Review for Mid-Term Exam CS 220 — Applied Discrete Mathematics

Draft

The midterm exam will be Wednesday, March 12, in class.

- Written exam. (Bring something to write with!)
- You may bring up to 20 pages of handwritten notes. (That is, 20 pieces of loose paper, up to letter size.) No printouts, no photocopies.
- No other resources: no books, no computers, no friends, no cellphones/smartphones/tablets.
- Multiple questions per section
- Questions similar to homework

01 Sets

- ▶ set, element/member, \in , notation ({a, b, c})
- \blacktriangleright \emptyset , \mathbb{N} , \mathbb{Z} , \mathbb{Q} , \mathbb{R}
- \blacktriangleright cardinality (|S|)
- set-builder notation ({expr | rules})
- ▶ subset (\subseteq), proper subset (\subset)
- ordered pair ((a, b)), Cartesian product (×)
- ▶ power set (𝒫)
- union (\cup), intersection (\cap), difference (-)
- universe, set complement
- set identities*
- indexed sets
- disjoint, partition
- indexed summation, product, union, intersection

- statement
- domain knowledge vs logical structure
- propositional logic: variables, compound propositions, connectives
- truth value, truth tables
- ▶ connectives: not (¬), and (\land), or (\lor), conditional/implies (⇒), iff/biconditional (⇔)
- evaluating the truth of propositions
- logical equivalence, logical equivalences*
- tautology, contradiction, contingent
- satisfiable, valid, unsatisfiable
- from truth table to proposition in DNF

- open statement
- predicate logic: predicates, object variables
- universal (∀) vs existential (∃) quantifiers
- evaluating quantified propositions
- translating statements into predicate logic

- relations as sets of pairs
- relation properties: reflexive, symmetric, antisymmetric, transitive
- relation composition (°), powers
- {reflexive,symmetric,transitive}-closure
- partial order, total order
- equivalence relation, equivalent
- equivalence classes

05 Functions

- (total) function, domain, codomain, range
- partial vs total function
- ▶ injective, surjective, bijective
- strictly increasing/decreasing, monotone
- function composition (°)
- image, pre-image
- inverse
- ▶ identity function (id_A)
- ▶ floor ([]), ceiling ([])
- min, max, arg min, arg max
- function notations: cases, pattern-matching, tables, etc
- homomorphisms, isomorphisms
- Prof. Hilbert's hotel

Homework Review