

## COT 4210 Fall 2014 Midterm#1 Topics

1. Properties of sets, sequences, relations and functions
  - a. Basic notions
  - b. Proof techniques
2. Computability, complexity, languages
  - a. Basic notions
3. Finite state automata and Regular languages
  - a. Definitions: Deterministic and Non-Deterministic
  - b. Notions of state transitions, acceptance and language accepted
  - c. State diagrams and state tables
  - d. Construction from descriptions of languages
  - e. Closures: negation, union, exclusive or, negation
  - f. More closures: concatenation, star
  - g. More closures: Reverse, Prefix, Postfix, Substring
  - h. More yet: Max, Min
  - i. Conversion of NFA to DFA
    - i.  $\lambda$ -Closure --  $E(s)$  and  $E(S)$
    - ii. Subset construction
    - iii. Reachable states
    - iv. Reaching states
  - j. Minimizing DFAs (distinguishable states)
4. Regular expressions and Regular Sets
  - a. Definition of regular expressions and regular sets
  - b. Every regular sets is a regular language
  - c. Every regular language is a regular set
    - i. Ripping states (GNFA)
    - ii.  $R_{i,j}(k)$
    - iii. Regular equations
      1. Uniqueness of solution to  $R=Q+RP$
      2. Solving for expressions associated with states
5. Pumping Lemma
  - a. Classic non-regular languages  $\{0^n 1^n \mid n \geq 0\}$
  - b. Formal statement and proof of Pumping Lemma for Regular Languages
  - c. Use of Pumping Lemma
6. Grammars
  - a. Definition of grammar and notions of derivation and language
  - b. Restricted grammars: Regular (right and left linear); context free
  - c. Why you can't mix right and left linear and stay in Regular domain.
  - d. Relation of regular grammars to finite state automata