CS 3233 Discrete Mathematical Structures – Fall 04

11/3/04

Material covered in class from 9/29/04 until 11/3/04

This is the material relevant for midterm 2

Week	Material
6	**Mathematical Induction (Ch. 3.3)** Induction proves sequence of propositions. Weak induction, strong induction. Base case, inductive step.
8	**Recursion (Ch. 3.4 until page 266, 3.5 until page 277; 6.1)** Recursive definitions: Recursively defined functions, recurrences. Fibonacci numbers, towers of Hanoi. Solve a recurrence: First guess a formula by expansion of the recurrence, then prove the guess by induction. Recursive algorithms.
9	**Counting, Pigeonhole Principle, Permutations and Combinations, Binomial Theorem (Ch. 4.1-4.4; 4.5 until page 338)** Count finite sets without listing all the elements. Union rules. Addition principle, multiplication principle. Count ordered tuples, or count subsets (unordered tuples). With repetition or without repetition of elements. Permutations, combinations. Pigeonhole principle. Binomial theorem, Pascal's triangle, Pascal's identity. Double counting to prove theorems.
10	**Discrete Probability, Random Variables and Expected Values (Ch. 5.1, 5.2 until page 366 and page 370, 5.3 until page 381)** Definition of probability P. Sample space Ω, event $E \subseteq \Omega$. If all outcomes are equally likely, then $P(E) = \frac{\lvert E \rvert}{\lvert \Omega \rvert}$. Rules for probability (such as $P(E \cup F) = P(E) + P(F) - P(E \cap F)$). Random variables. Expected value (of a random variable).
11	**Relations (Ch. 7.1, 7.2, 7.4 until page 498, 7.5)** Relations as subsets of cartesian products. Relations are generalizations of functions. Visualization of *binary* relations by directed graphs (with arrows representing the ordered pairs). Relations on a set: Reflexive, symmetric, antisymmetric, transitive. n-ary relations in databases: selection operator, projection operator, join operator. Closures of relations: Reflexive closure, symmetric closure, transitive closure. Equivalence relations, equivalence classes and partitions.

- Use the **pictures** on the web as an additional resource.
- A good review is to look over the **Key Terms and Results** at the end of every full chapter.
- The book provides many practice questions at the end of every section, as well as additional practice questions at the end of every full chapter. The answers to the odd numbered problems are given in the end of the book.

Midterm 2 is on Wednesday November 10 at the usual class time in the class room. It is closed-book and closed-notes.