Section Handout 5

Problem One: Designing PDAs

Below are a list of alphabets and languages over those alphabets. For each language, design a pushdown automaton that recognizes the given language.

i. Let Σ = {`0`, `1`, `?`} and let L = { *x*`?`*y* | *x*, *y* ∈ {`0`, `1`}* and *y* is the reverse of *x* }. Design a **deterministic** PDA that recognizes *L*.

ii. Let Σ = { `0`, `1`, `2` } and let L = { $\texttt{0}^m\texttt{1}^n\texttt{2}^p$ | *m*, *n*, *p* ∈ ℕ ∧ (*m* = *n* ∨ *m* = *p*) }. Design a PDA that recognizes *L*.

Problem Two: The Pumping Lemma

Let Σ = {`0`, `1`, `A`, `B`} and let *TWOWAYBALANCE* = { w | w contains the same number of `0`s and `1`s and the same number of `A`s and `B`s }. Prove that *TWOWAYBALANCE* is not context-free.*

Problem Three: Turing Machine Design

Write a **WB** program that accepts the language of all balanced parentheses over Σ = { `(`, `)` }. You can assume that the input has been shifted over by one step, leaving a blank cell in the first position on the tape, and that the tape head is now reading the very first symbol of the input (or a blank if the input was empty).

* This problem adapted from Problem 2.32 from Sipser.