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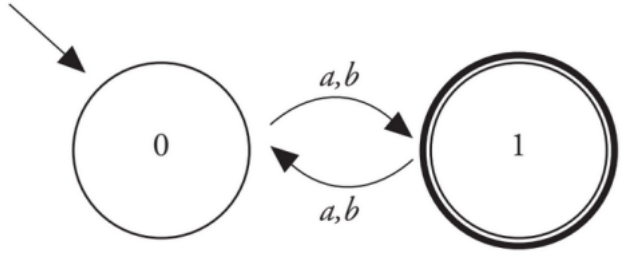
CMPT440 - Formal Languages and Computability
Assignment 3 - Nondeterministic Finite Automata

1. **Webber Chap. 3 Exercise 6**
   Prove by induction that $L(M) = \{x\ \varepsilon\ \{a,b\}^* \mid |x|\ mod\ 2 = 1\}$



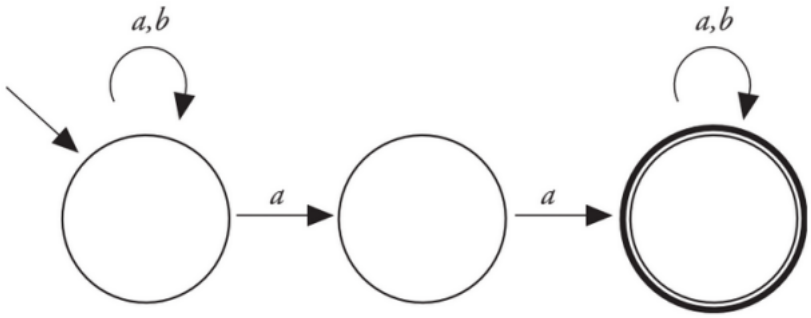
Base case: $When\ \ |x| = 0,$
$\delta^*(0,x)$
$= \delta^*(0,\epsilon)$
$= 0$
$= |x|\ \ mod\ \ 2$

Inductive case: $When\ \ |x| > 0,$
$\delta^*(0,x)$
$= \delta^*(0,yc)$
$= \delta(\delta^*(0,y),c)$
$= \delta(|y|\ \ mod\ \ 2,c)$
$= (|y|\ \ mod\ \ 2 + c)\ \ mod\ \ 2$
$= |yc|\ \ mod\ \ 2$
$= |x|\ \ mod\ \ 2$

$\delta^*(0,x) = |x|\ \ mod\ \ 2$

Conclusion: Since the only accepting state is 1, the language of strings accepted by the DFA is $L(M) = \{x\ \epsilon\ \{a,b\}^* \mid |x|\ mod\ 2 = 1\}$.

2. **Webber Chap. 5 Exercise 1**
For each of the following strings, say whether it is in the language accepted by this NFA:



(a) aa - accepted

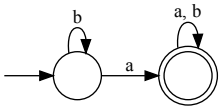
(b) baabb - accepted

(c) aabaab - accepted

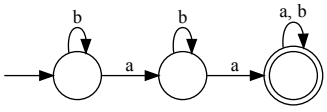
(d) ababa - rejected

(e) ababaab - accepted

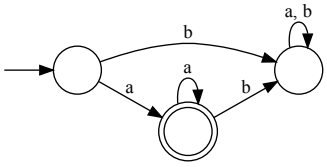
3. **Webber Chap. 5 Exercise 3**
Draw a DFA that accepts the same language as each of the following NFAs. Assume that the alphabet in each case is a, b; even though not all the NFAs explicitly mention both symbols, your DFAs must.



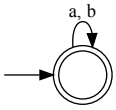
(a)



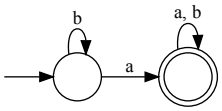
(b)



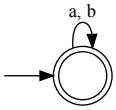
(c)



(d)



(e)



(f)