MATH 172   Spring, 2002   Exam #3   Name:_____

There are 100 points. For full credit you **must** show your work; do not just compute a number on your calculator – even if correct it will not get full credit. **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 are specifically directed to do so.**

1. (10 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 an even number?

2. (16 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 7 at bats he would hit exactly 2 home-runs or exactly 4 home-runs?

3. (22 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 70% chance of answering each problem correctly. Students who have not done the homework choose their answers at random. We know, by previous experience, that 40% of the class has done the homework.

a. What is the probability that a student chosen at random will get both answers correct?

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

c. Frank has answered problems #1 and #2 correctly. What is the probability that he did the homework? Explain why this answer is larger or smaller than your answer to b.

4. (10 points) A survey of 4500 families found that 2800 had a dog, 2200 had a cat, 900 had something else (bird, fish, iguana, hampsters, whatever). Further questioning revealed that 300 had a dog and an "other", 500 had a cat and an "other", and 1100 had both a dog and a cat. Of these an amazing 100 had all three. How many families had no pet at all?

5. (8 points) Of the following, which is deterministic and which probabilistic?
   a. Assuming no major disasters over the summer, and all construction and renovation projects stay on schedule, the capacity of campus housing at USC at the beginning of next Fall semester.

   b. Assuming no major disasters over the summer, and all construction and renovation projects stay on schedule, the number of upperclassmen who will be in campus housing at USC at the beginning of next Fall semester.

   c. The number of seniors who are enrolled at USC today.

   d. The number of seniors who will graduate from USC in 3 weeks.

6. (38 points) The streetside of your house has room for 25 plants in a row. You have invested in 8 white azaleas (W), 8 pink azaleas (P), 4 red azaleas (R), 5 hyacinths (H), which due to the pH of your soil will bloom blue, 2 pampas grass plants (G), and 2 saw palmetto plants (S). Other than type and color these plants have no distinguishing individual characteristics. The parts of this problem do NOT depend on one another.

a. You decide to plant one hyacinth in the middle, save the others for somewhere else, and finish the walk by planting the other 5 types. How many possible patterns can you produce?

b. You decide that the pattern should be more symmetrical: either the G's will be on the ends and the S's next in, or the other way around; either the H's, or 2 of the R's on each side of an H, will be in the middle; the other azaleas will be in the rest of the places, with all of one color grouped together; *i.e.*, the arrangement will be X - Y - A1 - M - A2 - Y - X, where X is G or S, and Y is the other one; A1 is azalea of type W or P; M is the middle group; and A2 is the remaining azalea type. How many patterns like this are there? Also give this answer numerically.

c. You have decided on a pattern that uses all 6 types, but you realize it will be more efficient to plant them type by type rather than going down the row since each type requires its own planting methods, and due to these different preparations and different numbers of each type to be planted, the time you will need for each type will be different. It's late enough in the day that you can only plant 4 types. In how many ways can you schedule your time? Also give this answer numerically.