Math 150

Section 8.4 Basic Concepts of Probability

Addition Rule for Counting:

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

Addition Rule for Probability:

$$P(E \cup F) = P(E) + P(F) - P(E \cap F)$$

Example 1 Let $S = \{1, 2, 3, 4, 5\}$. Choose one element of S at random. Let E be the event you choose an odd number. Let F be the event you choose a prime number. Find $P(E \cup F)$, the probability your choice is odd or prime.

If two events are disjoint (mutually exclusive), then the events cannot occur at the same time. Thus, $E \cap F = \varnothing$ and $P(E \cap F) = 0$. When E and F are disjoint, the Addition Rule for Probability simplifies to $P(E \cup F) = P(E) + P(F)$.

Compliment Rule:

$$P(E') = 1 - P(E)$$

Example 2 Suppose you roll 2 dice. Find the following:

- n(S)
- P(3 on 1st die)
- P(3 on 2nd die)
- P(3 on both dice)
- P(3 on 1st or 2nd die)
- P(1st die is less than 2nd die)
- P(sum of dice is 7)
- P(sum is less than or equal to 4)
- P(sum is 12)
- P(sum is not 12)
- P(sum is 5 or 10)

Odds in Favor of an Event If E is an event, then

$$P(E) = \frac{n(E)}{n(S)}.$$

So $P(E)$ compares the number of ways E can occur to the total number of possible outcomes.

The odds in favor of E compares the number of ways E can occur to the number of ways E cannot occur:

$$\text{The odds in favor of E } = n(E) : n(E')$$

Example 3 Suppose you roll 2 dice. Find the odds in favor of rolling a sum of 4.