DISCRETE PROBABILITY (MATH 20) – DARTMOUTH COLLEGE, FALL 2008

Class: MWF 1:45-2:50 PM, 006 Kemeny.

X-Hour: Thurs 1-1:50 PM, used each week, same classroom.

Office Hours: Mon 3-4:30 PM & Thurs 3-4 PM and by appointment.

Instructor: Paul Kinlaw (Paul.Kinlaw@dartmouth.edu, 213 Kemeny Hall).

Text: Intro to Probability, 2nd Revised Edition, Grinstead & Snell. This text is available at Wheelock Books, and also online at dartmouth.edu/~chance, a great web page.

Homework: There will be weekly homework assigned & due Fridays, two weeks in advance, except for the weeks of the two midterms. Some homework may be accompanied by an experiment to conduct.

Exams: There will be two midterm exams and a final exam.

Grades:
15% FIRST MIDTERM EXAM (Fri Oct 24 in class)
15% SECOND MIDTERM EXAM (Fri Nov 14 in class)
30% FINAL EXAM (Sun Dec 7 11:30AM)
30% Exercises
10% Experiments

Honor Code: No help given or received on exams. Help is permitted and encouraged on the homework and experiments, but copying is not permitted; feel free to consult any source you like, including classmates, and cite your sources.

Disabilities: Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me, ideally, before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

Religious Holidays: Let me know if you need accommodations due to religious holidays/events. Speak with me, ideally before the end of the second week of the term, especially regarding exam conflicts.

Introduction to Probability:

Probability is the branch of mathematics concerning likelihood, or chance. It originated in the 1600's in a discussion between Pascal and Fermat. Probability is rich in application to an immense number of sciences, such as economics, gambling, weather, physics, medicine and biology. There are also probabilistic methods of proof in pure mathematics. We'll study the applications, while using set theory to develop a purely mathematical model including all of these as examples.

Discrete probability (the focus of Math 20) concerns experiments with a countable (finite or countably infinite) number of outcomes, e.g. coin tosses, dice and cards. The mathematical model for discrete probability involves combinatorics (counting), and probability is defined as a sum.

Continuous probability (which we'll also study) concerns experiments with an uncountable number of outcomes, e.g. the probability of falling within a certain height range. It can often be used to model the discrete case with a large finite number of outcomes. The mathematical model for continuous probability involves calculus (limiting processes) and probability is defined as an integral. Sometimes geometry comes into play.

Discrete and continuous probability are both special cases of a much more general theory of probability involving a branch of mathematical analysis called measure theory (which is beyond the scope of this course).

Important Set Theory Terms:

Set, element (member), subset, union, intersection, complement, Venn diagrams.

Schedule

Even problems will be graded. Odd problems are suggested but will not be graded.

First Week: Chapter 1: Discrete Probability Distributions

Second Week: Chapter 3: Combinatorics
HW #1 due Friday 10/3/08: Section 1.2 #1,4-8,10-12,13,15,19,21,23,26
Section 3.1 #1,2,3,5,7,15,17
Experiment #1 due Friday 10/3/03: Flip a coin as fairly as possible 100 times, in ten groups of ten flips. For each group of ten flips, record the number of heads. This should be an integer between 0 and 10.
(a.)For each of these eleven outcomes, 0,…,10, write down the number of times this outcome occurred.
(b.) Are there any trends you may expect, intuitively and/or mathematically, in the larger pool of data we'll collect as a whole class?
Write a few sentences, and feel free to consult any source. Please be careful to collect the data accurately, as you would in a science experiment.

Third Week: Chapter 2: Continuous Probability Densities
HW#2 due Friday 10/10/08: *(12 even problems due)*
Section 1.2 #18,20,22
Section 3.1 #10-14
Section 3.2 #1,2,3,6,8,10,13,17,20
Section 2.2 #1,2,3,5,7

Fourth Week: Chapter 4: Conditional Probability
HW#3 due Friday 10/17/08: *(16 even problems due)*
Section 2.2 #4,6,8,14
Section 4.1 #1-8,14,16,17,24,26,35,36,38,48,51
Section 4.2 #1-3

Fifth Week: Review
EXAM I: Friday 10/24/08 in class: CHAPTERS 1-4

Sixth Week: Chapter 5: Important Distributions and Densities
HW #4 due Monday 11/3/08: *(19 even problems due)*
Section 5.1 #1,6,7,8,9, 11-17, 22,23,27,28,35,38,39,44,46
Section 5.2 #1,2,5, 14-19, 22-30, 37

Seventh Week: Chapter 6: Expected value and Variance
HW #5 due Monday 11/10/08: *(13 even problems due)*
Section 6.1 #1-9, 16,17,21,28
Section 6.2 #1-4, 7, 9-12, 22,23,30
Section 6.3 #1,2,3,13,19

Eighth Week: Chapter 8: Law of Large Numbers
EXAM II: Friday 11/14/08 in class: CHAPTERS 5-6

Ninth Week: Chapter 9: Central Limit Theorem

HW #6 due Monday 11/24/08: (10 even problems)

Section 8.1 #1,5,6,7,8,10,11,17
Section 8.2 #1,2,3,4,7,8,10,11
Section 9.1 #1,2,3,4,9,12,17
Section 9.2 #9

Tenth Week: Markov Chains & Review.

HW #7 due Weds, 12/3/08: (5 even problems)

Section 11.1 #1,2,3,7,8,17,18
Section 11.2 #1,2,3,4,5

Experiment #2: Choose an interesting probability problem of your choice, and write 2-3 pages about the problem, including some of the mathematics behind the solution. Suggestions: The Monty Hall Problem discussed in the text, or a classic card game such as 5-card Poker, Blackjack, or Texas Hold'em.

FINAL EXAM: SUNDAY DEC 7th 11:30AM