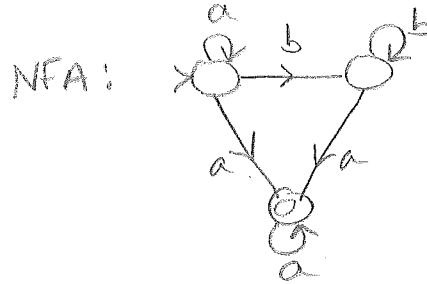
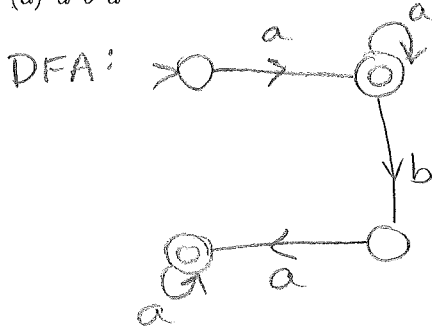


Computer Science 162 Practice for Final Exam

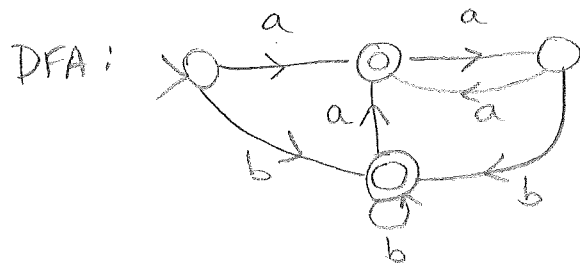
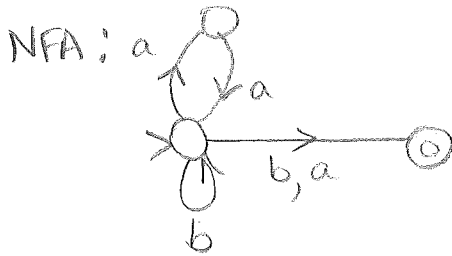
April 9, 2018

1. For each regular expression given below, give a DFA that accepts the language so described. When possible, find a NFA that is smaller than the DFA for the same language.

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



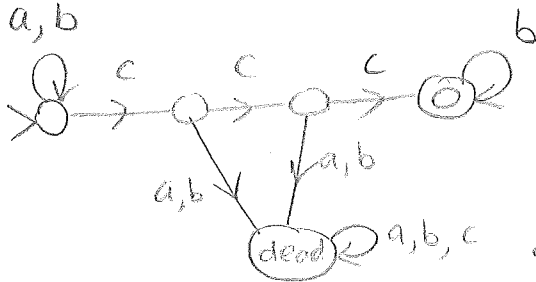
(b)  $(aa + b)^*(b + a)$



Kinda tricky!

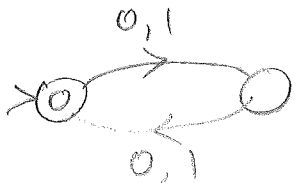
(c)  $(a + b)^*cccb^*$

DFA. (NFA is not smaller)

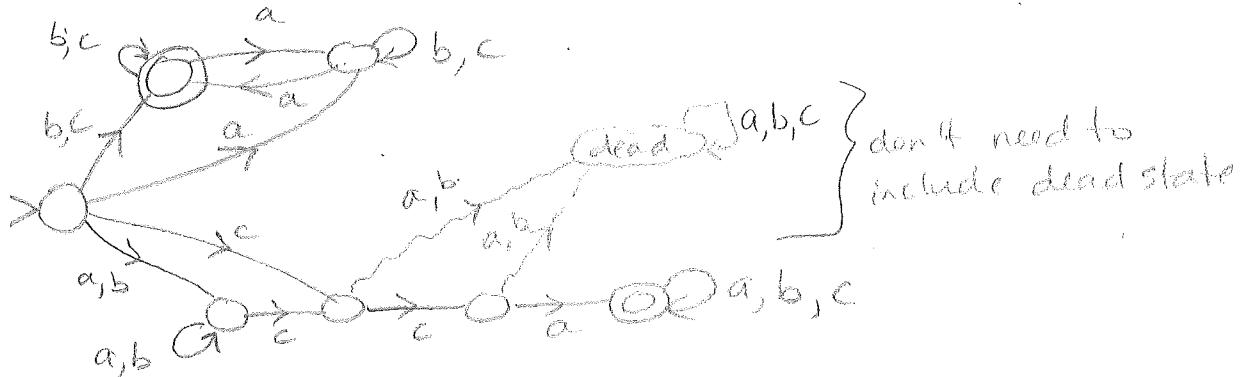


← don't need to include dead state.

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



2. Use non-determinism in an NFA that accepts the following language:  $\{w \in \{a,b,c\}^* \mid w \text{ has an even number of } a\text{s or contains } cca \text{ as a substring (or both)}\}$ .



3. For each of the string descriptions below, give a regular expression for the language of such strings. Assume the alphabet is  $\{a,b,c\}$  unless otherwise stated.

(a) All strings that contain baab or baaab as a substring.  
 $(a+b+c)^* (baab + baaab) (a+b+c)^*$

(b) Strings where no  $b$  is followed by  $a$ .  
 $(b^*c + a)(\epsilon + b)$

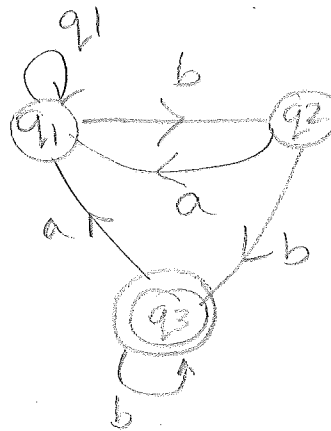
(c) Strings over  $\{a,b,c\}$  that have at least three  $c$ s.  
 $(a+b)^* c (a+b)^* c (a+b)^* c (a+b+c)^*$

(d) Strings that have no three  $c$ s in a row – that is, do not have  $ccc$  as a substring.  
 $(a + b + ca + cb + cca + ccb)^* (c + cc + \epsilon)$

(e) Strings that have no  $cs$  and an odd number of  $as$ .  
 $b^* (ab^* ab^*)^* a b^*$

- (f) The strings over  $\{a,b\}$  accepted by the DFA that has states  $q_1, q_2,$  and  $q_3$ , where  $q_1$  is the start state, and where the set of accept states is  $\{q_3\}$ , and where the transition function is the following:

state	input	destination state
$q_1$	$a$	$q_1$
$q_1$	$b$	$q_2$
$q_2$	$a$	$q_1$
$q_2$	$b$	$q_3$
$q_3$	$a$	$q_1$
$q_3$	$b$	$q_3$



Answer:  $(a+b)^* bb$