1) (30 pts) Find a context free grammar for each of the following languages: (language can also be represented by basic operations of other languages)
   a) (7 pts) \( L = \{a^nb^m : n \neq m-1\} \)
   b) (7 pts) \( L = \{a^nb^m : 2n \leq m \leq 3n\} \)
   c) (7 pts) \( L = \{a^nb^mc^k : k = n + m\} \)
   d) (9 pts) \( L = \{uvwv^R : u, v \in \{a, b\}^+, |u| = |w| = 2\} \)

2) (5 pts) Suppose \( L = \{a^nb^n : n \geq 0\} \):
   a) Show that \( L^2 \) is a context free language
   b) Show that \( L^k \) for every \( k \geq 1 \) is also context free

3) (10 pts) Remove the useless productions from the following grammar:
   \[
   \begin{align*}
   S & \rightarrow aA \mid a \mid B \mid C \\
   A & \rightarrow aB \mid \lambda \\
   B & \rightarrow Aa \\
   C & \rightarrow cCD \\
   D & \rightarrow ddd
   \end{align*}
   \]

4) (10 pts) Remove the nullable variables from this grammar:
   \[
   \begin{align*}
   S & \rightarrow AaB \mid aaB \\
   A & \rightarrow \lambda \\
   B & \rightarrow bbA \mid \lambda
   \end{align*}
   \]

5) (25 pts) Convert the following grammar to the Chomsky normal form:
   \[
   \begin{align*}
   S & \rightarrow abAB \\
   A & \rightarrow bAB \mid \lambda \\
   B & \rightarrow BAa \mid A \mid \lambda
   \end{align*}
   \]

6) (20 pts) Convert the following grammar to the Greibach normal form:
   \[
   \begin{align*}
   S & \rightarrow ABb \mid a \\
   A & \rightarrow aaA \mid B \\
   B & \rightarrow bAb
   \end{align*}
   \]