1. Find CFGs that generate the following regular languages. Assume $\Sigma = \{a, b\}$

(a) All strings that end in $b$ and have an even number of $b$'s in total
(b) All strings without the substring $aaa$

2. For the following CFG, find a regular expression that defines the language. Also describe the language.

$$
S \rightarrow aS \mid bX \mid a \\
X \rightarrow aX \mid bY \mid bZ \mid a \\
Y \rightarrow aY \mid a \\
Z \rightarrow aZ \mid bW \\
W \rightarrow aW \mid a
$$

3. Starting with the alphabet $\Sigma = \{a, b, (, +, *)\}$, find a CFG that generates all regular expressions. Is this language regular?

4. Find a regular form of the following CFG:

$$
S \rightarrow XY \\
X \rightarrow aX \mid Xa \mid a \\
Y \rightarrow bY \mid b
$$

5. Remove all $\Lambda$-productions from the following CFG:

$$
S \rightarrow XaX \mid bX \\
X \rightarrow XaX \mid XbX \mid \Lambda
$$

6. Remove all unit productions from the following CFG:

$$
S \rightarrow aX \mid Yb \\
X \rightarrow S \\
Y \rightarrow bY \mid b
$$
7. Convert the following CFG to CNF
   \[ E \rightarrow E + E \]
   \[ E \rightarrow E \ast E \]
   \[ E \rightarrow (E) \]
   \[ E \rightarrow 7 \]

8. Create a PDA for EVEN-EVEN

9. Build a deterministic PDA that accepts the language \( a^n b^{n+1} \) (Assume \( n > 0 \))

10. Consider the following PDA (Assume \( \Sigma = \{a, b\} \))

   ![Diagram](image)

   (a) Trace the following words on the PDA (show STACK and TAPE and STATE)
   
   \[ aaabbb \] and \[ aaaabb \]

   (b) Find a CFG that defines the language accepted by the PDA

   (c) Describe the language in English