Advanced Discrete Mathematics
CPMA 515
Spring 2006

Meeting Information

College Hall 225
Monday 6:00–8:40 p.m.
Final exam: Take home (Distributed Monday, Feb 27, 8:40 p.m., Due Monday, March 13, 6:00 p.m.)
Course web page: `http://www.blackboard.duq.edu`

Instructor

Dr. Jeffrey Jackson
Office: 433 College Hall
Office Hours: MWF 3 p.m.–4 p.m., WF 10 a.m.–noon, drop-in, and by appointment
Phone: 412-396-6466
Email: `jacksonj@duq.edu`

Textbook

Required: Discrete Mathematics and its Applications, 5th Edition, Rosen, McGraw-Hill.

My intention is to provide high-level coverage of all material appearing on exams in lecture, but the textbook provides details, depth of coverage, and examples that I may not cover. Readings will be assigned via Blackboard. Written assignments will for the most part be taken from the textbook.

Objectives

The study of discrete mathematics has expanded substantially since the advent of the digital computer, and therefore is a natural core course in computational mathematics. This course assumes that you already have some familiarity with the following discrete mathematics topics: basic set theory, propositional logic including quantification, a variety of standard proof techniques including mathematical induction, basic discrete probability theory and counting methods (combinatorics), asymptotic notation (big-O), function and relation concepts, and introductory graph theory. (A student weak in the logic and proof topic areas should take "Logic and Proof" (CPMA 511) before taking this course.)

This course builds on your existing knowledge of discrete mathematics, giving you new discrete mathematical tools as well as helping to reinforce previously learned topics. The course will cover some or all of the following topics (specific topics are chosen by the instructor based on interests and background of students):

- Number theory, sufficient to prove the correctness of the RSA public key encryption algorithm (given the assumption that factoring is computationally hard)
- Introduction to recursive function definitions, recursive algorithms, algorithm analysis, and solutions of recurrence relations
- Introduction to representations of Boolean functions, minimizing representations, and laws of Boolean algebra
- Key discrete mathematical algorithms, such as fast integer and matrix multiplication and the discrete Fast Fourier Transform
- Graph theory and algorithms
- Reducibility, with applications to proofs of NP completeness

Written homework assignments emphasizing proofs will be given after each class except the last (6 assignments in all). There will also be two computer-based assignments using Maple (a brief introduction to key features of Maple will be provided). The final exam will be comprehensive and similar in nature to the written assignments.

Grading

Grading will be based on:

- Written assignments 35%
- Computer-based projects 15%
- Final exam 50%

Note that I do not grade directly on class attendance, and that I do not anticipate requiring you to present any material in class.

Late Work Policy: Assignments will be discussed in class the day they are due. Therefore, unless I have approved your absence in advance (or in other exceptional circumstances at my discretion), I will not accept a late homework assignment.

The final grade will be assigned as follows:

100–93 = A, 92–90 = A-, 89–87 = B+, 86–83 = B, 82–80 = B-, 79–77 = C+, 76–70 = C, 69–60 = D, below 60 = F.

Honor Policy

All work that you turn in, whether exams or assignments, must be your own unless I specify otherwise, although of course any help you receive from me is acceptable. An assignment that contains work that is not your own may receive no credit for the assignment as a whole. Repeat offenses may result in course failure. If you are not sure what constitutes "your own" work, I expect you to ask me rather than assuming that your understanding is correct. If you don't have time to ask, assume that if you have a question about whether or not something is your own work, it probably is not.

Schedule

We are scheduled to have 7 class meetings. The tentative schedule is (number of meetings in parentheses):

1–2. Number theory and RSA cryptography (2)

3 Introduction to Maple, recursive definitions and algorithms and their analysis (1)

4–5 Recurrence relations, solutions (including generating functions), and applications to algorithm analysis

6 Boolean functions: representation, Boolean algebra, computing Boolean functions, minimization of representations

7 Selected topics in discrete mathematics (possible topics: algorithms, reductions, graph theory, etc.)

Note

Students with documented disabilities are entitled to reasonable accomodations if needed. If you need accomodations, please contact the Office of Freshman Development and Special Student Services in 309 Duquesne Union (412-396-6657) as soon as possible. Accomodations will not be granted retrospectively.

The information in this syllabus is subject to change at the instructor's discretion as circumstances dictate.