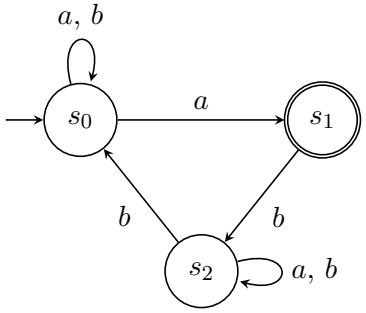
Exercises

[Compiled on August 29, 2017]

1. Given an alphabet $\{1, 2, +\}$, draw a finite state automaton such that the automaton accepts words evaluated to 3.

2. Apply subset construction to determinize the following automaton.



3. Let $M_1 = (Q_1, \Sigma, \delta_1, I_1, F_1)$ and $M_1 = (Q_2, \Sigma, \delta_2, I_2, F_2)$ be two NFAs. Construct an NFA M_3 such that $L(M_3) = L(M_1) \backslash L(M_2)$. Please describe the components of M_3 in detail.

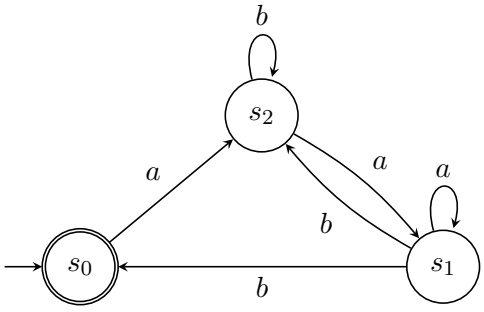
4. Write regular expressions to describe the following languages. ($\Sigma = \{a, b\}$)

   (a) $\{w \mid$ the length of w is even$\}$

   (b) $\{w \mid w$ has at most two b's$\}$

   (c) $\{w \mid$ every a in w is followed by $b\}$

5. Express the language of the following automaton by a regular expression.



6. Write WS1S formulas to describe the following words.

   (a) Only a's can occur between any two occurrences of b's

   (b) Has an odd length (please start with $\exists$)

7. Draw a Büchi automaton that accepts infinite words where p holds infinitely many times. ($\Sigma = \{p, \neg p\}$)

8. Express the following sentences in LTL formulas.

   (a) "p occurs infinitely often"

   (b) "whenever a message is sent, eventually an acknowledgement will be received"