# MT 460 Final Exam 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. Among 12 people, 4 will be selected to go to a seminar. In how many ways can this be done?
    c. 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. You roll two dice. What is the probability that the sum is a 4 or 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. Determine the probability that
    a. 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 at least 1 boy?
    b. Find the mean and standard deviation of the binomial pdf.

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. Highway patrol reports that over a 10 week period, 5 major accidents had occurred on a specific highway.
    a. What is the mean number of major accidents that have occurred per week?
    b. Find the probability that an accident will occur next week. Use Poisson distribution.
9. 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.
10. Mileages for tires before they are replaced are normally distributed with mean 55,000 miles and standard deviation 2,500 miles.
    a. What is the probability that tires will be replaced in under 42,000 miles?
    b. If a company wants to offer a warranty so that only the bottom 2% of their tires get replaced, then for how many miles should the warranty for the tires be? Round to the nearest thousand miles.
11. Recall that $z_C = \text{InvNorm}\left(\frac{1+C}{2}\right)$. Fill in the below table.

| $C$ | $z_C$ |
|---|---|
| 0.87 | |
| 0.90 | |
| 0.95 | |
| 0.97 | |
| 0.99 | |

12. People were asked "What is your monthly income"? The responses were as follow:

| | | | | |
|---|---|---|---|---|
| 2000 | 1500 | 2500 | 1600 | 1300 |
| 2000 | 1500 | 1000 | 0 | 800 |
| 1300 | 2000 | 2000 | 2800 | 1600 |
| 2000 | 300 | 700 | 1200 | 1400 |
| 1500 | 2800 | 750 | 500 | 1100 |
| 550 | 800 | 1750 | 1500 | 600 |

Construct a 92% confidence interval that contains the average monthly income for all people.