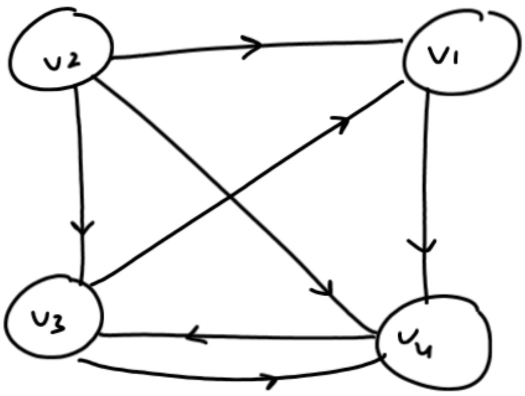
PATH MATRIX



$V_2 \to V_4 \to V_3 \to V_1 \to V_4$

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$$P_1 = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$$P_2 = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix} \end{array}$$

$$P_3 = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 \\ 1 & 0 & 2 & 2 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix} \end{array}$$

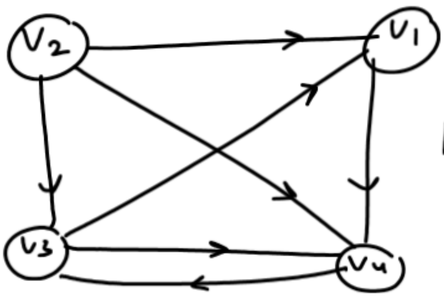
$$P_4 = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 1 \\ 2 & 0 & 2 & 3 \\ 1 & 0 & 1 & 2 \\ 1 & 0 & 1 & 1 \end{bmatrix} \end{array}$$

$$B = P_1 + P_2 + P_3 + P_4$$

$$B = \begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & 1 & 0 & 2 & 3 \\ v_2 & 5 & 0 & 6 & 8 \\ v_3 & 3 & 0 & 3 & 5 \\ v_4 & 2 & 0 & 3 & 3 \end{array}$$

$$P = \begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & 1 & 0 & 1 & 1 \\ v_2 & 1 & 0 & 1 & 1 \\ v_3 & 1 & 0 & 1 & 1 \\ v_4 & 1 & 0 & 1 & 1 \end{array}$$

<u>WARSHALL'S ALGORITHM FOR PATH MATRIX</u>



$$P_0 = \begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & 0 & 0 & 0 & 1 \\ v_2 & 1 & 0 & 1 & 1 \\ v_3 & 1 & 0 & 0 & 1 \\ v_4 & 0 & 0 & 1 & 0 \end{array}$$

$$P_k[I][J] = P_{k-1}[I][J] \,||\, (P_{k-1}[I][k] \,\&\&\, P_{k-1}[k][J])$$

$$P_1[2][1] = P_0[2][1] \,||\, (P_0[2][1] \,\&\&\, P_0[1][1])$$

K = Matrix No

I = Row

J = Col

$$P_1 \quad \begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & & & & 1 \\ v_2 & 1 & & & \\ v_3 & & & & 1 \\ v_4 & 0 & & & \end{array}$$

$1 \,||\, (1 \,\&\&\, 0)$

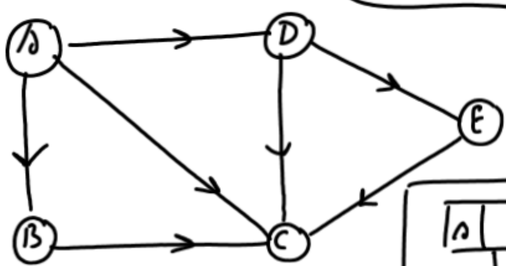
```c
#include <stdio.h>
void warshall(int[][4],int [][4]);
int main()
{
    int adj[4][4],path[4][4];
    int i,j;
    for(i=0;i<4;i++)
    {
        for(j=0;j<4;j++)
        {
            printf("Is there a direct path from vertex
[%d] to vertex[%d],Yes-1,No-0 ?",i+1,j+1);
            scanf("%d",&adj[i][j]);
        }
    }
    warshall(adj,path);
    printf("Path matrix is \n");
    for(i=0;i<4;i++)
    {
        for(j=0;j<4;j++)
        {
            printf("%d ",path[i][j]);
        }
        printf("\n");
    }
return 0;
}
```

$$P = \begin{array}{c} \\ 0 \\ 1 \\ 2 \\ 3 \end{array} \begin{array}{c} \begin{array}{cccc} 0 & 1 & 2 & 3 \end{array} \\ \begin{bmatrix} \underline{0} & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

```c
void warshall(int adj[][4],int path[][4])
{
    int i,j,k;
    for(i=0;i<4;i++)
    {
        for(j=0;j<4;j++)
        {
            path[i][j]=adj[i][j];
        }
    }
    for(k=0;k<4;k++)
    {
        for(i=0;i<4;i++)
        {
            for(j=0;j<4;j++)
            {
                path[i][j]=path[i][j]||(path[i][k]&&path[k][j]);
            }
        }
    }
}
```

P[0][1] = P[0][1] || (P[0][0] && P[0][1])
0 || (0 && 0)

ADJACENCY LIST REPRESENTATION OF A GRAPH



Nodes	Adj Nodes
A	B, C, D
B	C
C	–
D	C, E
E	C