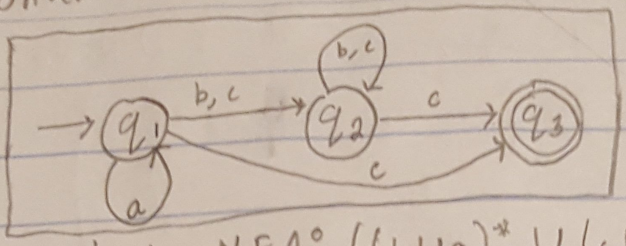
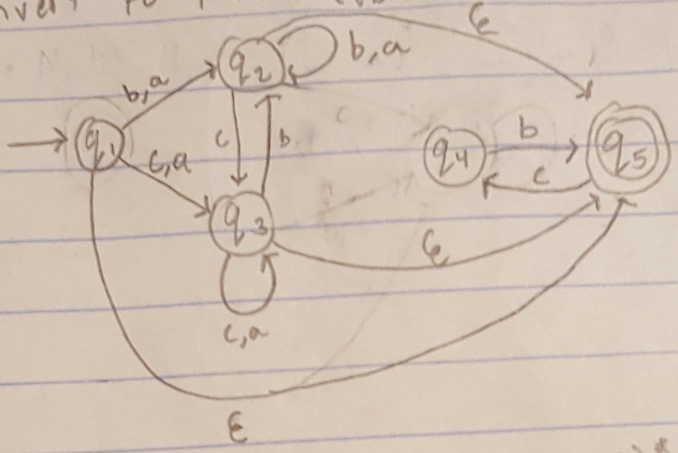
Thatcher Rickertsen - Formal Languages - HW04

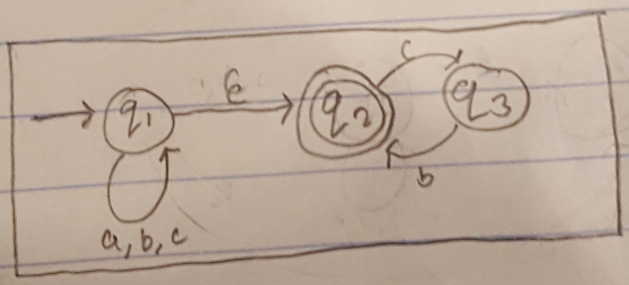
1. Convert to NFA: $a^*(b \cup c)^* c$



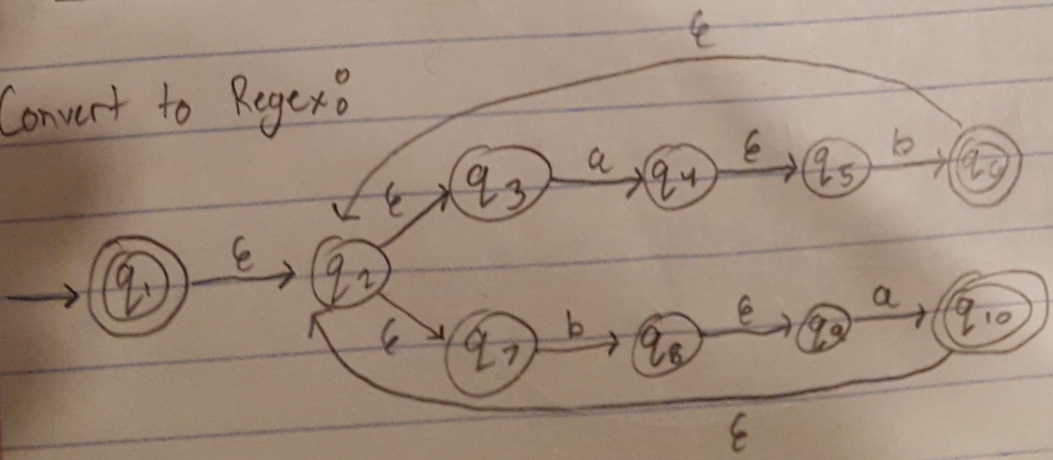
2. Convert to NFA: $((b \cup a)^* \cup (c \cup a))^* (cb)^*$



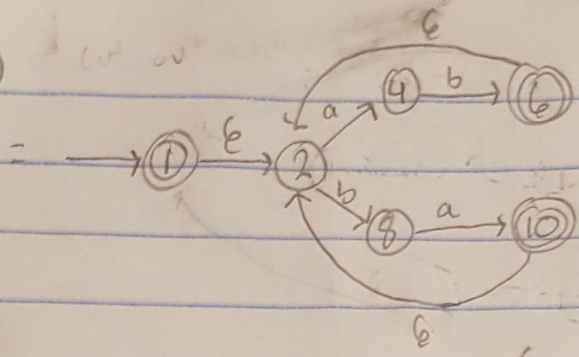
* Note that $((b \cup a)^* \cup (c \cup a))^* (cb)^*$
$= (a \cup b \cup c)^* (cb)^*$
so we could alternatively draw:



3. Convert to Regex:

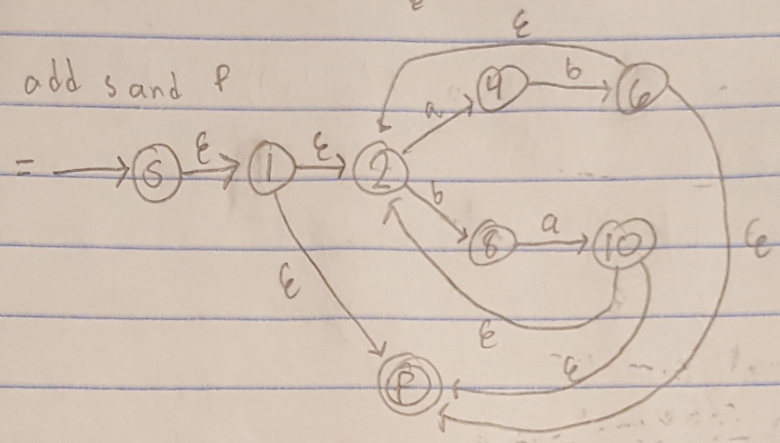


Step 1)

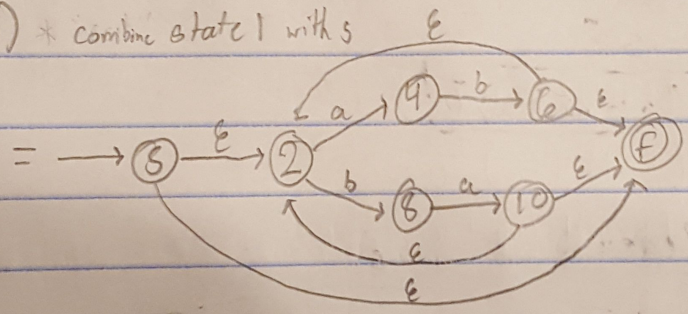


* cut out excess states that do nothing.

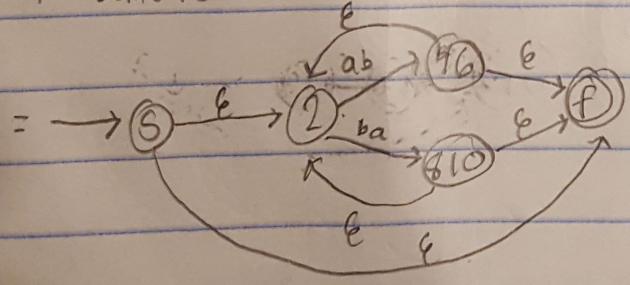
Step 2) add s and f



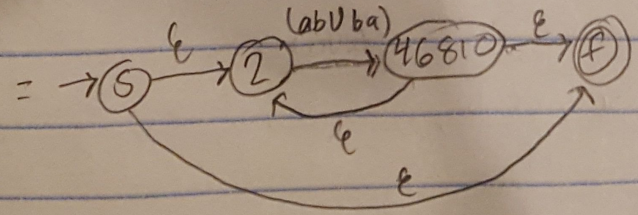
Step 3) * combine state 1 with s



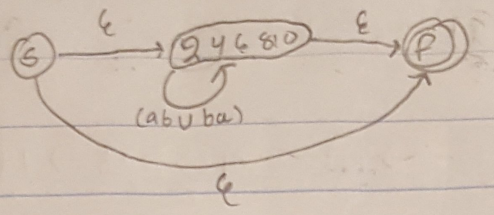
Step 4) * combine 4 with 6 and 8 with 10



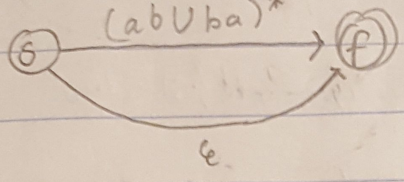
Step 5) combine 46 with 810



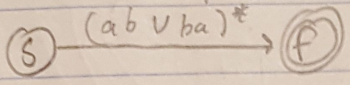
Step 6) simplify 2→46810 transition

= 

Step 7) Merge state 246810 with s

= 

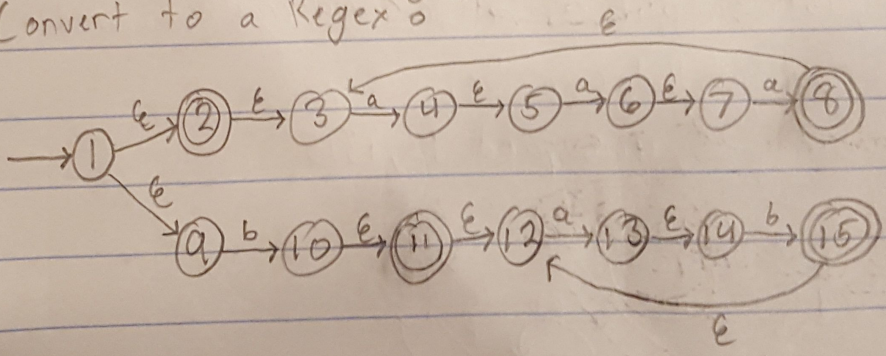
Step 8) Final simplification

= 

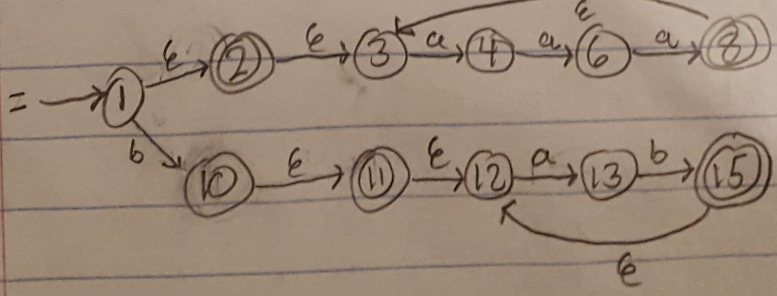
So the regex is:

$$\boxed{(ab \cup ba)^*}$$

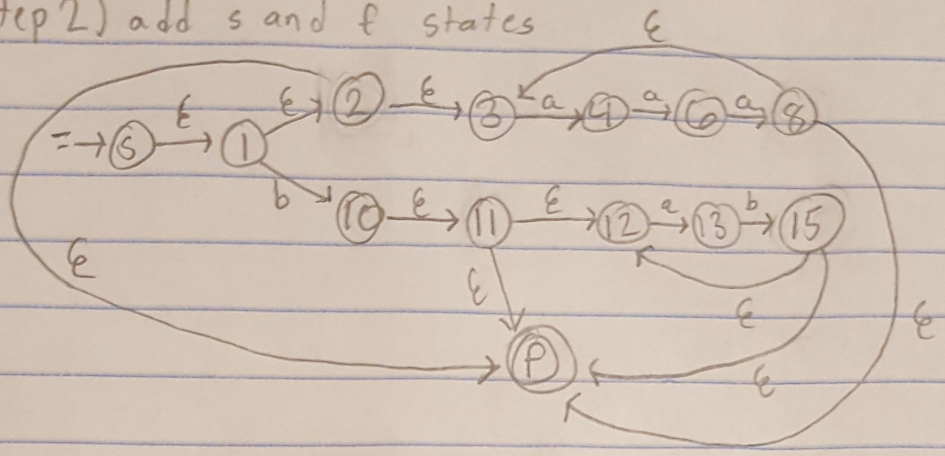
4) Convert to a Regex:



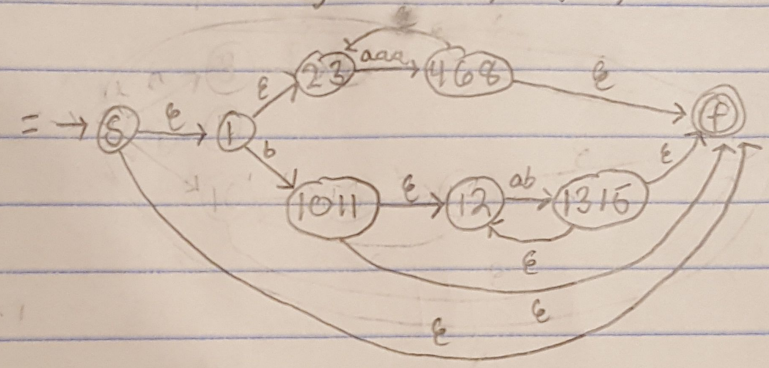
Step 1) simplify excess ε transitions

= 

Step 2) add s and f states

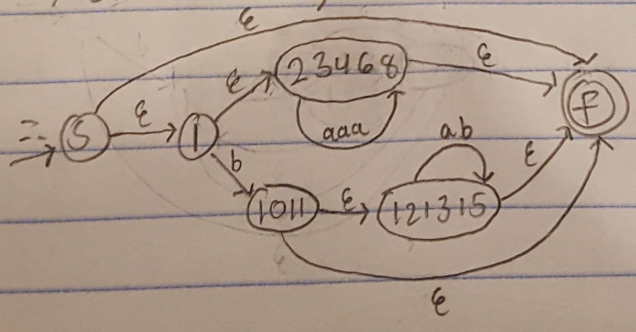


Step 3) combine 2,3; 4,6,8; 10,11; 13,15:

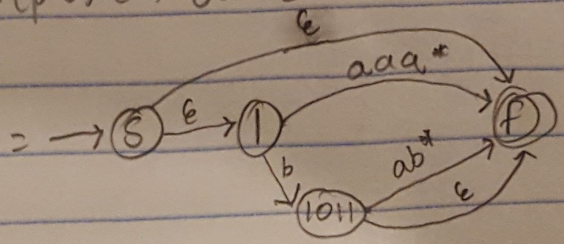


* This just simplifies all concatenation and ε transitions that can be.

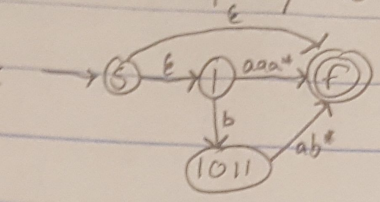
Step 4) Combine 23, 468 and 12, 1315:



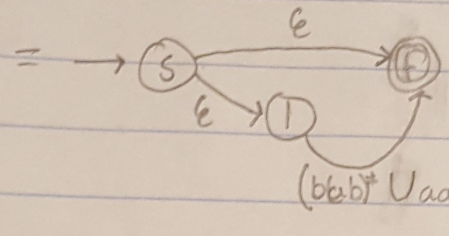
Step 5) Cut out 23468 and 121315



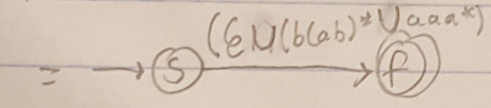
Step 6) Simplify 1011 → f transition:



Step 7) Cut out 1011 state



Step 8) Final Simplification



So the regex is:

$$\boxed{\varepsilon \cup (b(ab)^* \cup aaa^*)}$$