MATH 172X   Spring, 2001   Exam #3   Name:_____

There are 100 points. For full credit you must show your work. If you use your calculator for anything more than simple arithmetic, say so! **In these problems you can leave symbols like** $\binom{n}{k}$ **,** $_nC_k$ **,** $_nP_k$ **,** $n!$ **,** $66 \cdot 65 \cdot 64$ **,** $(.3)(.7)^2$ **, etc. in your final answer. There is no need to do all the arithmetic, unless you want to, or unless you are specifically directed to do so.**

1. (15 points) Two dice are rolled, one after the other.
    a. List all the possibilities showing which number is on which die, so that the sum is 8. Of all possible dice rolls what is the probability of getting a sum of 8?

    b. Given that the sum is 8, what is the probability that at least one die shows a 2?

    c. If you know nothing about the sum, what is the probability that at least one die shows a 2?

2. (15 points) Compute the sum of each series; or state that no sum exists.
    a. $\sum_{n=0}^{\infty}(-2/5)^n$

    b. $\sum_{k=1}^{\infty}(4/3)(2/5)^k$

    c. $\sum_{k=1}^{\infty}(3/4)(5/2)^k$

3. (15 points) Hank Aaron hit 755 home-runs in 12364 times at bat.
   a. What is the probability p that he hits a home-run in each at bat ("success")? What is the probability q that he does not?

   b. What is the probability that in 5 at bats he would hit exactly 2 home-runs or 3 home-runs?

4. (8 points) The Swiss air force has the following number of personnel on active duty

Type	Male	Female
Enlisted (drafted)	4000	0
Enlisted (volunteered)	110500	2800

   A 20 person grievance board is chosen from among the enlisted personnel. What is the probability that 1 is female, 5 were drafted, and 14 were male volunteers? (Do NOT attempt a numerical calculation!)

5. (10 points) In a large office building four elevators are arranged in a row so that from the center of one to the center of the next takes 5 steps. If you stand in front of elevator #1 (which is closest to the main entrance and closest to your office upstairs), and elevators #1, #2, and #4 are equally likely to arrive at the ground floor, but #3 is often out of order and has only a probability of 0.1 of arriving at the ground floor, what is your expected number of steps to catch the next arriving elevator?

6. (20 points) Make a tree diagram, filling in as many values as you can, for the following problem, and then compute the probabilities. A multiple choice quiz has 2 problems and each has four suggested answers of which only one is correct. A student who has done the homework has an 80% chance of answering each problem correctly. Students who have not done the homework choose their answers at random. We know, by previous experience, that 30% of the class has done the homework.

   a.   Beth has the correct answer to the first problem. What is the probability that she did the homework?

   b.   Joe has answered problems #1 and #2 correctly. What is the probability that he did the homework?

7. (7 points) There is a probability density function $p(x) = ce^{-cx}$. If $\Pr(0 \le x \le 3) = 0.2$, determine the value of c.

8. (10 points) The density function for time gaps between cars on the Arroyo Secco Freeway is now $p(x) = 0.25e^{-.25x}$, where x is the time in seconds.
   a. Compute the median time gap.

   b. If the cumulative distribution function is $F(x)$, what is the meaning of $F(4)$ in real life terms? What is the value of $F'(4)$?