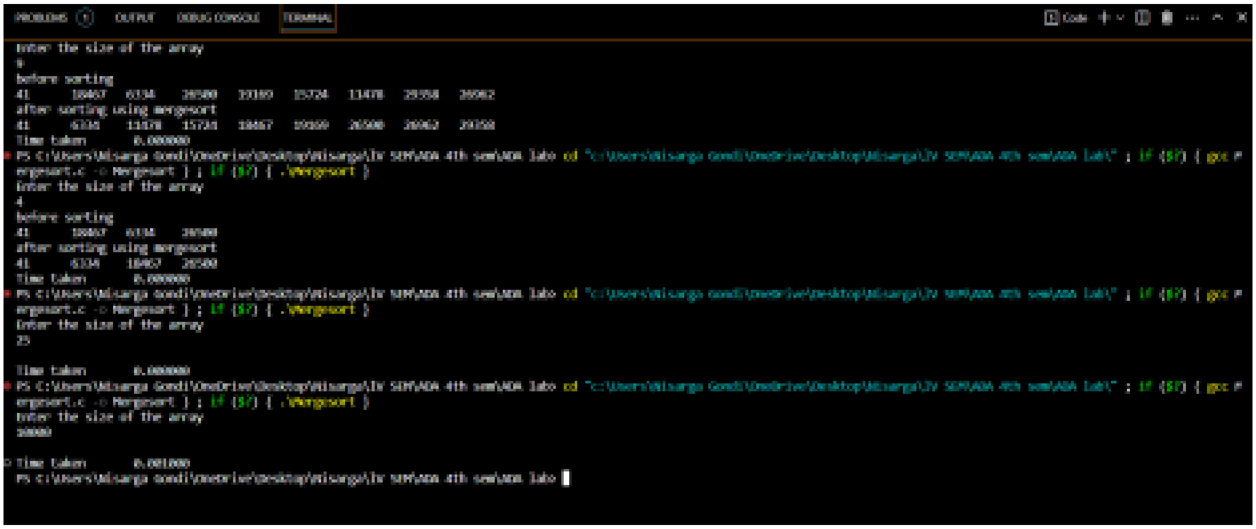
```
Nuber of switches to be done are 6
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc 3
T1.c -o 3T1 } ; if ($?) { .\3T1 }
Enter the Number of digits : 4
Permutations of the sequence :
1234
1243
1423
4123
4132
1432
1342
1324
3124
3142
3412
4312
4321
3421
3241
3214
2314
2341
2431
4231
4213
2413
2143
2134
Nuber of switches to be done are 24
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab>
```

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]);
}
}
```

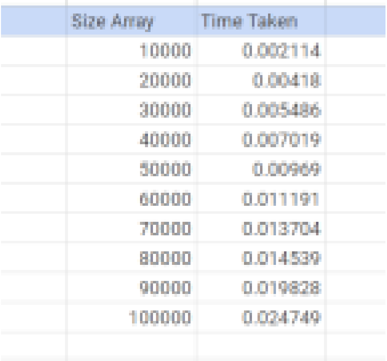
```
void main()
{
int arr[100000],n,i;
float time_taken;
clock_t st,et;
printf("Enter the size of the array\n");
scanf("%d",&n);
for(i=0;i<n;i++)
{
arr[i]=rand()%100;
}
printf("before sorting \n");
print(arr,n);
st=clock();
mergesort(arr,0,n-1);
et=clock();
printf("\nafter sorting using mergesort\n");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

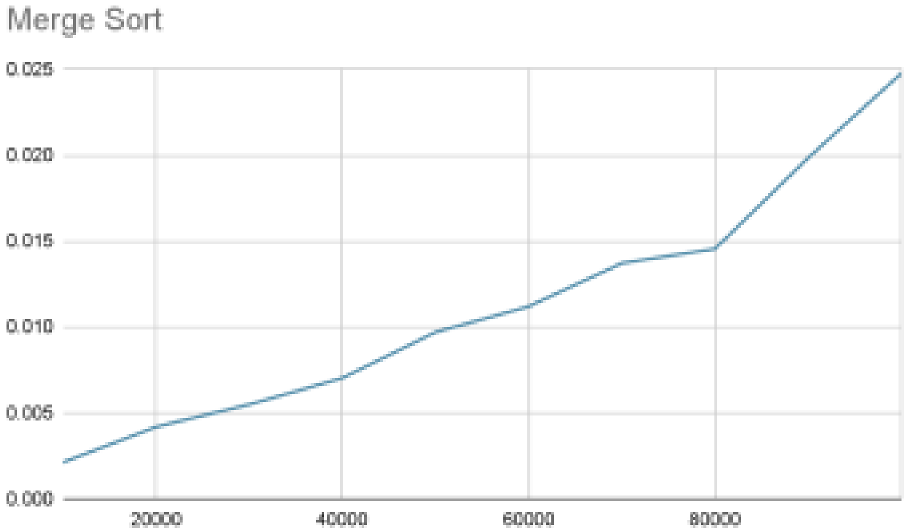


```
Enter the size of the array
9
before sorting
41      18467   6334    26500   19169   15724   11478   29358   26962
after sorting using mergesort
41      6334    11478   15724   18467   19169   26500   26962   29358
Time taken      0.000000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc m
ergesort.c -o mergesort } ; if ($?) { .\mergesort }
Enter the size of the array
4
before sorting
41      18467   6334    26500
after sorting using mergesort
41      6334    18467   26500
Time taken      0.000000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc m
ergesort.c -o mergesort } ; if ($?) { .\mergesort }
Enter the size of the array
25

Time taken      0.000000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc m
ergesort.c -o mergesort } ; if ($?) { .\mergesort }
Enter the size of the array
10000

Time taken      0.001000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab> 
```

GRAPH:



Size Array	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

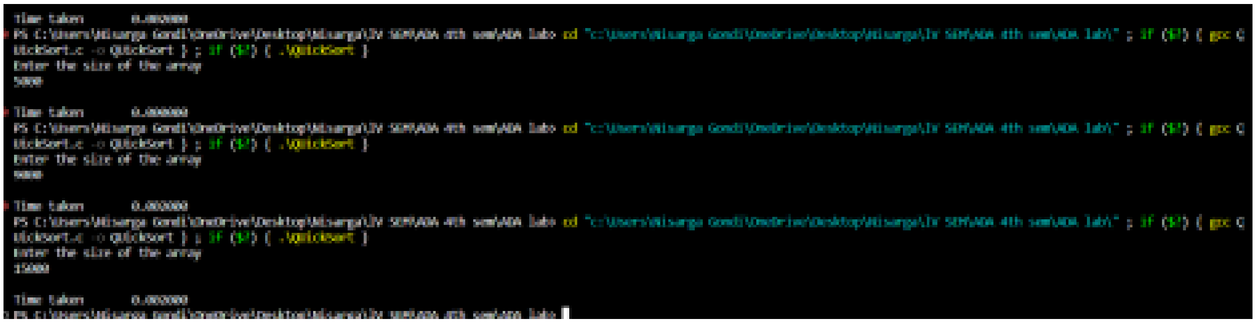


5.Sort a given set of N integer elements using Quick Sort technique and compute its time taken.

```
#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);

}

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]);

}
```

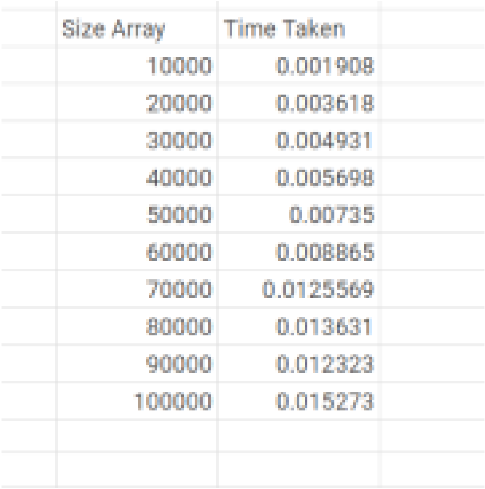
```
}

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:

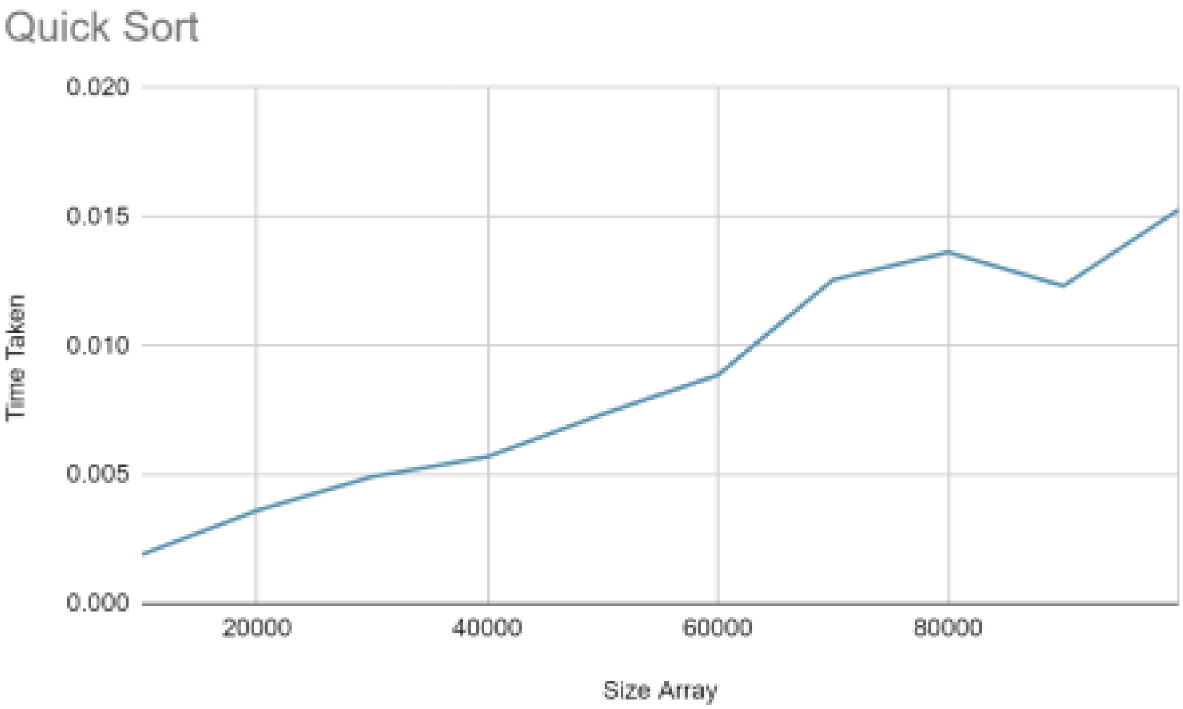


```
Time taken      0.002000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc Q
uickSort.c -o QuickSort } ; if ($?) { .\QuickSort }
Enter the size of the array
5000

Time taken      0.000000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc Q
uickSort.c -o QuickSort } ; if ($?) { .\QuickSort }
Enter the size of the array
9000

Time taken      0.002000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc Q
uickSort.c -o QuickSort } ; if ($?) { .\QuickSort }
Enter the size of the array
15000

Time taken      0.002000
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs>
```

Graph :



Size Array	Time Taken
10000	0.001908
20000	0.003618
30000	0.004931
40000	0.005698
50000	0.00735
60000	0.008865
70000	0.0125569
80000	0.013631
90000	0.012323
100000	0.015273



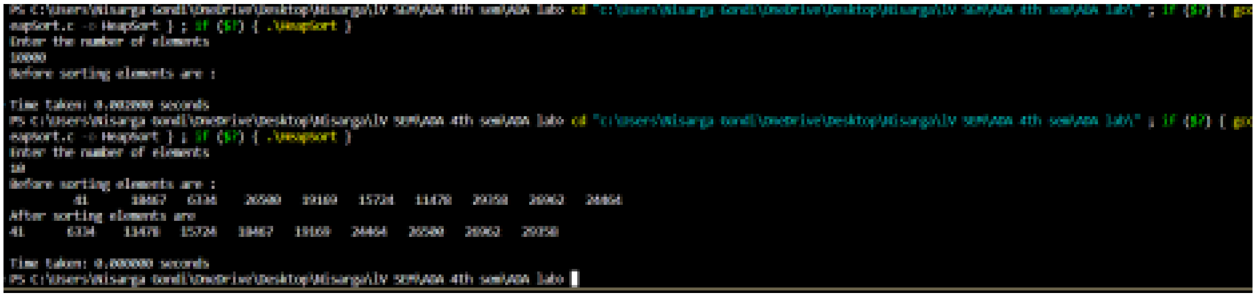
6.Sort a given set of N integer elements using Heap Sort technique and compute its time taken.

```
#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));
```

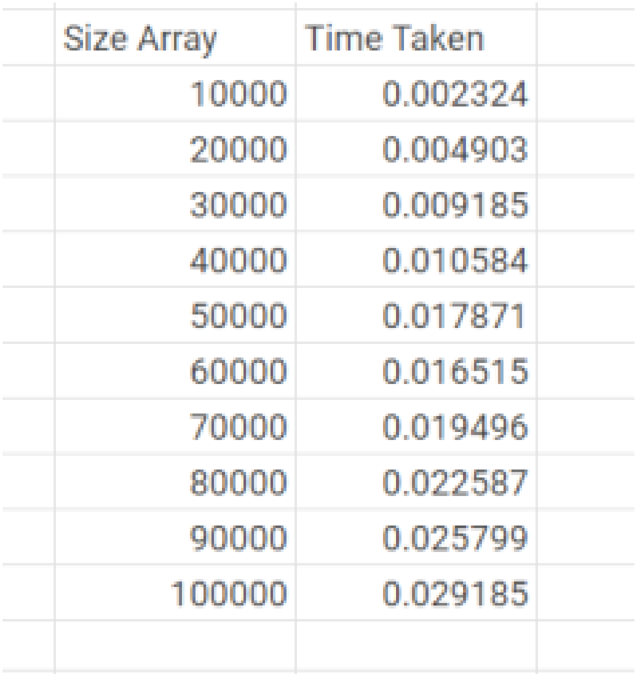
```
if (a == NULL) {
printf("Memory allocation failed.\n");
return 1;
}
// Generate random values and place them in the array
for (i = 0; i < n; i++) {
a[i] = rand();
}
st = clock();
heapsort(a, n);
et = clock();
ts = (float)(et - st) / CLOCKS_PER_SEC;
if (n <= 20) {
printf("\nAfter sorting elements are\n");
print(a, n);
}
// Free dynamically allocated memory
free(a);
printf("\nTime taken: %f seconds\n", ts);
return 0;
}
```

OUTPUT:



```
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc
eapSort.c -o HeapSort } ; if ($?) { .\HeapSort }
Enter the number of elements
10000
Before sorting elements are :

Time taken: 0.002000 seconds
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs> cd "c:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA lab\" ; if ($?) { gcc
eapSort.c -o HeapSort } ; if ($?) { .\HeapSort }
Enter the number of elements
10
Before sorting elements are :
        41      18467   6334    26500   19169   15724   11478   29358   26962   24464
After sorting elements are
41      6334    11478   15724   18467   19169   24464   26500   26962   29358

Time taken: 0.000000 seconds
PS C:\Users\Nisarga Gondi\OneDrive\Desktop\Nisarga\IV SEM\ADA 4th sem\ADA labs>
```

Graph:



Size Array	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

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:

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:

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:

//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:

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:

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: