Statistics 339: Lecture Topic 2
Discrete Probability Distributions

5.1 Random Variables

- A random variable is a numerical description of the outcome of an experiment. (p.186)
- Assigns a numerical value to each basic outcome in the sample space
- A random variable con be classified as either *discrete* or *continuous* (p. 186)

Discrete Random Variables

- A discrete random variable may assume either a finite number of values or an infinite sequence of values. (p. 186)

Continuous Random Variables

- A continuous random variable may assume any numerical value in an interval. (p.187)

5.2 Discrete Probability Distributions

- The probability distribution for a random variable describes how probabilities are distributed over the values of the random variable. (p.188)
- The probability distribution is defined by a probability function, denoted by $f(x)$, which provides the probability for each value of the random variable. (p.188)
- There are two required conditions that must be satisfied for a discrete probability function
  - $\boldsymbol{f(x) \geq 0}$
  - $\boldsymbol{\Sigma f(x) = 1}$

- The discrete uniform probability distribution is the simplest example of a discrete probability distribution given by a formula:

$$f(x) = 1/n$$

where:

n = the number of values the random variable may assume

5.3 Expected Value and Variance

- The <u>expected value</u> of a random variable is a measure of its central location. (p. 194)
- The <u>variance</u> summarized the variability in the values of a random variable. (p.194)
- The <u>standard deviation (σ)</u> is the positive square root of the variance.

5.4 Binomial Probability Distribution

- Properties of a Binomial Experiment (p.199)
    - The experiment consists of a sequence of n identical trials.
    - Two outcomes, success and failure, are possible on each trial.
    - The probability of a success, denoted by ***p***, does not change from trial to trial.
    - The trials are independent.

- The probability distribution associated with a discrete random variable is called a <u>binomial probability distribution.</u> (p. 199)

Binomial Probability Function

- The probability function for the binomial random variable tells us the probability of seeing a given number of successes in N trials and is given by

5.5 Poisson Probability Distribution

- Properties of a Poisson Experiment
    - The probability of an occurrence is the same for any two intervals of equal length.
    - The occurrence or nonoccurrence in any interval is independent of the occurrence or nonoccurrence in any other interval.

5.6 Hypergeometric Probability Distribution

- The hypergeometric distribution is closely related to the binomial distribution. (p.212)
    - The two probability distributions differ in two ways with the hypergeometric distribution
        - The trials are not independent
        - The probability of success changes from trial to trial

Hypergeometric Probability Function

- Used to compute the probability that in a random selection of n elements, selected without replacement, we obtain x element labeled success and $n - x$ elements labeled failure.

- The hypergeometric probability function provides $f(x)$, the probability of obtaining x successes in a sample of size n.