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
   
   $E \rightarrow E + E$
   $E \rightarrow E * E$
   $E \rightarrow (E)$
   $E \rightarrow 7$
8. Create a PDA for EVEN-EVEN (even number of a’s and b’s in any order)

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

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

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(a) Trace the following words on the PDA (show STACK and TAPE and STATE)

- $aaabbb$
- $aaaabb$

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

(c) Describe the language in English