# CS3133
## HW#3 SOLUTIONS

1. **a)** $(0+1)^* 11(0+1)^*$

**b)** Every 1 must either be followed by a 0 or be the last character of the string.

$$(0+10)^*(e+1)$$

or, if you don't want to use $e$ in the regular expression, $(0+10)^* + (0+10)^* 1$ .

**c)** $(0+1)^* 1(0+1)$

2. The set of binary strings containing 000.

3. **a)**

$R_{11}^0 = e$

$R_{12}^0 = 0$

$R_{13}^0 = 1$

$R_{21}^0 = 0$

$R_{22}^0 = e$

$R_{23}^0 = 1$

$R_{31}^0 = 1$

$R_{32}^0 = 0$

$R_{33}^0 = e$

**b)**

$R_{11}^1 = e$

$R_{12}^1 = 0$

$R_{13}^1 = 1$

$R_{21}^1 = 0$

$R_{22}^1 = e + 00$

$R_{23}^1 = 1 + 01$

$R_{31}^1 = 1$

$R_{32}^1 = 0 + 10$

$R_{33}^1 = e + 11$

**c)**

$$R_{11}^{2}=e+0(00)^{*}0=(00)^{*}$$

$$R_{12}^{2}=0+0(00)^{*}(e+00)^{*}=0(00)^{*}$$

$$R_{13}^{2}=1+0(e+00)^{*}(1+01)=1+0(00)^{*}(e+0)1=0^{*}1$$

$$R_{21}^{2}=0+(e+00)(e+00)^{*}0=0+(00)^{*}0=(00)^{*}0$$

$$R_{22}^{2}=e+00+(e+00)(e+00)^{*}(e+00)=(00)^{*}$$

$$R_{23}^{2}=1+01+(e+00)(e+00)^{*}(1+01)=(00)^{*}(1+01)$$

$$R_{31}^{2}=1+(0+10)(e+00)^{*}0=1+(0+10)(00)^{*}0$$

$$R_{32}^{2}=0+10+(0+10)(e+00)^{*}(e+00)=(0+10)(00)^{*}$$

$$R_{33}^{2}=e+11+(0+10)(e+00)^{*}(1+01)=e+11+(0+10)(00)^{*}(1+01)$$

**d)** Our answer is $R_{13}^{3}$, which is

$$R_{13}^{2}=0^{*}1+0^{*}1\left(e+11+(0+10)(00)^{*}(1+01)\right)^{*}\left(e+11+(0+10)(00)^{*}(1+01)\right)$$

$$=0^{*}1\left(11+(0+10)(00)^{*}(1+01)\right)^{*}$$