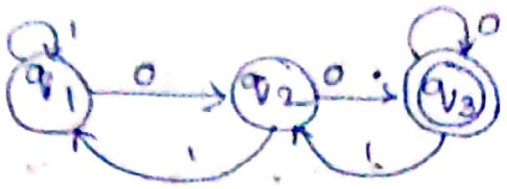
Name : Rahul Goel
Reg No: RA1911030010094
Section : O2

1

	0	1
→ q_1	q_2	q_1
q_2	q_3	q_1
* q_3	q_3	q_2



$K = 0, 1, 2, 3$

$K = 0$:

$R_{11} = \varepsilon + 1$ $\quad R_{21} = 1$ $\quad R_{31} = \phi$

$R_{12} = 0$ $\quad R_{22} = \varepsilon + \phi$ $\quad R_{32} = 1$

$R_{13} = \phi$ $\quad R_{23} = 0$ $\quad R_{33} = \varepsilon + 0$

$K = 1$

$$R_{11}(1) = R_{11}(0) + R_{11}(0)\,(R_{11}(0))^*\,R_{11}(0)$$
$$= \varepsilon + 1 + (\varepsilon + 1)(\varepsilon + 1)^*\,\varepsilon + 1$$
$$= \varepsilon + 1 + (\varepsilon + 1)1^*\,\varepsilon + 1$$
$$= \varepsilon + 1 + (1^*(\varepsilon + 1)$$
$$= \varepsilon + 1 + 1^* = 1^*$$

$$R_{12}(1) = R_{12}(0) + R_{11}(0)\,(R_{11}(0))^*\,R_{12}(0)$$
$$= 0 + (\varepsilon + 1)(\varepsilon + 1)^* 0$$
$$= 0 + (\varepsilon + 1)1^* 0$$
$$= 0 + 1^* 0 = 1^* 0$$

$R_{13}(1) = R_{13}(0) + R_{11}(0)(R_{11}(0))^* R_{13}(0)$

$= \phi + (\varepsilon+1)(\varepsilon+1)^* \phi$

$= \phi + (\varepsilon+1)1^* \phi$

$= \phi + 1^* \phi$

$= \phi + \phi = \phi$

$R_{21}(1) = R_{21}(0) + R_{21}(0)(R_{11}(0))^* R_{11}(0)$

$= 1 + 1(\varepsilon+1)^*(\varepsilon+1)$

$= 1 + 1\,1^*(\varepsilon+1)$

$= 1 + 1 \cdot 1^*$

$R_{22}(1) = R_{22}(0) + R_{21}(0)(R_{11}(0))^* R_{12}(0)$

$= \varepsilon + 1(\varepsilon+1)^* 0$

$= (\varepsilon + 1)\,1^* 0$

$R_{23}(1) = R_{23}(0) + R_{21}(0)(R_{11}(0))^* R_{13}(0)$

$= 0 + 1(\varepsilon+1)^* \phi$

$= 0 + 1 \cdot 1^* \phi$

$= 0 + 0 = 0$

$R_{31}(1) = R_{3}(0) + R_{31}(0)(R_{11}(0))^* R_{11}(0)$

$= \phi + \phi(\varepsilon+1)^* \varepsilon + 1$

$= \phi + \phi\,1^*(\varepsilon+1)$

$= \phi + \phi 1^* = \phi + \phi = \phi$

$R_{32}(1) = R_{32}(0) + R_{31}(0)(R_{11}(0))^* R_{12}(0)$

$= 1 + \phi (\varepsilon + 1)^* 0$

$= 1 + \phi 1^* 0$

$= 1 + \phi = 1$

$R_{33}(1) = R_{33}(0) + R_{31}(0)(R_{11}(0))^* R_{13}(0)$

$= \varepsilon + 0 + \phi (\varepsilon + 1)^* \phi$

$= \varepsilon + 0 + \phi = \varepsilon + 0$

K=2

$R_{11}(2) = R_{11}(1) + R_{12}(1)(R_{22}(1))^* R_{21}(1)$

$= 1^* + 1^* 0 ((\varepsilon + 1) 1^* 0)^* (1 + 1 \cdot 1^*)$

$R_{12}(2) = R_{12}(1) + R_{12}(1)(R_{22}(1))^* R_{22}(1)$

$= 1^* 0 + 1^* 0 (\varepsilon + 1 \cdot 1^* 0)^* (\varepsilon + 1 \cdot 1^* 0)$

$R_{13}(2) = R_{12}(1) + R_{12}(1)(R_{22}(1))^* R_{23}(1)$

$= \phi + 1^* 0 (\varepsilon + 1 \cdot 1^* 0)^* 0$

$= 1^* 0 (\varepsilon + 1 \cdot 1^* 0)^* 0$

$$R_{33}(2) = R_{33}(1) + R_{32}(1)\,(R_{22}(1))^{*}\,R_{23}(1)$$

$$= \varepsilon + 0 + 1\,(\varepsilon + 1 \cdot 1^{*} 0)^{*} 0$$

$$R_{13}(3) = R_{13}(2) + R_{13}(2)\,(R_{33}(2))^{*}\,R_{33}(2)$$

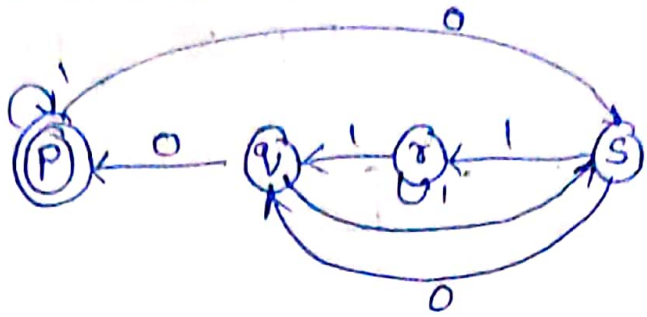
$$= 1^{*}0\,(\varepsilon + 1 \cdot 1^{*}0)^{*}0 + 1^{*}0\,(\varepsilon + 1 \cdot 1^{*}0)^{*}0\,(\varepsilon + 0 + 1\,(\varepsilon + 1 \cdot 1^{*}0)^{*}0)^{*}$$

$$(\varepsilon + 1 \cdot 1^{*}0)^{*}0$$

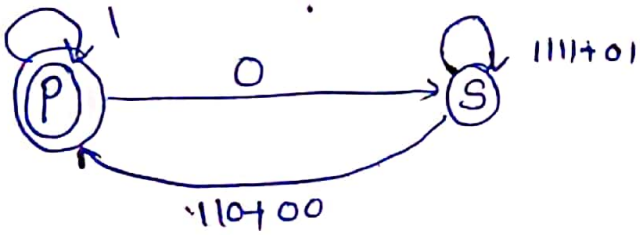
$$(\varepsilon + 0 + 1\,(\varepsilon + 1 \cdot 1^{*}0)^{*}0$$

2

	0	1
→ * p	q	p
q	p	s
r	r	q
s	q	r



	Direct	Indirect
pp	$1+\emptyset = 1$	p-q-r-p
ps	$0+\emptyset = 0$	p-q-r-s = ∅ p-q-s : q . 1 = ∅ p-r-s = ∅
sp	$\emptyset + 110+00 : 110+00$	s-r-q-p = 110 s-q-p = 00 s-r-p = ∅
ss	$\emptyset + 111+01 = 111+01$	s-r-q-s = 1111 s-r-s = ∅ s-q-s = 01



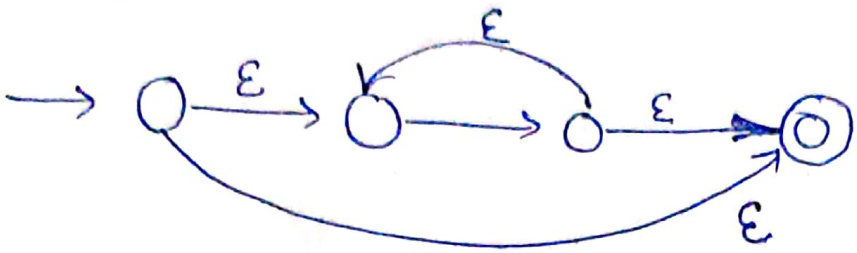
$(R+Su^*T)^*Su^* = (1+0(111+01)^*(110+00))^*0(111+01)^*$

3 (a) 01^*

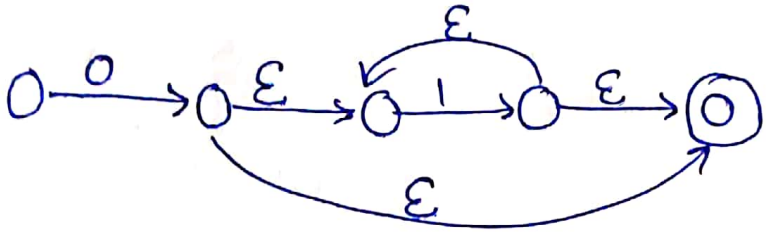
0:

1:

1^*:

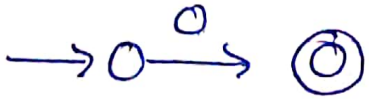


01^*:



(b) $(0+1)01$

0:



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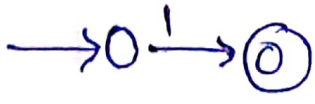
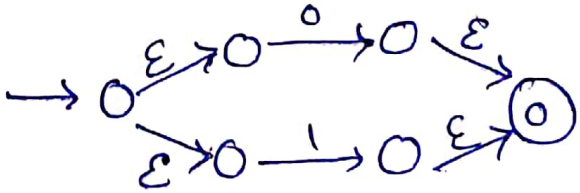
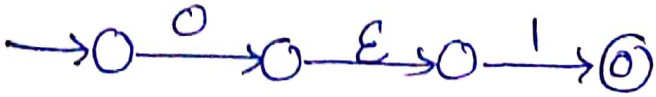


0+1:



01:



(0+1) 01: