Midterm– probability – Schneider
Always give reasons

1. (15 points) Write down the number of possibilities in the following problems (you can leave in symbolic form with numbers in correct places)
   a. The number of different letter arrangements from **aardvark**
   b. How many different 5 card poker hands can you get where one of the cards must be the ace of spades and another the ace of hearts.
   c. How many different subsets of a 10-element set are there where the subsets have less than 9 elements.
   d. You have 16 people in a class. How many ways can you make two committees of 8 people in each committee.
   e. What is the coefficient of x^{11} n the expansion of $(x+2)^{50}$. I want the number that multiplies x^{11}

2. (15 points) Two symmetric dice have had three of their sides painted red, two painted black, and one painted yellow. When this pair is rolled what is the probability that the dice land with different colors facing up.

3. (15 points) Suppose for the two events A, B we know $P(A^c|B)=.8$; $P(B)=.4$; and $P(AB^c)=.2$. Find $P(B|A)$. Hint: $P(X|Y)$ is a probability for sets X.

4. (15 points) Prove that if $P(A^cB)= P(A^c)P(B)$ then $P(AB) = P(A)P(B)$

5. (15 points) Urn A contains 2 red and 8 black balls. Urn B contains 8 red and 2 black balls. Bob picks a black ball from urn A and a red ball from urn B. The balls are not replaced and Jane follows Bob and picks a ball from each urn. What is the probability that Jane picks the exact same 2 colored balls in the same order as Bob.

6. (15 points) You have a normal 52 card deck. Note that your hand does not depend on order. You are dealt three cards.
   a. In how many ways can you be dealt a three-card hand.
   b. What is the probability you will get two aces?
   c. What is the probability you will get at most two aces?
   d. What is the conditional probability that you will have three aces given that you have two aces.

7. (15 points) On rainy days, Joe is late to work with probability .3; on nonrainy days, he is late with probability .1. With probability .7, it will rain tomorrow.
   a. Find the probability that Joe is early tomorrow.
   b. Given that Joe was early, what is the conditional probability that it rained?