Assignment 1

Due February 12, 4:35 p.m. Please remember that consulting outside or online materials for help with this assignment is a breach of academic integrity, which must be reported to the Academic Panel.

Problem 1

Consider the following deterministic finite automaton (DFA), $M$:

```
  b
 start q0 ----> a q1 ----> a q2 ----> b q3
      |       |       |       |
      b       a       |       |
```

a. What is the start state of $M$?

b. What is the set of accept (final) states of $M$?

c. What sequence of states does $M$ go through on input $bbaaa$?

d. Does $M$ accept the input $babababa$? (Briefly explain why or why not.)

e. Describe the set of strings accepted by $M$.

Problem 2

Give state diagrams of deterministic finite automata (DFAs) recognizing the following languages over $\Sigma = \{a, b\}$:

a. All strings except the empty string.

b. $\{w \mid w$ starts with an $a$ and has odd length, or $w$ starts with a $b$ and has even length$\}$

c. $\{w \mid w$ is any string not in $a^*b^*$}$

d. $\{w \mid |w| \mod 3 = 0\}$, i.e., the length of $w$ divides evenly by 3

Problem 3

Construct nondeterministic finite automata (NFAs) – with or without $\varepsilon$-transitions – to recognize the following languages:

a. $\{w \in \Sigma^* \mid w$ ends in $a, bb,$ or $ccc\}$, where $\Sigma = \{a, b, c\}$.

b. $\{w \in \Sigma^* \mid w$ contains at least two bs with exactly five characters between them$\}$, where $\Sigma = \{a, b\}$. E.g., $baaaaab$ is in the language, as is $aabaabaaabbb$, but $bbbb$ is not, nor is $aaabab$. 