Concepts

CS 381—Introduction to Theory of Computing, Fall 2007

September 10, 2007

1 Four basic ideas

Four basic ideas that will be important

(1) Diagonalization

(2) Nondeterminism

(3) Reduction of one problem to another

(4) Interweaving

2 Notation

- ϵ, $\{\epsilon\}$, $\emptyset$
- $L_1 \cdot L_2 = \{xy \mid x \in L_1, y \in L_2\}$
- $L^* = \{\epsilon\} \cup L \cup L^2 \cup \cdots$
- 2^S is the set of all subsets of S
- $\{0^n 1 0^n 1 \mid n \geq 1\}$ and $\{0^n 1 0^n 1 \mid n \geq 1\}^*$

3 Concepts

- object and name of object
- finite but arbitrarily large
- contably infinite
- noncountably infinite

- diagonalization
- $\{0+1\}^*$, the set of all finite length strings of 0's and 1's is countably infinite
- $2^{\{0+1\}^*}$, the set of all subsets of finite length string is not countably infinite
- induction
- (deterministic) finite automaton (FA or fa or DFA or dfa)
- nondeterministic finite automaton (NFA or nfa)
- ϵ-nfa (nondeterministic finite automaton with ϵ transitions)
- ϵ-closure

4 Finite automaton

- construct finite automata from simple set description
- convert NFA to deterministic finite automaton
- subset construction
- cross product construction

5 Regular expressions

- definitions
- write regular expression corresponding to simple set description
- convert finite automaton to regular expression (deleting states)
- convert finite automaton to regular expression ($R^k_{i,j}$)
- convert regular expression to finite automaton

6 Closure properties of regular sets

- union ($L_1 \cup L_2$)
- intersection ($L_1 \cap L_2$)
- complement (L^c or $\bar{L}$)
- closure (L^*)
- set difference ($L_1 \setminus L_2$)
- homomorphism h
- inverse homomorphism h^{-1}
- reversal (L^R)

Wednesday, September 12, 2007

- definition of homomorphism
- proof that the class of regular sets if closed under homomorphism

Friday, September 14, 2007

- machine construction for closure of regular sets under homomorphisms
- inverse homomorphisms

Monday September 17, 2007

Proof that the class of regular sets is closed under shuffle using h, h^{-1} and intersection with regular sets

Wednesday September 19, 2007

Valid computation for dfa

A short summary: We reviewed inverse homomorphisms and the concept of a valid computation for a finite automaton. A valid computation has the state of the finite automaton inserted with the input symbol. This can be done by an inverse homomorphism and intersection with a regular set.