Statistics 1: Elementary Statistics

Section 4-7

Probability

- **Chapter 3**
  - **Section 2: Fundamentals**
  - **Section 3: Addition Rule**
  - **Section 4: Multiplication Rule #1**
  - **Section 5: Multiplication Rule #2**
  - **Section 6: Simulating Probabilities**
  - **Section 7: Counting**

Learning to Count

- **Why do we need to learn to count?**
- **We approach probability through the doorway of relative frequency**

Learning to Count

- **Count ways for A = s**
- **Count all ways = n**
- **Probability = s/n**

Five Counting Rules

- **Fundamental Counting Rule**
- **Factorial Rule**
- **Permutations Rule**
- **Permutations Rule when some items are identical to others**
- **Combinations Rule**

Fundamental Counting Rule

- **Event A can happen in “m” ways**
- **Event B can happen in “n” ways**
- **Then A and B can happen together in (m)(n) ways**
- **Examples**

Fundamental Counting Rule Examples

- **Dice**
  - **1st die can happen in 6 ways**
  - **2nd die can happen in 6 ways**
  - **the two dice can happen in (6)(6)=36 ways**
- **Birthday example**

Factorial Rule

- **If there are N distinct items, they can be arranged in N! different sequences**
- **Synonyms: sequences, orders, arrangements**

Factorial Rule

- **Calculator use for "factorials"**

Permutations Rule

- **There are N <u>distinct</u> items**
- **You could form different distinct sequences of size "r" (sequence matters)**
- **How many?**

$$ {}_{n}P_{r} = \frac{N!}{(N-r)!} $$

Permutations Rule

- **Using the calculator function for "permutations"**

Permutations Rule #2

- **You have N items made up of "k" groups, and within each group the items are not distinct.**
- **The N items together can form this many distinct sequences:**

$$ \frac{N!}{(r_1!r_2!\cdots r_k!)} $$

Combinations Rule

- **There are N <u>distinct</u> items**
- **You could form different combinations of size "r" for which the sequence does not matter**
- **How many?** $${}_{n}C_{r} = \frac{N!}{(N-r)!r!}$$

Combinations Rule

- **Using the calculator function for "combinations"**