**COMPUTER SCIENCE 174: Combinatorics and Discrete Probability**
**Spring 2016**

**Description**: This class provides a modern study of randomization and probabilistic techniques that play an important role in modern computer science. We will cover Markov's inequality, Chebyshev's inequality, Chernoff bounds, balls-and-bins models, the probabilistic method, and Markov chains as well as some more advanced techniques. We will apply these techniques to develop a range of randomized algorithms ranging from min-cut to packet routing to hashing, random graphs and satisfiability.

**Instructor**: Eric Friedman, ejf27@berkeley.edu
**Teaching Assistant**: Calvin Cheng <calvincheng@berkeley.edu>
**Office hours**: Friedman: Tues. 4:15-5:15, Thurs 11-12, in 329 Soda. Cheng Mon. 5-6 and Fri. 12-1 in 611 Soda. Also by appointment.
**Lecture**: TuTh 2-330P, 60 EVANS
**Discussion sections**: Th 4-5P, 71 EVANS, Th 5-6P, 4 EVANS
**Class Website**: Assignments and other "official stuff" will be on bspace and questions and discussions will be on the piazza website,
https://piazza.com/berkeley/spring2016/cs174
**Exams**: Midterm: Tuesday 3/8 (in class), Final: MONDAY, MAY 9, 2016 1130-230P (location TBD)
**Textbook**: Probability and Computing: Randomized Algorithms and Probabilistic Analysis, by Michael Mitzenmacher and Eli Upfal.
See http://www.eecs.harvard.edu/~michaelm for errata in the first and second printings of the book
**Prerequisites:**
An upper division course on algorithms (CS 170 or equivalent).
A course on discrete mathematics including basic probability (CS 70, Math 55 or equivalent).
**Course requirements**: Lectures are mandatory as are discussion section. Grades will be based on weekly problem sets, a midterm, a final exam and a class participation grade. Note the midterm and final exam dates as there will be no makeup exams except for documented emergencies. If you have a conflict talk to me asap.
**Grading**: The final grade will be computed from:
0.2PS+0.05Class + max(0.25MT+ 0.5F, 0.15MT+0.6F)
**Problem sets**: Problem sets are due at the beginning of Lecture on Tuesdays. Late problem sets (up to 48 hours – Thursday at the beginning of lecture) will be penalized one grade. Your lowest 2 problem sets will be dropped. You may work with other students on the problem sets but you must write up your own solutions. Latex is recommended but other math typesetting programs or neat (very neat) handwriting are acceptable.
Problem sets will be graded (holistically) as
G – great (100pts)
S – satisfactory (90pts)
W – weak (75pts)
P – poor (50pts)
Not handed in (0pts)

**Academic Dishonesty**: Your attention is drawn to the Department's Policy on Academic Dishonesty -- http://www.eecs.berkeley.edu/Policies/acad.dis.shtml
In particular, you should be aware that copying solutions, in whole or in part, from other students in the class or any other source constitutes cheating. Any student found to be cheating risks automatically failing the class and being referred to the Office of Student Conduct.

**Suggestions**: I recommend skimming the designated sections in the book before lecture then reading them more carefully afterwards and referring to them while working on the problems sets. Don't fall behind; the topics are cumulative so if you miss something the next topic won't make sense. Problem sets are (intentionally) not a large part of your grade (unless you don't do them in which case you will fail the class). However, they are the key to learning the material and doing well on the exams. I recommend working with one to two other students but no more (or less!). Note that this topic can be very "finicky," as the detailed definitions and abstract notation used can easily trip you up if you don't pay careful attention.

**Preliminary Schedule (subject to change):**

Chapter 1: Events and Probability
Chapter 2: Discrete Random Variables and Expectation
Chapter: 3 Moments and Deviations
Chapter 4: Chernoff Bounds
Chapter 5: Balls, Bins, and Random Graphs
Chapter 6 The Probabilistic Method
Chapter 7 Markov Chains and Random Walks
Chapter 8 Entropy, Randomness, and Information