20 July

P10) Given a weighted connected graph (directed, undirected) find the lengths of shortest paths from each vertex to all the other vertices.

```
import java.util.Scanner;
public class floyd{
  public static void main(String [] args){
    int a[][] = new int [10][10];
    int i,j;
    Scanner in= new Scanner(System.in);
    System.out.println("** Floyds' algorithm**");
    System.out.println("Enter the number
        of vertices:");
    int n= in.nextInt();
    System.out.println("Enter weight matrix:");
    for(i=1;i<=n;i++)
      for(j=1;j<=n;j++)
        a[i][j]=in.nextInt();
    System.out.println("Entered matrix:");
    for(i=1;i<=n;i++){
        for(j=1;j<=n;j++){
          System.out.print(a[i][j]+"\t");}
        System.out.println();
    }
```

```
floyd(a,n);
System.out.println("All pair shortest path
matrix:");
for(i=1;i<=n;i++){
    for(j=1;j<=n;j++)
        System.out.print(a[i][j]+"\t");
    System.out.println();
}
System.out.println("*****");
}

static void floyd(int a[],int n)
{
    for(int k=1;k<=n;k++){
        for(int i=1;i<=n;i++)
            for(int j=1;j<=n;j++)
                a[i][j]=min(a[i][j],a[i][k]+a[k][j]);
    }}
static int min(int a,int b)
{
    if a>b
        return b;
    else
        return a;
}}
```

min [Element, same row's first element + same col's 1st elem] classmate

k=1

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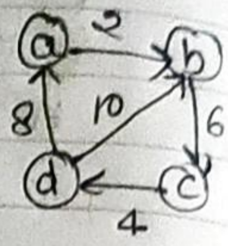
Output:



*** floyd's Algorithm ***

Enter the number of vertices:

4

Enter the weight of matrix:

	a	b	c	d
a	0	2	999	999
b	6	0	999	999
c	999	999	0	4
d	8	10	999	0

Entered weight matrix:

0	2	999	999
6	0	999	999
999	999	0	4
8	10	999	0

All pair shortest path matrix.

0	2	999	999
6	0	999	999
12	14	0	4
8	10	999	0

tracing:

k=1 n=4 1≤4

i=1 i≤4

j=1 j=2

a[1][1] = min[0, 0] = 0 a[1][2] = min[2, 0+2] = 2

$j=3$

$a[1][3] = \min[999, 0+999] = 999$

$j=4 \quad a[1][4] = \min[999, 0+999] = 999$

$i=2$ $j=1 \quad a[2,1] = \min[6, 6+0] = 6$ D' 0 2 999 999

$j=2 \quad a[2,2] = \min[\quad, 6+2] = 0$ 6 0 999 999

$j=3 \quad a[2,3] = \min[999, 6+999] = 999$ (6 = $a[2][1] + a[1][2]$) 999 999 0 4

$j=4 \quad a[2,4] = \min[999, 6+999] = 999$ 8 10 999 0

$i=3$ $j=1 \quad a[3,1] = 999 \quad a[3,2] = 999 \quad a[3,3] = 0 \quad a[3,4] = 4$

$i=4 \quad a[4,1] = 8 \quad a[4,2] = 10 \quad a[4,3] = 999 \quad a[4,4] = 0$

$K=2$ $i=1$ $j=1 \quad a[1][1] = \min(0, 2+6) = 0$

$a[1][2] = \min(2, 2+0) = 2$

$a[1][3] = 999 \quad a[1][4] = 999$

$i=2 \quad a[2][1] = 6 \quad a[2][2] = 0 \quad a[2][3] = 999 \quad a[2][4] = 999$

$i=3 \quad a[3][1] = 999 \quad a[3][2] = 999 \quad a[3][3] = 0 \quad a[3][4] = 4$

$i=4 \quad a[4][1] = 8 \quad a[4][2] = 10 \quad a[4][3] = 999 \quad a[4][4] = 0$

$D^2 =$

0	2	999	999
6	0	999	999
999	999	0	4
8	10	999	0

$K=3$ $a[1][1] = 0$ matrix remains same as

$K=4$ $a[1][1] = 0$

$a[3][1] = 12 \quad a[3][2] = 14$