1. For the following graph, use Warshall's to compute the transitive closure. Show all steps (6 R matrices).
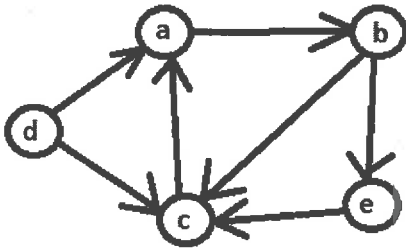

$R^{(0)} =$

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

$R^{(1)} =$

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

$R^{(2)}$

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

$R^{(3)} =$

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

$R^{(4)}$

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

$R^{(5)}$

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

Solution

2. For the following graph, use Floyd's to computer the all pairs shortest paths. Show all steps (6 D Matrices).

$$D^{(0)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & \infty & \infty & \infty \\ b & \infty & 0 & 4 & \infty & 1 \\ c & 2 & \infty & 0 & \infty & \infty \\ d & 4 & \infty & 1 & 0 & \infty \\ e & \infty & \infty & 1 & \infty & 0 \end{array}$$
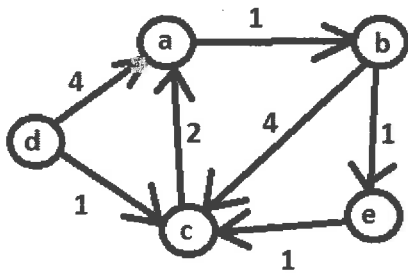
$$D^{(1)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & \infty & \infty & \infty \\ b & \infty & 0 & 4 & \infty & 1 \\ c & 2 & 3 & 0 & \infty & \infty \\ d & 4 & 4 & 1 & 0 & \infty \\ e & \infty & \infty & 1 & \infty & 0 \end{array}$$

$$D^{(2)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 5 & \infty & 2 \\ b & \infty & 0 & 4 & \infty & 1 \\ c & 2 & 3 & 0 & \infty & 4 \\ d & 4 & 4 & 1 & 0 & 5 \\ e & \infty & \infty & 1 & \infty & 0 \end{array}$$

$$D^{(3)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 5 & \infty & 2 \\ b & 6 & 0 & 4 & \infty & 1 \\ c & 2 & 3 & 0 & \infty & 4 \\ d & 3 & 4 & 1 & 0 & 5 \\ e & 3 & 4 & 1 & \infty & 0 \end{array}$$

$$D^{(4)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 5 & \infty & 2 \\ b & 6 & 0 & 4 & \infty & 1 \\ c & 2 & 3 & 0 & \infty & 4 \\ d & 3 & 4 & 1 & 0 & 5 \\ e & 3 & 4 & 1 & \infty & 0 \end{array}$$

$$D^{(5)} = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 3 & \infty & 2 \\ b & 4 & 0 & 2 & \infty & 1 \\ c & 2 & 3 & 0 & \infty & 4 \\ d & 3 & 4 & 1 & 0 & 5 \\ e & 3 & 4 & 1 & \infty & 0 \end{array}$$