Reading assignment: Reading Section 2.1 of Sipser’s text and the handouts on Chomsky Normal Form and the CKY algorithm.

Problems:

1. Sipser’s text, page 121, Problem 2.15.

2. Sipser’s text, page 120, Exercise 2.4 part (e). Justify your grammar design.

3. Sipser’s text, page 120, Exercise 2.6: For part (b) assume alphabet \( \{a, b\} \). Justify your grammar designs.

4. Convert the following grammar to Chomsky normal form using the procedure on the handout.

\[
\begin{align*}
S & \rightarrow A \mid ABa \mid AbA \\
A & \rightarrow Aa \mid \epsilon \\
B & \rightarrow Bb \mid BC \\
C & \rightarrow CB \mid CA \mid bB
\end{align*}
\]

5. Sipser’s text, page 121, Problem 2.19.


7. (Bonus) A CFG \( G = (V, \Sigma, R, S) \) is regular (also known as right-linear) iff every rule of \( G \) is of the form \( A \rightarrow wB \) or \( A \rightarrow w \) for \( w \in \Sigma^* \) and \( A, B \in V \).

In class we showed that every regular language is \( L(G) \) for some regular grammar \( G \). Complete the proof that regular grammars generate precisely the regular languages by showing that every regular grammar \( G, L(G) \) is regular.

8. (Bonus) Sipser’s text, page 122, Problem 2.25.