

Practice problems set 2

1. Determine whether the following languages are regular or not. If a language is regular, provide a DFA that recognizes it. If a language is not regular, explain why.

Consider the alphabet $\Sigma = \{0, 1\}$.

- a. $L_1 = \{w \mid w \text{ contains an equal number of 0's and 1's}\}$
- b. $L_2 = \{w \mid w \text{ has at least two consecutive 0's followed by two consecutive 1's}\}$
- c. $L_3 = \{010, 1\}$
- d. $L_4 = \{a^n b^n \mid n \geq 0\}$ over $\Sigma = \{a, b\}$.

2. Give state diagrams of DFAs recognizing the following languages. In all cases, the alphabet is $\{0, 1\}$.

- a. $\{w \mid w \text{ accepts even number of 0's and even number of 1's}\}$
- b. $\{w \mid w \text{ contains fifth symbol 1}\}$
- c. $\{w \mid w \text{ is in } \{0, 1\}^* \text{ and } w \text{ does not have two consecutive 1's}\}$

3. Design a DFA that accepts all strings over the alphabet $\{a, b\}$ that contain the substring *abbb*.

- a.** $\{w \mid w \text{ begin with "aba" and end with "bb"}. \}$
- b.** $L = \{w \mid w \text{ is a string of a's and b's that has an odd length } \}.$
- c.** $L = \{w \mid w \text{ begin with 'a' but do not contain 'aab' as a substring } \}.$