Discussion 4

1. Exercise 2.2(a,b)
2. Give an informal description and a state diagram for a pushdown automata for the language

   $$L_1 = \{0^i 1^j 2^k \mid i = j \text{ or } j = k, \text{ where } i, j, k \geq 0\}$$

   Assume the alphabet $\Sigma = \{0, 1, 2\}$.
3. Exercise 2.11
4. Show using the pumping lemma that the language $\{a^n b a^{2n} b a^{3n} \mid n \geq 1\}$ is not context-free. Assume the alphabet $\Sigma = \{a, b\}$.
5. Show that the following langauge is not context-free.

   $$L_2 = \{w \mid w \text{ contains an equal number of } a, b, c \text{ symbols}\}$$

   Assume the alphabet $\Sigma = \{a, b, c\}$.
6. Give an implementation-level description of a Turing Machine that decides the following language. Assume the alphabet $\Sigma = \{0, 1\}$.

   - $L_3 = \{w \mid w \text{ contains an equal number of } 0s \text{ and } 1s\}$
7. Problem 3.9(a,b)