CS 341 Automata Theory
STUDENT NAME - EID
Homework 8
Due Tuesday, March 6

This assignment covers Chapter 12.

1) Build a PDA to accept each of the following languages L:

   a) $\{a^n b^m : m \leq n \leq 2m\}$.

   Solution: ☐

   b) $\{w \in \{a, b\}^* : \text{every prefix of } w \text{ has at least as many a's as b's}\}$.

   Solution: ☐

   c) $\{a^n b^m : m \geq n, m - n \text{ is even}\}$.

   Solution: ☐

2) Let $L = \{ba^{m_1} ba^{m_2} ba^{m_3} \ldots ba^{m_n} : n \geq 2, m_1, m_2, \ldots, m_n \geq 0, \text{ and } m_i \neq m_j \text{ for some } i, j\}$.

   a) Show a PDA that accepts L.

   Solution: ☐

   b) Show a context-free grammar that generates L.

   Solution: ☐

   c) Prove that L is not regular.

   Proof: ☐

3) Consider the language $L = L_1 \cap L_2$, where $L_1 = \{ww^R : w \in \{a, b\}^*\}$ and $L_2 = \{a^n b^* a^n : n \geq 0\}$.

   a) List the first four strings in the lexicographic enumeration of L.

   Solution: ☐

   b) Write a context-free grammar to generate L.

   Solution: ☐

   c) Show a natural PDA for L. (In other words, dont just build it from the grammar using one of the two-state constructions presented in the book.)

   Solution: ☐

   d) Prove that L is not regular.

   Proof: ☐

4) * Let $L = \{w \in \{a, b\}^* : \text{the first, middle, and last characters of } w \text{ are identical}\}$.

a) Show a context-free grammar for L.

   Solution: □

b) Show a natural PDA that accepts L.

   Solution: □

c) Prove that L is not regular.

   Proof: □