Due by 4pm on Friday, November 8. Please leave your homework on the table before class begins on Friday or leave it in the dropbox outside my office. Do not forget to attach the honor code. Each problem is worth 10 points.

(1) Of a population of consumers, 60% are reputed to prefer a particular brand, A, of toothpaste. If a group of randomly selected consumers is interviewed, what is the probability that exactly five people have to be interviewed to encounter the first consumer who prefers brand A? At least five people?

(2) Ten motors are packaged for sale in a certain warehouse. The motors sell for \$100 each, but a double-your-money-back guarantee is in effect for any defectives the purchaser may receive. Find the expected net gain for the seller if the probability of any one motor being defective is .08. (Assume that the quality of any one motor is independent of that of the others.)

(3) Two people took turns tossing a fair die until one of them tossed a 6. Person A tossed first, B second, A third, and so on. Given that person B threw the first 6, what is the probability that B obtained the first 6 on her second toss (that is, on the fourth toss overall)?

(4) The telephone lines serving an airline reservation office are all busy about 60% of the time.
   (a) If you are calling this office, what is the probability that you will complete your call on the first try? The second try? The third try?
   (b) If you and a friend must both complete calls to this office, what is the probability that a total of four tries will be necessary for both of you to get through?

(5) A geological study indicates that an exploratory oil well should strike oil with probability .2.
   (a) What is the probability that the first strike comes on the third well drilled?
   (b) What is the probability that the third strike comes on the seventh well drilled?
   (c) What assumptions did you make to obtain the answers to parts (a) and (b)?
   (d) Find the mean of the number of wells that must be drilled if the company wants to set up three producing wells.

(6) In southern California, a growing number of individuals pursuing teaching credentials are choosing paid internships over traditional student teaching programs. A group of eight candidates for three local teaching positions consisted of five who had enrolled in paid internships and three who enrolled in traditional student teaching programs. All eight candidates appear to be equally qualified, so three are randomly selected to fill the open positions. Let Y be the number of internship trained candidates who are hired.
   (a) Does Y have a binomial or hypergeometric distribution? Why?
   (b) Find the probability that two or more internship trained candidates are hired.
   (c) What is the expected value of Y ?

(7) Show that the cdf for a geometric random variable is given by

$$F_X(t) = 1 - (1-p)^{\lfloor t \rfloor},$$

where $\lfloor t \rfloor$ denotes the greatest integer in t, $t \geq 0$.

(8) Customers arrive at a checkout counter in a department store according to a Poisson distribution at an average of seven per hour. During a given hour, what are the probabilities that
   (a) no more than three customers arrive?
   (b) at least two customers arrive?
   (c) exactly five customers arrive?

(9) In the daily production of a certain kind of rope, the number of defects per foot Y is assumed to have a Poisson distribution with mean $\lambda = 2$. The profit per foot when the rope is sold is given by X, where $X = 5 - 2Y - Y^2$. Find the expected profit per foot.

(10) The California Mellows are a semipro baseball team. Eschewing all forms of violence, the laid-back Mellow batters never swing at a pitch, and should they be fortunate enough to reach base on a walk, they never try to steal. On the average, how many runs will the Mellows score in a nine-inning road game, assuming the opposing pitcher has a 50% probability of throwing a strike on any given pitch?