Sections 3.1-3.3: Turing Machines

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) Turing machine, $M = (Q, \Sigma, \Gamma, \delta, q_0, q_{accept}, q_{reject})$

(b) Transition function of a Turing machine, $\delta : Q \times \Gamma \to Q \times \Gamma \times \{L, R\}$

(c) A configuration of a Turing machine M

(d) The language $L(M)$ of a Turing machine M

(e) A Turing-decidable language

(f) A Turing-recognizable language

(f) A multitape Turing machine

(f) A nondeterministic Turing machine

(f) An enumerator

(f) An algorithm

Representations

Give two important representations of Turing machines.

Results

Give several examples of Turing-decidable languages, and the Turing machines which decide them.

State the principle result concerning the equivalence or lack thereof of the princple variants of Turing machines: multitape Turing machines, nondeterministic Turing machines, and enumerators.

State the Church-Turing hypothesis. Why is it an hypothesis and not a theorem?

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 Chapter 3, pages 147–148: 1, 2, 3, 4, 5, 6, 7, 8

Problems for Chapter 3, page 149: 14, 15