

Section 2.2: Pushdown Automata

These exercises reflect material from our text, *Introduction to the Theory of Computation*, by Michael Sipser, PWS Publishing Co., 1997.

Definitions

Define each of the following concepts:

- (a) Pushdown automaton, $M = (Q, \Sigma, \Gamma, \delta, q_0, F)$
- (b) Transition function of a pushdown automaton, $\delta : Q \times \Sigma_\epsilon \times \Gamma_\epsilon \rightarrow \mathcal{P}(Q \times \Gamma_\epsilon)$

Results

Sketch the proof of the following theorem:

The language L is context-free iff

- (i) L is generated by a CFG
- (ii) L is accepted by a PDA

Sketch the proof of the following theorem: Regular languages are context-free.

Sketch the proof of the following theorem: The class of context-free languages is closed under the regular operations, union, concatenation, and star.

Algorithms

Given a PDA, construct an equivalent CFG.

Given a CFG, construct an equivalent PDA.

Exercises

We will attempt to solve each of the following exercises as a community project in class today. Finish these solutions as homework exercises, write them up carefully and clearly, and hand them in at the beginning of the next class.

Exercises for Section 2.2, pages 120–121: 5, 6, 7, 8, 9, 10, 11, 12