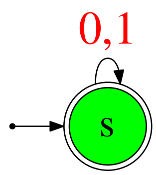
December 13, 2017

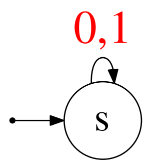
Consider an NFA $N = (Q, \Sigma, \delta, s, A)$. A standard mental exercise is to try and negate it. Namely, consider the NFA $\overline{N} = (Q, \Sigma, \delta, s, Q \setminus A)$.

1. $L(\overline{N}) = \overline{L(N)}$:

N:



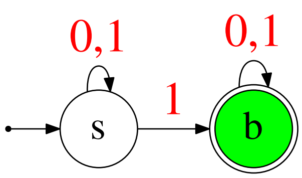
$\overline{N}$:



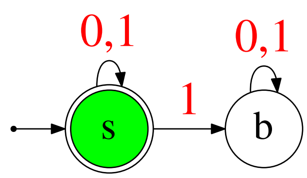
$L(N) = \{0, 1\}^*$, and $L(\overline{N}) = \emptyset$.

2. $L(N) \subsetneq L(\overline{N})$:

N:



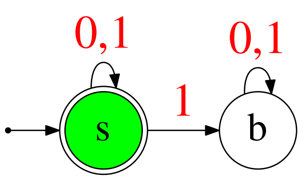
$\overline{N}$:



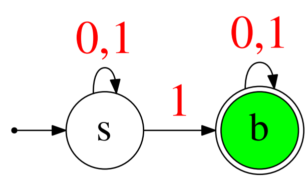
$L(N) = (0+1)^* 1 (0+1)^*$, and $L(\overline{N}) = \Sigma^*$.

3. $L(N) \not\subseteq L(\overline{N})$:

N:



$\overline{N}$:



$L(N) = \Sigma^*$ and $L(\overline{N}) = (0+1)^* 1 (0+1)^*$.

In conclusion, that is no meaningful relation between $L(N)$ and $L(\overline{N})$.