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CSci 311: Models of Computation
CSci 500: Fundamental Concepts of Computing
Fall 2024 Homework #2
Due Date: October 24, 2024 by 2:30 p.m.

Directions: Do all of the question. For each problem where you are creating an NPDA, don't forget to write the septuple on paper and submit a JFlap file.

1. Find an s-grammar for the language, $L = \{a^n b^{n+1} : n \geq 2\}$. (2 points)
2. Convert the CFG, $G = (\{S, A\}, \{a, b\}, S, P)$ with productions

$$\begin{aligned} S &\rightarrow aSa \mid bSb \mid aAb \\ A &\rightarrow aAb \mid ab \end{aligned}$$

into Backus-Naur Form (BNF). (3 points)

3. Convert the CFG, $G = (\{S, A\}, \{a, b\}, S, P)$ with productions

$$\begin{aligned} S &\rightarrow aSa \mid bSb \mid aAb \\ A &\rightarrow aAb \mid ab \end{aligned}$$

into Chomsky Normal Form (CNF). (3 points)

4. Construct an npda that accepts the language, $L = \{ab(ab)^n b(ba)^n : n \geq 0\}$. (5 points)
5. Construct an npda that accepts the language, $L = \{aab * aba^*\}$. (5 points)
6. Construct an npda that accepts the language, $L = \{a^n b^m c^{n+m} : n \geq 0, m \geq 0\}$. (5 points)
7. Construct an npda that accepts the language, $L = \{w : n_a(w) = 2n_b(w)\}$. (5 points)
8. Construct an npda that accepts the language, $L = \{a^n b^m : n \geq 0, m \neq n\}$. (5 points)
9. Show that the language, $L = \{a^n b^{2n} : n \geq 0\}$ is a deterministic context-free language. (5 points)