Jawahar Education Societys Annasaheb Chudaman Patil College of Engineering, Kharghar, Navi Mumbai

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SUBJECT: Analysis of Algorithms Lab

Implement a C program for All Pair Shortest Path using Dynamic Programming Approach. Using Dynamic Programming

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Experiment No-07

Aim:- To implement All pair shortest path using Dynamic Programming Approach.

Objectives: To implement complexity of All pair shortest path (Flyod warshalls Algorithm.)

Outcomes:- Student will be able to compute the complexity of All pair shortest path.

Hardware / Software Required: Turbo C.

Theory

- **Dynamic programming:**

Dynamic programming is an algorithm design method that can be used when the solution to the problem can be viewed as the result of a sequence of decision. it avoid recomputing solution that have already been computed. Op user "principle of optimality."

The principle of optimality state that "in an optimal sequence of decisions or choice, each subsequence must also be optimal."

Problem Definition:-

Let G=(V,E) be a directed graph with n vertices. Let A be a cost adjaconcy matrix for G such that A(i,i) =0 for all i=1. to n. A(i,j) is a length of edge (i,i) if (i,i) E(G)= any A(i,j) = ∞ if i=j any (i,j) E(G). The all pair shortest path problem is to determine a matrix A(i,j) is length of shortest path from i to j.

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The all pair shortest path algorithm is also known as Floyd-Warshall algorithm is used to find all pair shortest path problem from a given weight graph. As a result of this algorithm, it will generate a matrix, which will represent the minimum distance from any node to all other nodes in the graph.

- Procedure / Algorithm:

```
Algorithm APSP (W,n)
1) A ← W          // initialize D array to W[]
2) P ← 0          // initialize P array to [0]
3) for K ← 1 to n
                  // computing D' from D
4) do for i ← 1 to n
5)     do for (j ← 1 to n)
6)         if (A[i,j] > A[i,K] + A[k,j])
7)             Then A'[i,j] ← A[i,k] + A[k,j]
8)             P[i,j] ← K;
9)         else A'[i,j] ← A[i,j]
10)    move A' to A
```

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- Analysis :

$$T(n) = \sum_{k=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n}$$

$$= O(n^3)$$

* Conclusion:

Thus, it observed that the complexity of All Pair Shortest path problem is $O(n^3)$.

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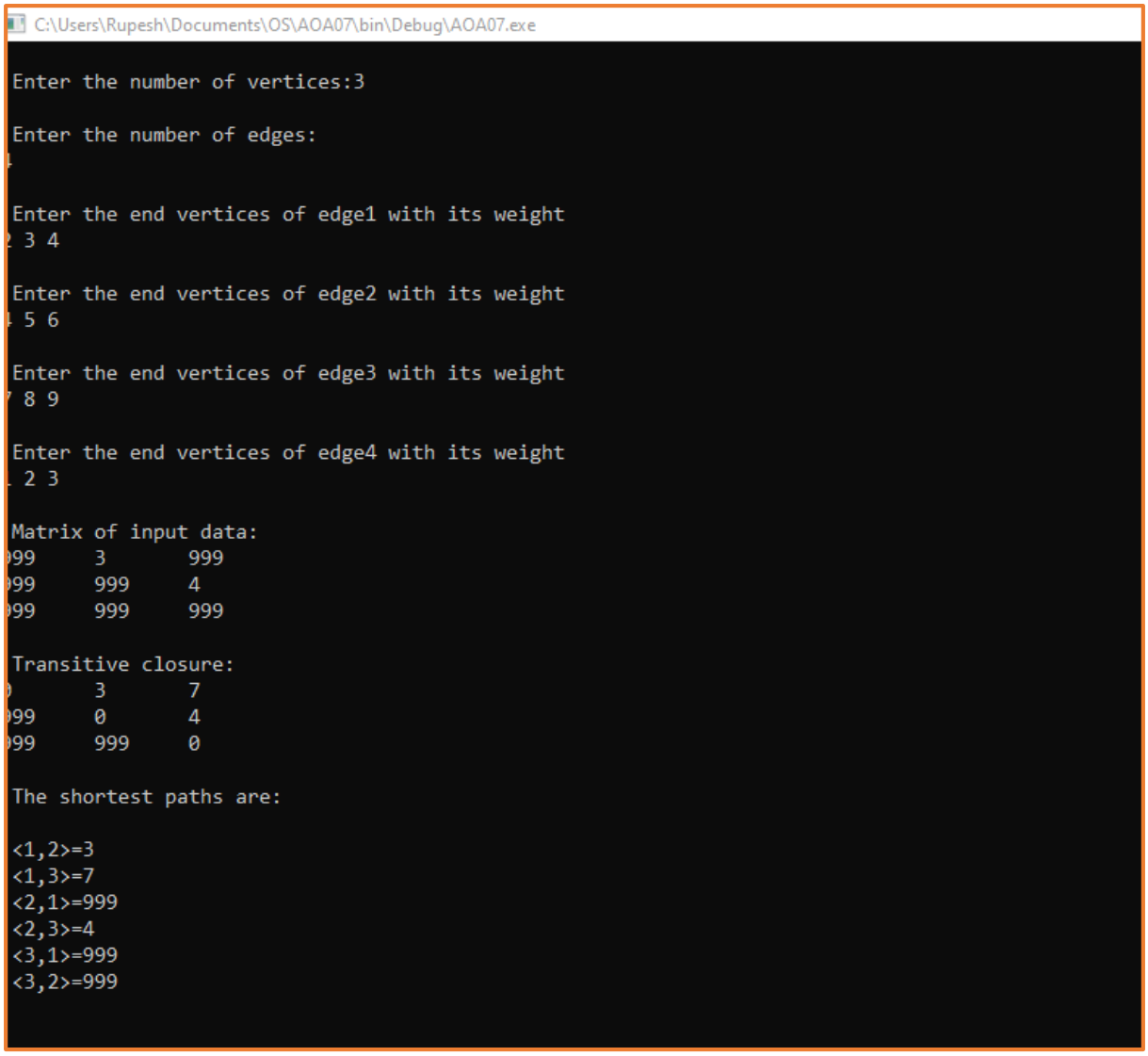
Implement a C program for All Pair Shortest Path using Dynamic Programming Approach. Using Dynamic Programming

Input:

```
#include<stdio.h>
#include<conio.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("\n Enter the number of vertices:");
 scanf("%d",&n);
 printf("\n Enter the number of edges:\n");
 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("\n Enter the end vertices of edge%d with its weight \n",i);
  scanf("%d%d%d",&u,&v,&w);
  p[u][v]=w;
 }
 printf("\n Matrix of input data:\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("\n Transitive closure:\n");
 for(i=1;i<=n;i++)
 {
  for(j=1;j<=n;j++)
   printf("%d \t",p[i][j]);
  printf("\n");
 }
 printf("\n The shortest paths are:\n");
 for(i=1;i<=n;i++)
  for(j=1;j<=n;j++)
  {
   if(i!=j)
    printf("\n <%d,%d>=%d",i,j,p[i][j]);
  }
  getch();
}
```

Implement a C program for All Pair Shortest Path using Dynamic Programming Approach. Using Dynamic Programming

Output:



Conclusion: Thus it is observed that **All Pair Shortest Path Problem** is **$O(n^3)$.**