

# Assignment #10

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(18)  $L = \{w \in \{a, b\}^* : n_a(w) = n_b(w); w \text{ does not contain a substring } aab\}$

First, recognize that the language:

$L_1 = \{w \in \{a, b\}^* : n_a(w) = n_b(w)\}$  is context-free, we've looked at the NPDA for it.

Then the language:

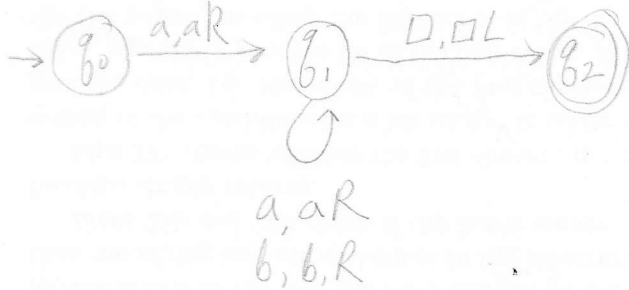
$L_2 = \{aab\}$  is finite (in fact has only one string) so is regular.

Now,

$L = L_1 - L_2$  and thus, by regular difference,

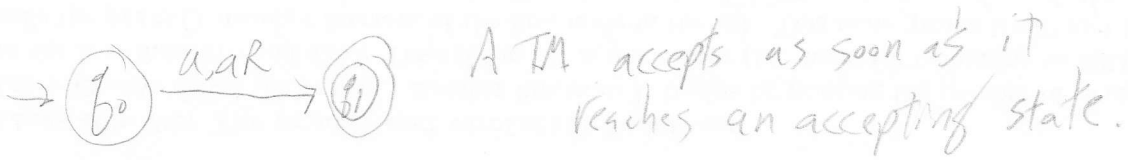
$L$  is context-free.

②



And see answer in back of text

Because a TM doesn't have to read the whole input string the following 2 state TM will work:



③ aba

Initial configuration:  $q_0 a b a \vdash x q_1 b a \vdash q_2 x y a$

$\vdash x q_0 y a \vdash x y q_3 a$  fail there's no transition for  $\delta(q_3, a)$ .

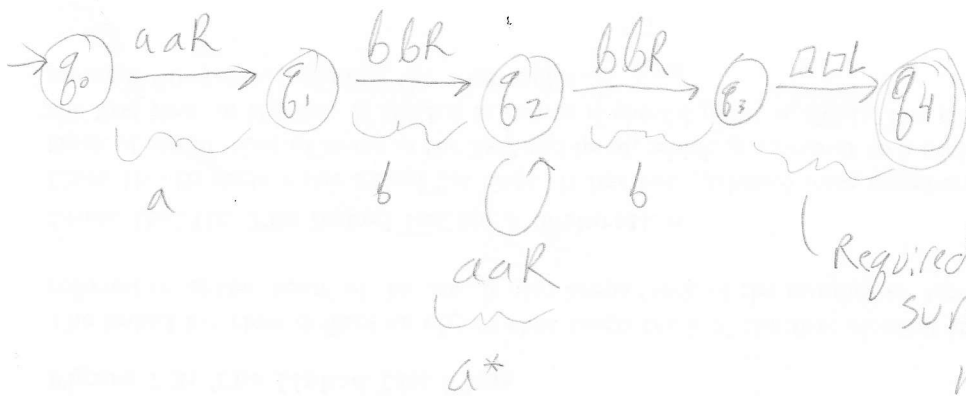
aaa bbbb

The TM expects more y's or a blank (in which case it accepts)

several steps  $\rightarrow$

$q_0 a a a b b b b \vdash x q_1 a a b b b b$   
 $\vdash^* x a a q_1 b b b b \vdash x a q_2 a y b b b \vdash^* q_2 x a a y b b b \vdash x q_0 a a y b b b$   
 $\vdash x x q_1 a y b b b \vdash^* x x a y q_1 b b b \vdash x x a y q_2 y b b \vdash^*$  goes back replaces a w/ x then b w/ y  
 finally  $\vdash^* x x x q_0 y y y b \vdash x x x y q_3 y y b \vdash^* x x x y y y q_3 b$  fail

$$7a) L = L(aba^*b)$$



Required to make sure there are no "extra" characters.