

Assignment 2

1. Assume that the alphabet is $\{a, b\}$. Give the state diagram of a DFA that recognizes the language, $\{w \mid w \text{ has an even number of } a\text{'s and one or two } b\text{'s}\}$
2. Assume that the alphabet is $\{a, b\}$. Give the state diagram of a DFA that recognizes the language $\{w \mid w \text{ does not contain the substring } baba\}$
3. Give regular expressions generating the languages. In all parts, the alphabet is $\{0, 1\}$.
 - a. $\{w \mid w \text{ begins with a 1 and ends with a 0}\}$
 - b. $\{w \mid w \text{ contains at least three 1s}\}$
 - c. $\{w \mid w \text{ contains the substring } 0101 \text{ (i.e., } w = x0101y \text{ for some } x \text{ and } y)\}$
 - d. $\{w \mid w \text{ has length at least 3 and its third symbol is a 0}\}$
 - e. $\{w \mid w \text{ starts with 0 and has odd length, or starts with 1 and has even length}\}$
 - f. $\{w \mid w \text{ doesn't contain the substring } 110\}$
 - g. $\{w \mid \text{the length of } w \text{ is at most 5}\}$
 - h. $\{w \mid w \text{ is any string except } 11 \text{ and } 111\}$
 - i. $\{w \mid \text{every odd position of } w \text{ is a 1}\}$
 - j. $\{w \mid w \text{ contains at least two 0s and at most one 1}\}$
 - k. $\{\epsilon, 0\}$
 - l. $\{w \mid w \text{ contains an even number of 0s, or contains exactly two 1s}\}$
 - m. The empty set
 - n. All strings except the empty string
4. Give the state diagrams of NFAs recognizing the union of the languages
 - a. $A = \{w \mid w \text{ contains the substring } 0101 \text{ (i.e., } w = x0101y \text{ for some } x \text{ and } y)\}$
 - b. $B = \{w \mid w \text{ doesn't contain the substring } 110\}$
5. Convert the following regular expressions to nondeterministic finite automata.
 - a. $(0 \cup 1)^*000(0 \cup 1)^*$
 - b. $((00)^*(11)) \cup 01)^*$