MT 460 Midterm Review

1. Answer the following counting questions.
    a. Six people run in a race. In how many ways can first, second and third places finish?

    b. How many permutations of the letters in the word "SCIT" can you have?

    c. Among 12 people, 4 will be selected to go to a seminar. In how many ways can this be done?

    d. A manufacturer has 14 motors and 15 switches to choose from. In how many ways can you select 5 motors and 3 switches to build your project?

2. Answer the following probability questions.
    a. What is the probability of drawing an Ace or Number card 2 from a 52 deck card deck?

    b. Two cards are drawn from a well-shuffled deck of 52 cards. Find the probability that they are both aces if the first card is not replaced. Note: There are 4 aces available.

    c. In a lot of 40 chairs, 10 are defective. If you pick 5 chairs at random, what is the probability that you will get <u>at least</u> 2 defective chairs?

    d. You roll two dice. What is the probability that the sum is a 4 <u>or</u> 5?

3. A couple plans to have 4 kids. What is the probability that there will be at least one boy? Assume probability of 0.5 to have a boy and the events are independent. Use Binomial PDF.

4. A single ball is drawn at random from a box containing 10 red balls, 3 white balls, and 4 blue balls.
    a. Determine the probability that it is Red.

    b. Three balls are drawn successively. Find the probability that they are drawn in the order red, white, and blue if the ball is not replaced.

5. Suppose that a coin is tossed twice so that the sample space is S = {HH, HT, TH, TT}. Let X represent the # of heads that can come up. Create a table for its Probability Distribution Function (PDF) and draw its histogram. Test if the sum of probability is 1.

x	$P(x)$

Sum

6. Find the probability distribution of boys in a family of 3 children, assuming fair probability (p=0.5). Note: This is a binomial distribution.

x	$P(x)$
0	
1	
2	
3	
Sum	

a. What is the probability that the couple will have <u>at least 1</u> boy?

b. Find the mean and standard deviation of the binomial pdf. You can use the shortcut formulas.

$E(X) = \mu = \sum_x x\,P(x)$ $\quad Var(X) = \sigma^2 = \sum_x (x-\mu)^2\,P(x)$ $\quad Std(X) = \sqrt{Var(X)}$

7. Suppose a game is to be played with a single die assumed fair, find mean (expectation) of x which denotes payout for this game.

x	$P(x)$
\$0	1/6
\$20	1/6
0	1/6
\$40	1/6
0	1/6
-\$30	1/6
Sum	

8. An island reports that over a 30 year period, 150 tourists had died.
    a. What is the mean number of people that died per year?

    b. Find the probability that 1 person will die next year? Use Poisson distribution.

9. An IQ test is normally distributed with mean of 105 and a standard deviation of 20.
    a. What is the probability that a random person has an IQ less than 90?

    b. What is the probability that a random person has an IQ more than 140?

10. The standardized score for a college entrance test had a mean 920 and standard deviation 205. For Stanford, they require a score of 1200 to get in.
    a. What percentage of students will not be able to get into this college?

    b. What score will you need to be on the top 5% of this batch of students? This is an inverse norm problem.