Sample Midterm 1

Math/Stats 425 (Instructor: Edward Ionides)

Name: _____ UMID #: _____

- **There are** 6 **questions, each worth** 10 **points.**
- **Points will be awarded for a clearly explained and accurate method, as well as for finding the correct answer.**
- **You are allowed to bring along to the test a single-sided sheet of notes.**
- **You are not allowed to use a calculator, or any other electronic device, during the exam. Electronic devices brought into the room should remain in a closed bag on the floor, and penalties will be applied if this rule is violated. For example, no cell phone usage for the duration of the exam, please!**

Problem	Points	Your Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
Total	60	

1. In a group of students, 70% are Democrat and 30% Republican. Of the Democrats, 60% support introduction of a ban on assault rifles. 30% of the Republicans are in favor of such a ban. If a randomly selected student opposes a ban, what is the chance that the student is Republican?

2. A five card poker hand is dealt from a shuffled deck of 52 cards.

   (a) Find an expression for the chance that the hand contains a pair (i.e., two cards of the same rank, all other cards of different ranks).

   (b) Find an expression for the chance that the hand contains two pairs (i.e., two cards of one rank, two of another rank and a fifth card of yet another rank).

3. For three events E, F and G you know the following facts:

$$P(E) = 0.6, P(F) = 0.3, P(E \cap F) = 0.1, P(E \cap G) = 0.3, P(F \cap G) = 0.2.$$

What are the largest and smallest possible values of $P(G)$? Hint: It may help you to set $x = P(E \cap F \cap G)$ and $y = P(G \cap E^c \cap F^c)$.

4. The number of fish in a lake can be investigated by a capture-recapture experiment. Suppose that 10 fish are caught, tagged, and replaced in the lake. Next day, 20 more fish are caught. Find an expression for the probability of recapturing k tagged fish if there are N fish in the lake. Comment on your assumptions.

5. Each morning, Xi works out by doing three sets of each of five exercises. A workout routine is a list giving the sequence of the sets, i.e. a list of fifteen sets in which each each exercise appears exactly three times. For example, labeling the exercises A, B, C, D, E a possible routine is $AABCABDBCEECDDE$. This concrete example should make clear what is meant by a routine for the purposes of this question.

   a) Find an expression for the number of possible routines Xi can choose.

   b) One of the exercises is press-ups. Xi does not like to do press-ups until she is warmed up, and so she would prefer if none of the first five sets were press-ups. How many routines satisfy this constraint?

6. Andy and Ben alternate rolling a pair of dice, stopping either when Andy rolls a sum of 9 or when Ben rolls a sum of 7. Assuming that Andy rolls first, find the probability that he also makes the final roll.