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), $M$:

![DFA Diagram]

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 $\epsilon$-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 $b$s with exactly five characters between them\}$, where $\Sigma = \{a, b\}$. E.g., $baaaaab$ is in the language, as is $aabaababbb$, but $bbbb$ is not, nor is $aaabab$. 