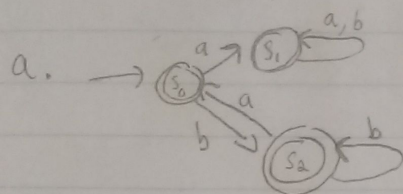


# Regular Expressions

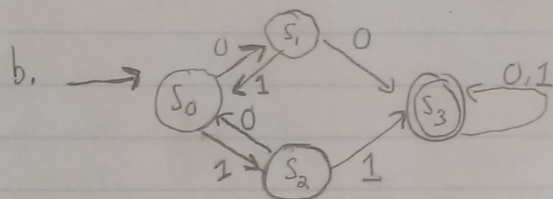
~~3, 5, 7~~

1. Describe the languages accepted by:



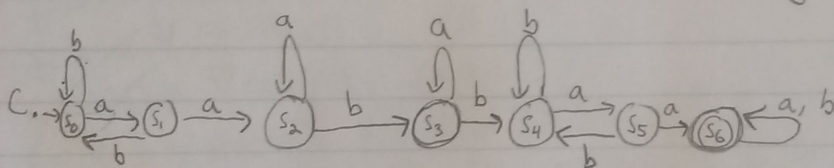
Language consists of:

- An a followed by any # of a's or b's infinitely (BAN)
- A b followed by any # of b's (including 0) and <sup>at the end</sup> then a single a. If more than a single a we get stuck in a loop like the 1<sup>st</sup> bullet point



Language consists of:

- A 0 or 1 followed by a 0 or 1 and the infinitely may 0's or 1's (or none)
- The Binary Language (but every # has at least 2 digits) 0 in our language = 00

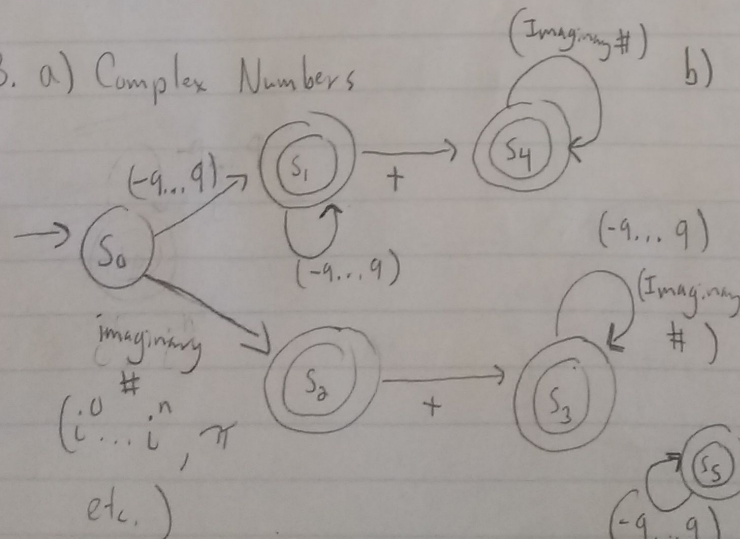


Language consists of:

- Any # of b's <sup>(including 0)</sup> followed by 2 or more a's then a b then any # of a's (including 0) then a b then any # of b's (including 0) then 2 a's followed by any # (including 0) and combination of a's + b's

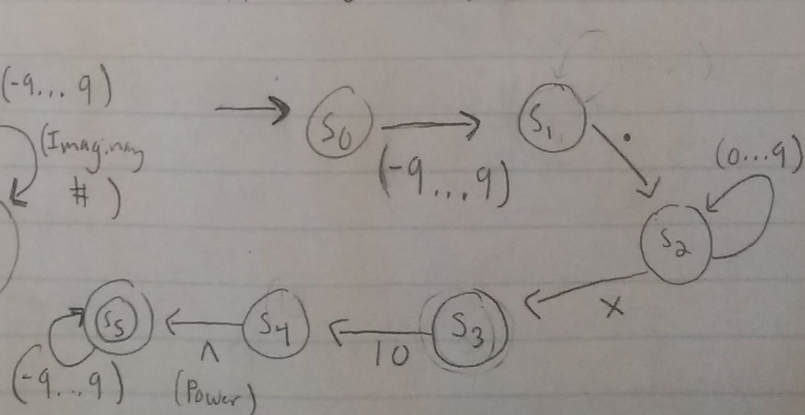
3. a) Complex Numbers

Complex:  
 Reals +  
 Imaginaries



b) Decimal #'s in Scientific Notation

$$0.1 = 1 \times 10^{-1} \quad 0.01 = 1 \times 10^{-2} \dots$$



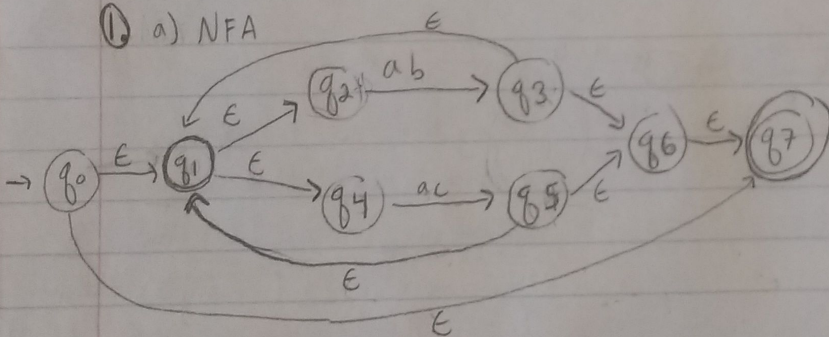


5b.  $\Sigma = \{0, 1\}$   $\hookrightarrow$  set of all strings of 0s + 1s  
that contain an even # of 0s or even # of 1s

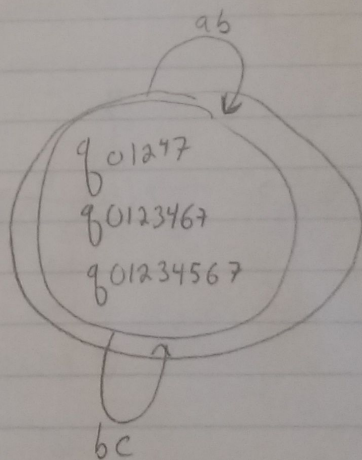
$(10 | 01)^* \Rightarrow 00010$  or any order concatenation  
 $(10 | 01 | 00 | 11)^* \Rightarrow 00001$   $1, *, ( ), 10$   
 $(1)^* 00 (0)^* 11)^* \Rightarrow 01000$   
 $(11)^* 00 | 0(0)^* 11 | (11)^* 0 | (00)^* 1)^* \Rightarrow 100011$   
 $(00 | 11)^*$

7. ①  $(ab | ac)^*$   
 ②  $(0 | 1)^* 1100 1^*$   
 ③  $(01 | 10 | 00)^* 11$

① a) NFA

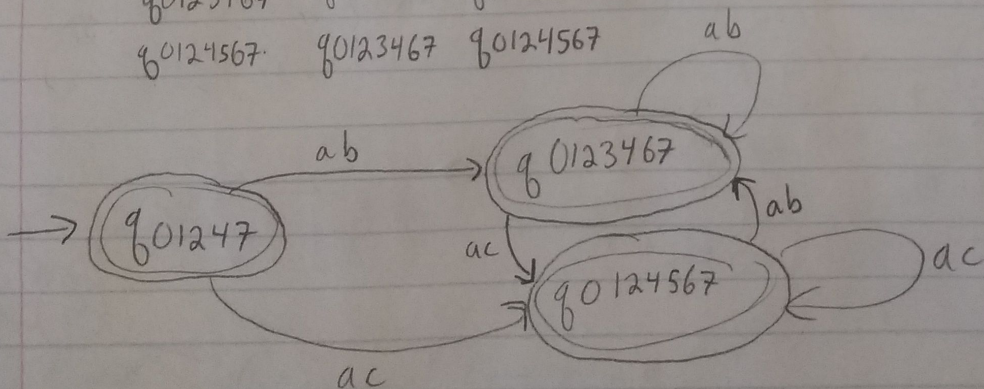


c)



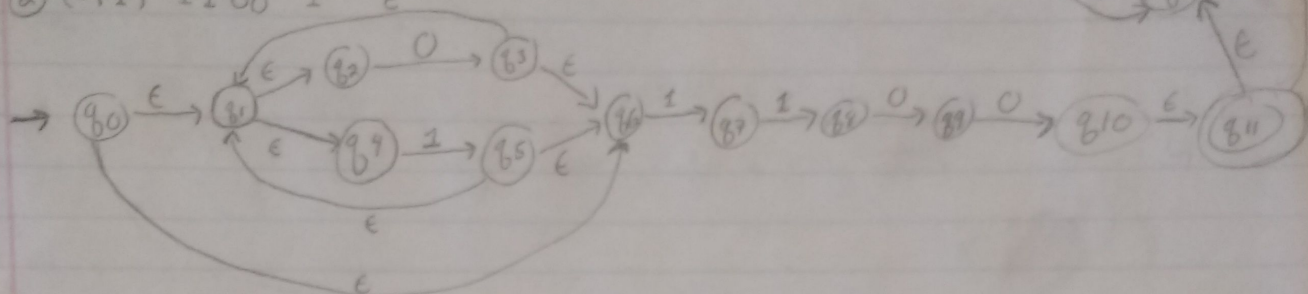
b) DFA

	ab	ac
q01247	q0123467	q0124567
q0123467	q0123467	q0124567
q0124567	q0123467	q0124567





a) NFA  
 ②  $(011)^* 1100 1^*$   $\epsilon$



b) DFA

0 1

d0 $\Rightarrow$ q01246	q012346	q012456
d1 $\Rightarrow$ q012346	d1	q0124567
d2 $\Rightarrow$ q012456	d1	q0124567
d3 $\Rightarrow$ q0124567	d1	q01245678
d4 $\Rightarrow$ q01245678	q01234689	d4
d5 $\Rightarrow$ q0123689	q01238910	d3
d6 $\Rightarrow$ q01238910	q0123891011121314	q012511121314
d7 $\Rightarrow$ q0123891011121314	d7	q012511121314
d8 $\Rightarrow$ q012511121314	q012311121314	q012511121314

q5 only on 1's  
 q3 only on 0's  
 q13 only on 1's

There should be more states in these final ones... I definitely missed a few biging states here

- Should be more states that I missed (Early states)

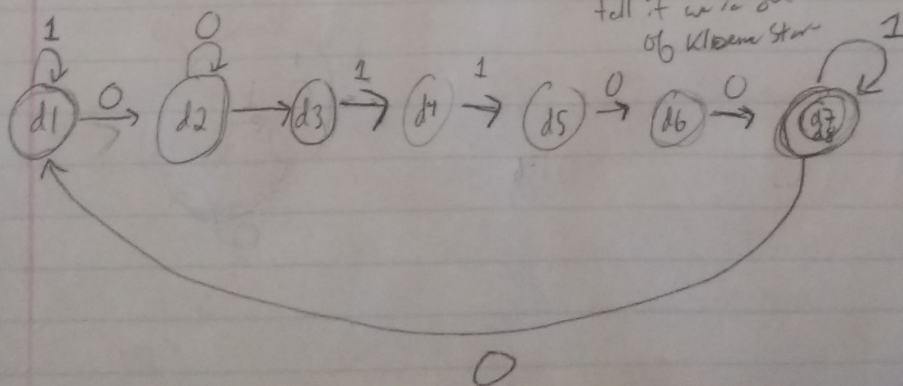
- Boot one, reduce ... on and on the 1100

c.

Really kills it

There's some weird loop... we can't

tell if we're out of Kleene star



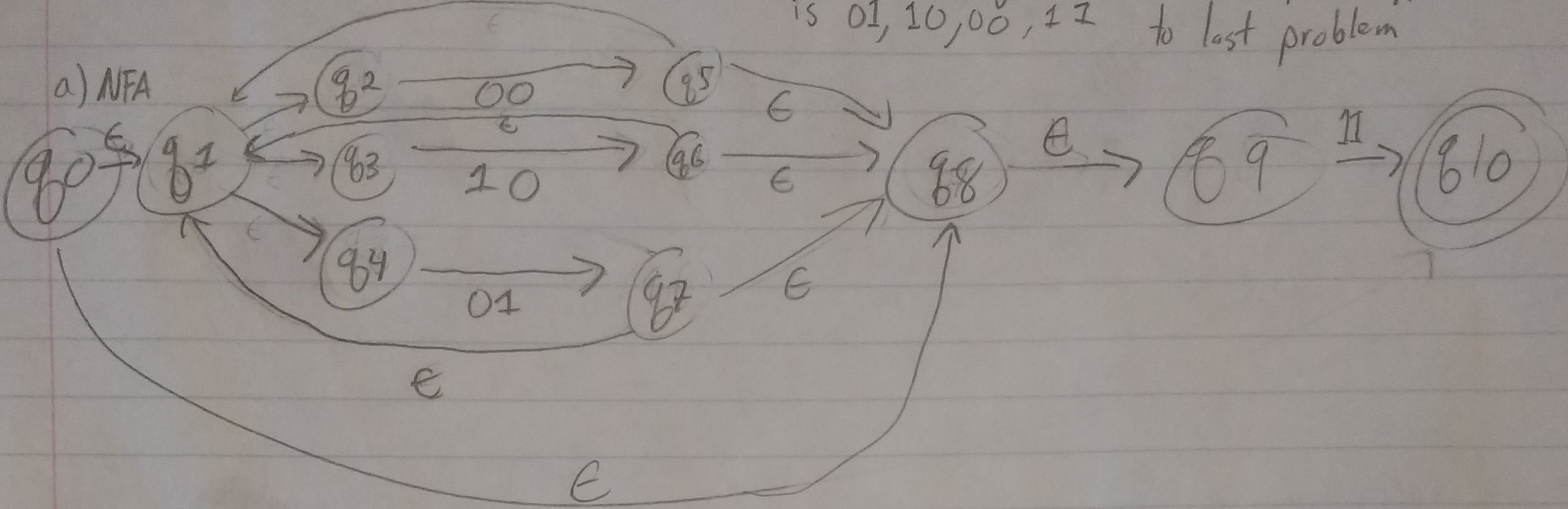
- The problem is we don't know if we are in Kleene star or matching on the pattern...  
 - Makes a ton of states and way more than I have...



③  $(01 | 10 | 00)^* 11$

Assume order language is 01, 10, 00, 11. No overlap as opposed to last problem

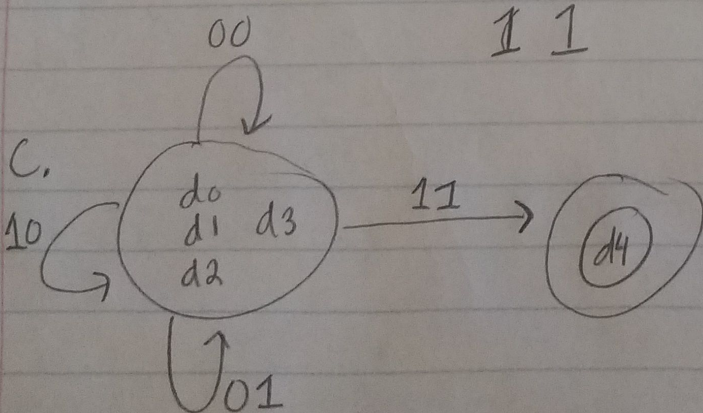
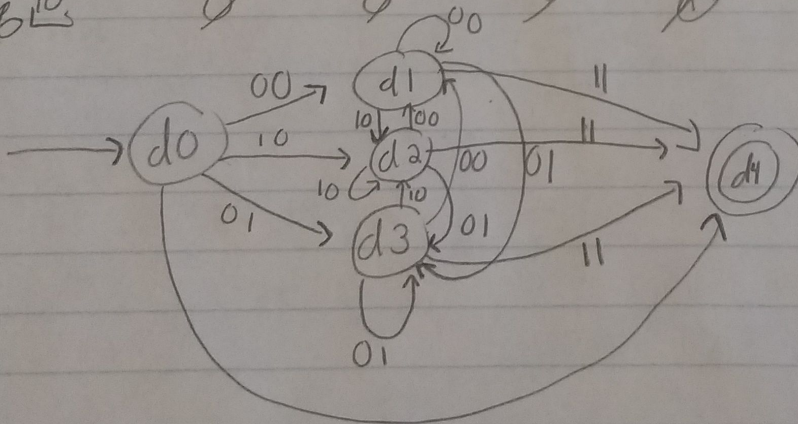
a) NFA



b) DFA

b)	00	10	01	11
d0	q0123489	q01234589	q01234689	q01234789
d1	q01234589	d1	d2	d3
d2	q01234689	d1	d2	d3
d3	q01234789	d1	d2	d3
d4	q10	✓	✓	✓

DFA



Minimized  
DFA