Economics 521    Fall, 2006:    First exam

Turn off any connection with the outside world: cell phones, beepers, text messaging devices. Close out any Internet connections. Leave at least one seat between you and anyone next to you. Do all problems. **EXPLAIN** your reasoning for each answer!! [Tell me WHY you add when you add, WHY you multiply when you multiply, ... .] Include a statement of exactly what assumptions you are making.

1. (20 pts) For the experiment of dealing a five card hand from a well-shuffled poker deck, the random variable $X$ is the number of suits represented in the hand. (Recall there are 4 suits in the deck!) Determine the probability distribution of $X$ and calculate the mean of this random variable.

2. (20 pts) Suppose that 80% of all statisticians are shy, whereas only 15% of all economists are shy. Suppose also that 90% of the people at a large gathering are economists and the other 10% are statisticians. If you meet a shy person at random at the gathering, what is the probability that the person is a statistician?

3. (20 pts) (A) (10 pts) To reach its target, a bomber has to fly over five successive independent defense stations; each station has a probability of 0.15 of hitting the plane. If hit even once, the plane is downed. A CNN military analyst claims that the probability the plane will be downed before reaching the target would be $5 \times 0.15 = 0.75$. If you agree, support the reasoning; if you disagree, state why and determine a different answer.

   (B) (10 points) Do the problem again, but this time, a plane can survive being hit one time - but not two. So the first time the plane is hit, it can keep going; but if then it is hit again, the plane is down and will not reach its target. Now what is the probability that a plane will not reach its target?

4. (20 pts) Four fair dice are tossed independently and the four numbers on the tops are observed. Let the random variable $X$ be the mean - the arithmetic average - of those four numbers. Determine each of the following:
   1. $P(X = 6)$;
   2. $P(X = 1.5)$;
   3. $P(X = 3)$.

5. (20 pts) There is an experiment for which there are three possible outcomes: A, B, and C. Any time we run the experiment those outcomes occur with positive probabilities $p_A$, $p_B$, and $p_C$, respectively. You run a sequence of the experiments repeatedly until outcome A occurs. Show that the probability that outcome B does not occur in the sequence is:
   $$
p_A / (1 - p_C)$$
   What is the value of this probability if $p_A = p_B$ ?

6. (Extra credit general culture question) Who is Edwin Moses?