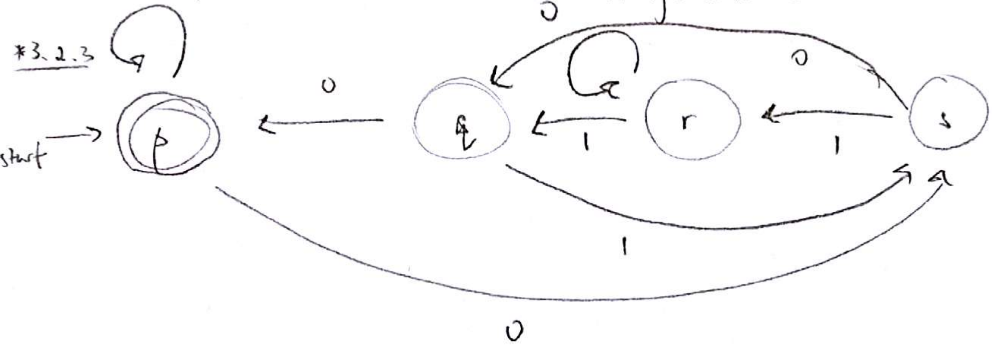
Patrick Pei
CS3252-01

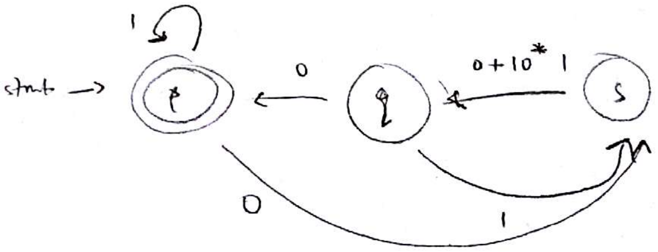
Assignment 5

*3.2.3



elimination of state r

$(s,q) = 0 + 10^*1$



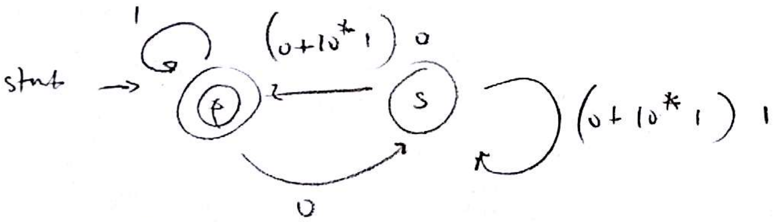
elimination of q

$(s,p) = \emptyset + (0+10^*1)\emptyset^*0$

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

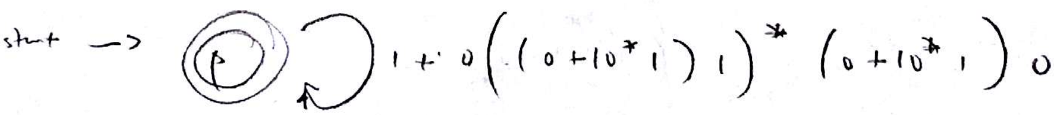
$(s,s) = \emptyset + (0+10^*1)\emptyset^*1$

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



elimination of s

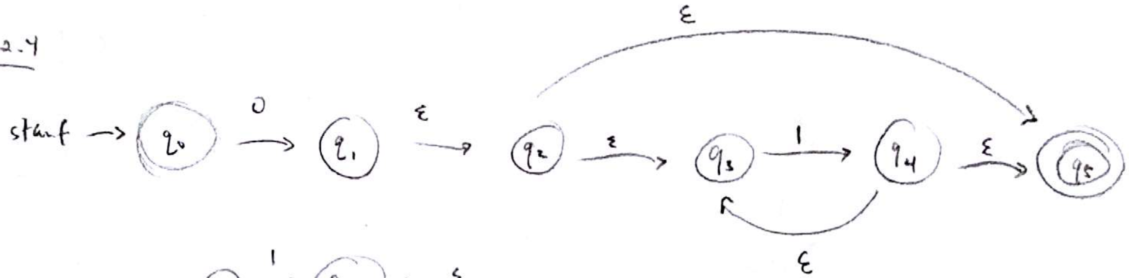
$(p,p) = 1 + 0((0+10^*1)1)^*(0+10^*1)0$



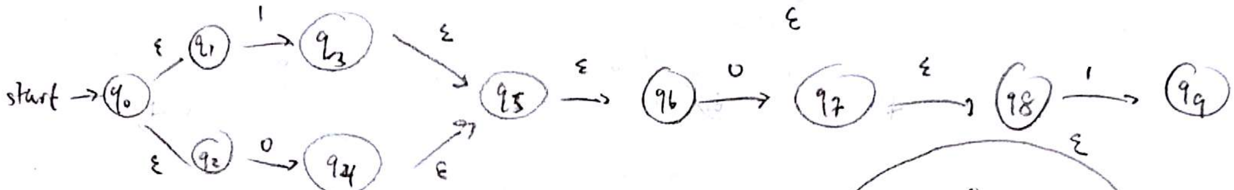
$= (1+0((0+10^*1)1)^*(0+10^*1)0)^*$

*3.2.4

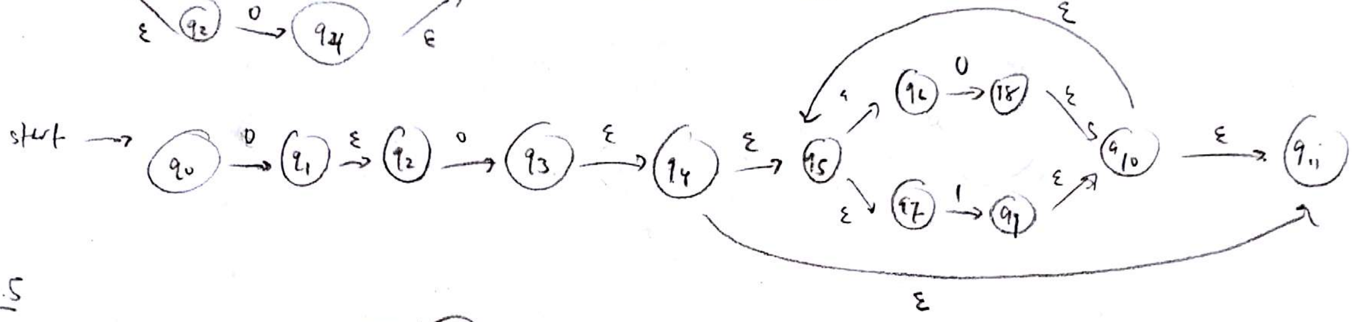
a.



b.



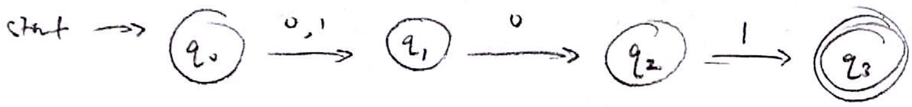
c.



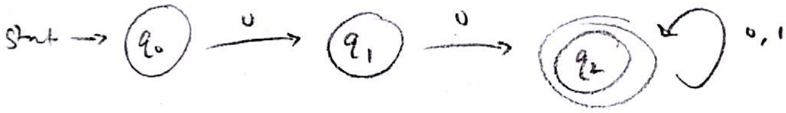
*3.2.5

a.

b.



c.



*3.4.1

d. $R(S+T) = RS + RT$

Suppose a string w is in $R(S+T)$, then $w = xy$ where $x \in R$ and $y \in$ either S or T. If $y \in S$, then $xy = RS$ and therefore $\in RS + RT$. Conversely, if $y \in T$, then $xy = RT$ and therefore in $RS + RT$.

Suppose w is in $RS + RT$, then w is either RS or RT. Then for $w = xy$, if $x \in R$ and y is S, then since $y \in S$, it is in $S+T$ and conversely for $y \in T$.

e. $(R+S)T = RT + ST$

Suppose a string w is in $(R+S)T$, then $w = xy$ where $x \in$ either R or S and $y \in T$. If $x \in R$, then $xy = RT$ and therefore $\in RT + ST$. conversely if $x \in S$, then $xy = ST$ and therefore $\in RT + ST$.

suppose $w \in RT + ST$, then $w \in$ either RT or ST. Then for $w = xy$, if $x \in R$ and $y \in T$ then since $x \in R$ then it is in $R+S$ and conversely for $x \in S$.

g. $(\varepsilon + R)^* = R^*$

by substitution of symbols: $(\varepsilon + a)^* = a^*$

since $\varepsilon^* = \varepsilon$ and $a^* = a^0 + a^1 + a^2 + \dots$

$= \varepsilon + a + aa$

ε is already contained by a^*

h. $(R^* S^*)^* = (R+S)^*$

by substitution of symbols:

$$(a^* b^*)^* = (a+b)^*$$

It is clear that both sides intuitively represent all strings of a and b.

Thus, the two concrete expressions denote the same language so $(R^* S^*)^* = (R+S)^*$ holds.

* 3.4.2

b. $(RS + R)^* R = R(SR + R)^*$

True

concrete expression:

$$(ab + a)^* a = a(ba + a)^*$$

by visual inspection, it is clear that both these languages represent strings that start with a and contain any number of a's or single occurrences of b that end in a.

d. $(R+S)^* S = (R^* S)^*$

concrete expression:

$$(a+b)^* b = (a^* b)^*$$

False, proof by contradiction

the string bb $\in L((a+b)^* b)$ but not $L((a^* b)^*)$. thus, the concrete expression does not hold and neither does the statement in general.