CoE/EE460
Switching Theory

Lecture 20

Washington University
Spring 2001

http://www.arl.wustl.edu/~lockwood/class/coe460/

Announcements

- Final Exam
  - Time
    - Friday May 4, 2001
    - 10:30am - 12:30pm
  - Place
    - Regular classroom
  - Material
    - Comprehensive
      - Exams 1-2
      - Lectures 1-19
      - Homeworks 1-8
  - Closed Book
    - Three pages of Notes allowed
- Homework 8:
  - Due Today!
- New Course
  - Fall 2001
  - CS/COE535m :
    - Acceleration of Algorithms in Hardware
    - Now Cross-listed with Computer Engineering
    - Sign up today if interested.
  - Network Packet processing in VHDL

Finite Automata

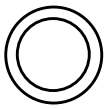
- Type of Finite State Machine
- Declares inputs to be:
  - Accepted -or-
  - Rejected
- Input : X
- State : S
- State Transitions : δ
- Initial State : S_0
- Accepting States : A

Regular Language

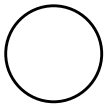
- Regular Language
  - Alphabet: Set of symbols, e.g. {0,1} or {a,b,c}.
  - String: Sequence of symbols in the alphabet
    - |S| = Length of String
    - Empty String: ε
      - $|\varepsilon| = 0$
  - L: Language = Set of strings
    - |L| = Size of language
    - Can be infinite

Accepted Language / Accepting States

- Accepted Language
  - Input = String
  - Output = Accepted
- NFA : Non-disjoint next-state transitions
  - Example Markov Chain



Accepting State (Output = 1)



(Output = 0)

DFA / NFA

- DFA : Deterministic Finite Automation
  - Next state transitions well-defined
- NFA : Non-deterministic Finite Automation
  - Multiple Next-state transitions possible
  - Concise Description
  - Non-physical implementation
- Example
  - Graph with states that allow transistion to non-singleton set of next-states.

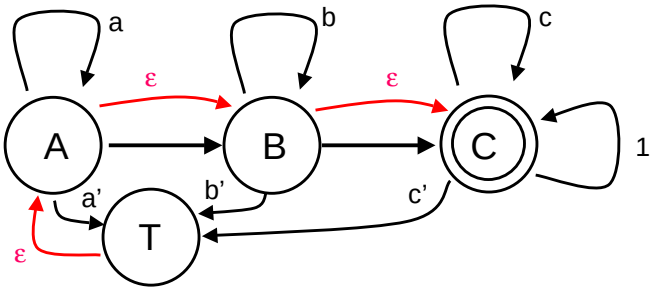
Finite State Transitions

- Deterministic Finite State Transitions
  - Consider (s,x) : $X \times S \rightarrow S$
  - Where $t = \delta(s,x) \in S$
- Non-Deterministic Finite Automata
  - Some $\delta(s,x)$ map to multiple states
    - For all possible S in S, X in X
  - Consider (s,x) : $X \times S \rightarrow 2^S$
  - Where $T = \delta(s,x) \in 2^S$
- Complete Deterministic Finite Automata
  - All possible $\delta(S_i,X_k)$ map to single state
    - For all possible S in S, X in X

NFAs

- Empty Input = ε
- State Transitions
  - Initial State
    - δ(A,a)=A, δ(A,a')=T, δ(A, ε)=B
  - Intermediate State
    - δ(B,b)=B, δ(B,b')=T, δ(B, ε)=C
  - Accepting State
    - δ(C,c)=C, δ(C,c')=T, Output = Accepted
  - Trap State
    - T

Transitions of NFA



- Accepting Strings
  - abc
  - aaabbbbcc
  - ac

Last Lecture Note of the Semester!

- Congratulations
  - You have worked hard throughout the semester!
- Where to go from here?
  - Classes next fall
    - CS/COE 535m: Acceleration of Algorithms in Hardware
  - Graduate School
    - Computer Engineering
    - Computer Science
    - EE
  - Industry
    - ASIC Design, Design Automation, Hardware Engineering
    - Xilinx, Altera, Intel, Cisco, Nortel, TI, Motorola, Others