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Theory of Computability

Decidability

Chapter 4

Examples of decidable languages

Decidable:

- {1,3,5}
- $\varnothing$
- {x | x is even}
- {x | x is a perfect square}
- {x | x^2-10x = 0}
- {x | x=y∗z for some integers y,z>1 (i.e. x is not prime)}
- {x | x is a prime (i.e. x is not divisible by anything except 1 and itself)}
- {<G> | G is a connected graph}
- {<P> | P is a one-variable polynomial expression with an integral root}

Undecidable:

- {<P> | P is a two-variable polynomial expression with an integral root}

The acceptance problem for DFAs is decidable

Let A_{DFA} = {<B,w> | B is a DFA that accepts input string w}

Theorem 4.1: A_{DFA} is a decidable language.

Proof idea: Here is a Turing machine M that decides A_{DFA}:

M = "On input <B,w>, where B is a DFA and w is a string:

1. Simulate B on input w.
2. If the simulation ends in an accept state, *accept*.
   If the simulation ends in a nonaccept state, *reject*."