CSCI 2400 – Models of Computation

Homework 5

Problem 1 (Chomsky Normal Form). Convert the following grammars to Chomsky normal forms.

(a) \( S \rightarrow aSbSa \mid ab. \)

(b)

\[
\begin{align*}
S & \rightarrow aSA \mid A \\
A & \rightarrow aA \mid bB \\
B & \rightarrow \lambda \mid S
\end{align*}
\]

Problem 2 (Pushdown Automata). Draw pushdown automata that accept the following languages defined over the alphabet \{a, b\}:

(a) \( L = \{ w : n_a(w) = n_b(w) + 3 \} \)

(b) \( L = \{ w : n_a(w) \leq n_b(w) \} \)

(c) \( L = \{ w : n_a(w) \neq n_b(w) \} \)