CS131:
Review for the Final Exam

Exam date, time, location, what to bring:

- Thursday, May 5, 12:30pm-2:30pm
- CAS 224

- **Cheat sheet:** up to 4 double-sided pages, handwritten or printed

How to Prepare:

- Review the topics and types of questions listed in the review document
- Write/type & print out a cheat sheet
- Review midterm exam (some are still at my office)
- Review HWs 1-9, do HW corrections (till the end of Fri Apr29)
- Review Lectures 1-16 on Bb (there were no HWs on Lecture 15 and 16)
- For textbook sections corresponding to the topics review course schedule at Bb: Information

CS131:
List of Topics, Problem Types

Logic

- Writing propositional statements in a logical form, using
  - translating correctly: necessary, sufficient, if, implies, follows, iff, for any, all, there is/there are/exist
  - connective symbols: $\vee$, $\wedge$, $\neg$, $\rightarrow$,$\leftrightarrow$
  - quantifiers: $\exists$,$\forall$
  - variables; x,y
  - propositional functions: P(x)
- Translating math definitions into a logical form
- Evaluating their truth values via truth tables
- Checking whether propositions are equivalent
- Simplifying the propositions
- Negating propositions
- Analyzing arguments for validity via
  - valid/invalid argument forms
  - truth tables
  - Euler diagrams

Review:

- HW1,2,3
- Midterm exam
- Lectures 1-6

Sets

- **Topics:**
  - Set operations: $A \cap B$, $A \cup B$, $A \setminus B$
  - Empty set: $\emptyset$, disjoint sets
  - Relationship between sets: $A \subset B$, $A \subseteq B$, $A = B$
  - Venn and Euler set diagrams
- **Review:**
  - HW1 (#6), 4(#2,#6)
  - Midterm Exam: #8c
  - Lecture 3
  - How to Prove It: 1.3, 1.4

Proof Strategies

- **Topics:**
  - Direct proof, proof by contradiction, contrapositive
  - Proof of the statements with “and”, “or”, “not”, “for all”, “any”, “exists”, “if-then”, “iff”
  - Math induction and strong induction
- **Review:**
  - HW4, 5, 6
  - Midterm Exam
  - Lecture 8, 9,10

Recursive Definitions and Algorithms

- **Topics:**
  - Recursively defined sets
  - Define a property of a recursively defined set
  - Recursive algorithms
  - Prove correctness of a recursive algorithm by math or strong induction
- **Review:**
  - HW 5 (#5,#6), 6
  - Lecture 10

Recurrence Relations

- **Topics:**
  - Recurrence relations
    - linear 1st order – solving via backward substitutions
    - linear 2nd order homogeneous
    - linear k-th order homogeneous
    - linear non-homogeneous
    - divide-and-conquer
  - Time complexity of recursive algorithms
    - connection with recurrence relations
    - big-O estimate
- **Review:**
  - HW 6,7,8
  - Lecture 11,12

Combinatorics

- **Topics:**
  - Product rule
  - Sum rule
  - Pigeonhole Principle
  - Number of Permutations
  - Number of Combinations
  - Inclusion-Exclusion Principle
  - Binomial Coefficients of $(x+y)^n$
- **Review:**
  - HW 8,9
  - Lecture 13, 14

Graphs

- **Topics:**
  - Problems modeled by graphs
  - Types of graphs: complete, bipartite, circuit, wheel, n-cube
  - Relation between number of edges and degrees of vertices in undirected and directed graph
  - Connectivity undirected and directed graphs, connected components
  - Isomorphism between graphs
  - Representation of graphs in the computer
    - Adjacency list
    - Adjacency matrix
  - Number of paths between 2 vertices
  - Euler and Hamiltonian circuit and path
- **Review:**
  - Lecture 15
  - Problems solved during lab
  - **Rosen 10.4:** 1, 3-6, 11ab, 19; **Rosen 10.5:** 1,10, 30, 31

Trees

- **Topics:**
  - Problems modeled by trees
  - Which graph is called a tree?
  - Rooted tree, m-ary tree, balanced tree
  - Tree terms: nodes, edges, parents, children, ancestors, descendants, root, leaves, internal nodes, subtree of a node, level, height
  - Relations between number of nodes, edges, internal nodes, leaves, height in a tree
- **Review:**
  - Lecture 16
  - **Rosen 11.1:** 1, 17, 18.