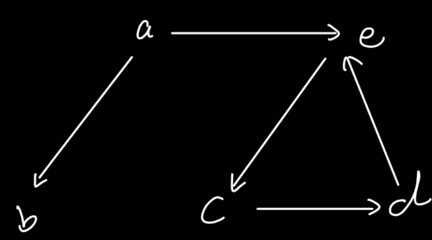
Architecture

Consider following directed graph.

$R = \{(a,b), (a,e), (c,d), (d,e), (e,c)\}$

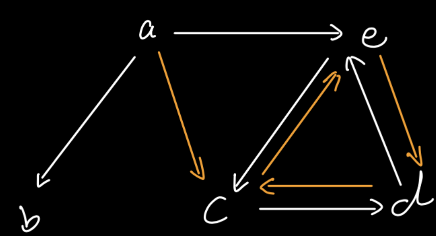
Adjacency matrix: (The walk step is 1)

	a	b	c	d	e
a	0	1	0	0	1
b	0	0	0	0	0
c	0	0	0	1	0
d	0	0	0	0	1
e	0	0	1	0	0



Begin walking : (The walk step is 2)

	a	b	c	d	e
a	0	1	1	0	1
b	0	0	0	0	0
c	0	0	0	1	1
d	0	0	1	0	1
e	0	0	1	1	0



Keep walking

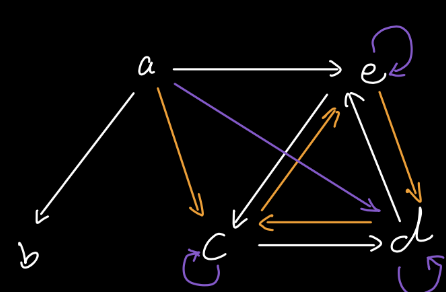
(The walk step is 3)

⟶ : step = 1

⟶ : step = 2

⟶ : step = 3

	a	b	c	d	e
a	0	1	1	1	1
b	0	0	0	0	0
c	0	0	1	1	1
d	0	0	1	1	1
e	0	0	1	1	1



For this graph, increasing step more than 3 will not bring more connections, so the final result of the transitive closure is

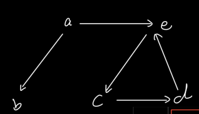
$$\{(a,b),(a,c),(a,d),(a,e),(c,c),(c,d),(c,e),(d,c),(d,d),(d,e),(e,c),(e,d),(e,e)\}$$

Synchronize with the code (Warshall)

```
Warshall(A, n)
    for k ← 0 to n−1
        for i ← 0 to n−1
            //find all nodes reachable from i via k
            if A[i,k]
                for j ← 0 to n−1
                    if A[k,j]
                        A[i,j] ← 1
```

For 'a' as the intermediate node. No node can reach to 'a', pass.

	a	b	c	d	e
a	0	1	0	0	1
b	0	0	0	0	0
c	0	0	0	1	0
d	0	0	0	0	1
e	0	0	1	1	0



	a	b	c	d	e
a	0	1	0	0	1
b	0	0	0	0	0
c	0	0	0	1	1
d	0	0	0	0	1
e	0	0	1	1	1

For 'b' as the intermediate node, since 'b' can reach no node. pass.

For 'c' as the intermediate node,

$A(e,c)=1$ and $A(c,d)=1 \Rightarrow A(e,d)=1$

For 'd' as the intermediate node,

$A(c,d)=1$ and $A(d,e)=1 \Rightarrow A(c,e)=1$

$A(e,d)=1$ and $A(d,e)=1 \Rightarrow A(e,e)=1$

For 'e' as the intermediate node,

$A(a,e)=1$ and $A(e,c)=1$ and $A(e,d)=1 \Rightarrow A(a,c)=1, A(a,d)=1$

$A(c,e)=1$ and $A(e,c)=1$ and $A(e,d)=1 \Rightarrow A(c,c)=1, A(c,d)=1$

$A(d,e)=1$ and $A(e,c)=1$ and $A(e,d)=1 \Rightarrow A(d,c)=1, A(d,d)=1$

End

	a	b	c	d	e
a	0	1	1	1	1
b	0	0	0	0	0
c	0	0	1	1	1
d	0	0	1	1	1
e	0	0	1	1	1

The final transitive closure is: