

CIS 160 Mathematical Foundations of Computer Science

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| Course Number & Title (A.1) | CIS 160 Mathematical Foundations of Computer Science |
| Credit Units (A.2) | 1 CU (3 hours of lecture and 1 hour of recitation per week) |
| Instructor (A.3) | Max Mintz, Professor, mintz@cis.upenn.edu , 462 Levine Hall, 215-898-7909 |
| Text(s)/Required Materials (A.4) | 1) Lecture Notes on the Mathematical Foundations of Computer Science, by Max Mintz, 1996-2011. These notes and other material will be distributed in class. |
| Catalog Description (A.5a) | What are the basic mathematical concepts and techniques needed in computer science? The course provides an introduction to proof principles, number theory, functions and relations, induction principles, combinatorics, and graph theory, as well as a rigorous grounding in writing and reading mathematical proofs. |
| Prerequisites (A.5b) | none |
| Course Satisfies (A.5c) | [x] Math [] Science [] Engineering [] Technical Elective [] TBS (check only one, UG curric impact only) Required |
| Course Web | http://www.seas.upenn.edu/~cis160/ |
| Course Outcomes (A.6a) | <ul style="list-style-type: none"> • The student will learn what is a formal proof and what are the basic rules of logic. • The student will understand the need for formal proofs as well as the need for communicating and writing proofs informally. • The student will learn how to use: the proof-by-contradiction and proof-by-contrapositive methods. • The student will learn elementary number theory and its use in the development of the RSA algorithm. • The students will learn the elements of naïve set theory. • The student will learn how to prove properties by induction (ordinary and complete). • The student will learn what are functions and relations, and study the main properties of functions (injectivity, surjectivity, bijectivity). • The student will learn basic combinatorics, including combinatorial proofs, and the principle of inclusion-exclusion. • The student will learn concepts of graph theory (directed and undirected graphs) and basic connectivity properties. • Throughout the course, the student will be required to solve problems, using a high-level language like, Mathematica, Maple, or Java, that expand on the material presented in the lectures. • Students will develop skills for presenting arguments and proofs. |
| Contribution towards Program Outcomes (A.6b) | a,f |
| Topics Covered (A.7) | <ul style="list-style-type: none"> • Mathematical reasoning, proof principles and logic • Elementary number theory • Basic concepts of set theory • Well-ordered sets and the induction principle • Relations, functions, partial functions • Basic properties of functions: injectivity, surjectivity, bijectivity. • Inverse of a function. • Equinumerosity • Cantor diagonalization • Combinatorics: Permutations, combinations, combinatorial proofs, principle of inclusion-exclusion • Directed Graphs • Paths, strongly connected components • Undirected Graphs • Paths, connected components • Trees and their properties |
| Grading Details | 10 % Homework 15 % Quizzes (8) 45 % Preliminary Exams (3) 30% Final |
| Prepared By/Date | Max Mintz, August 2011 |