

1. Exercise 2.1

- a.
- b.
- c.
- d.

2. Construct a pushdown automata that recognizes

$$\{w \mid w \in \{0,1\}^* \text{ s.t. the number of 0's in } w = \text{the number of 1's in } w\}$$

3. Exercise 2.2

4. Exercise 2.4b

5. Give a CFG for

$$\{0^a 1^b 2^c 3^d 4^e 5^f \mid \text{such that } a, b, c, d, e, f \geq 0 \text{ and } a + b = d + e\}$$

6. Exercise 2.4e

7. Put the rules following in Chomsky normal form (assume that  $S$  is the new start variable)

$$\begin{aligned} S &\rightarrow aAA \mid aBC \mid abc \\ A &\rightarrow AA \mid Aa \mid ab \\ B &\rightarrow aaBC \mid BC \\ C &\rightarrow a \mid bc \end{aligned}$$

8. Exercise 2.15

9. Show the following is context free using a CFG

$$\{xy \mid x, y \in \{0,1\}^*, |x| = |y|, y \neq x^R\}$$

10. Construct a pushdown automata that recognizes

$$\{w \mid w \text{ is an element of } \{a,b,c,d\}^* \text{ such that the number of a's in } w \text{ plus the number of b's in } w \text{ is equal to the number of c's in } w \text{ plus the number of d's in } w\}$$