Notes:

- MON 5/3: 10-12, 1-3
- TUE 5/4: 10-12, 1-3
- WED 5/5: 10-12, 1-3
- THU 5/6: 10-12
  or by appointment

- Topics: Basically everything which has been on the homework and the exams, up to and including the Central Limit Theorem (but not hypothesis testing). Specifically:
  1. Counting
  2. Axioms of probability, events & sample spaces
  3. Discrete random variables, probability distributions and cumulative distribution functions
  4. Conditional probability, Bayes's theorem for events
  5. Independence (for events)
  6. Continuous random variables, probability density functions, & cumulative distribution functions
  7. Independence (for random variables)
  8. Joint probability densities & marginal densities
  9. Conditional probability densities & Bayes's formula for continuous random variables
  10. Expectation value, variance, and standard deviation
  11. Normal random variables and the Central Limit Theorem

- The exam itself is on THURSDAY, 5/6/04, at 4 pm. It will take place in 194 Mercer Room 308. You are allowed two pages (both double-sided) of "cheat sheets," as well as your calculators. No other computational devices (computers, cell phones, abacuses) are allowed.
Practice Problems:

1. Counting:
   (a) How many five-card hands can we draw out of a deck of 52 cards?
   (b) How many subsets of size 4 can we form out of a set of 9 objects? How many subsets of all sizes?
   (c) In how many ways can we distribute 7 identical tennis balls to 5 people? In how many ways can we distribute 7 billiard balls with distinct numbers to 5 people?
   (d) If we toss a balanced die 5 times, what is the probability that 3 appears at most once?

2. Expectation values: We throw darts at a board shown below. Each part of the board corresponds to a different payoff.

   Suppose our darts always land inside the biggest square in the picture (ie we always make at least $10).
   (a) What is the probability that we make $100?
   (b) What is the probability that we make exactly $50?
   (c) What is the probability that we make exactly $10?
   (d) What is the expected value of the payoff from this game?

3. Bayes’s theorem. A bag contains 65 coins, exactly one of which has two heads and the rest are fair. Carl randomly picks a coin from the collection and tosses it 6 times. Given that the coin turns up heads all 6 times, what is the probability that Carl picked the two-headed coin?
4. **Normal random variables:** Let $X$ and $Y$ be independent, standard normal random variables.

   (a) What is the joint density $f_{XY}(x, y)$?
   (b) Compute $P((-1 < X < 1) \cup (-1 < Y < 1))$.

5. **Central Limit Theorem:** A poll published by the New York Times today asked 1,042 people around the country whether they approve of the President’s performance.

   (a) Suppose the actual proportion of people who approve of the President’s performance is exactly 50%. What is the probability that more than 55% out of 1,042 people answer yes?
   (b) Again assuming that the actual proportion of people who approve of the President’s performance is exactly 50%, what is the standard error in the survey? (The same article states that the margin of error is about 3%).