Homework 3
COSE215, Spring 2019

Hakjoo Oh

Due: 5/22 (Wed) (in class)

Problem 1 (30pts) Design context-free grammars for the following languages:

1. The language described by regular expression $0^*1(0+1)^*$
2. $L = \{a^n b^m \mid n \neq m - 1\}$ (n and m are non-negative integers)
3. $L = \{w \in \{a, b\}^* \mid n_a(w) \neq n_b(w)\}$

Problem 2 (15pts) Consider the grammar

$$S \to aS \mid aSbS \mid \epsilon$$

This grammar is ambiguous. Show that the string aab has two:

1. Parse trees.
2. Leftmost derivations.
3. Rightmost derivations.

Problem 3 (10pts) Design a PDA that accepts the following language:

$$L = \{0^n 1^n \mid n \geq 1\}$$

Problem 4 (10pts) Design a deterministic PDA that accepts the following language:

$$L = \{wcw^R \mid w \in \{a, b\}^*\}$$

Problem 5 (15pts) Design a deterministic PDA that accepts the language:

$$L = \{0^n 1^m \mid n \leq m\}$$

Problem 6 (20pts) Consider the following grammar:

$$\begin{array}{lcl} S & \to & ASB \mid \epsilon \\ A & \to & aAS \mid a \\ B & \to & SbS \mid A \mid bb \end{array}$$

1. Eliminate ϵ-productions.
2. Eliminate any unit productions in the resulting grammar.
3. Eliminate any useless symbols in the resulting grammar.
4. Put the resulting grammar into Chomsky Normal Form.