11.6 – Events involving Not and Or; Odds

The probability of the complement of an event E - *P(not E)* is the probability that event E does not occur.

$$P(E)+P(\text{not } E)=1 \qquad \text{or} \qquad P(\text{not } E)=1-P(E)$$

Example

Events *A* and *B* are **mutually exclusive** or **disjoint** if they have nothing in common. If *A* and *B* are mutually exclusive then the addition rule becomes

$$P(A \text{ or } B)=P(A)+P(B)$$

Examples

P(Ace or Club)

P(Ace or 10)

The Addition Rule: For any two events A and B,

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B).$$

Examples

Odds

In many everyday situations odds are used instead of probabilities. Odds are usually given in the form of odds **against** an event E occurring.

Probability to Odds

Odds against are written in the form a to b or $a:b$. If the experiment is ran $a+b$ times then the event will occur b times and not occur a times.

$$\text{Odds against event } E = \frac{P(\text{not } E)}{P(E)} = \frac{P(\text{failure})}{P(\text{success})} = \frac{a}{b}$$

Write odds with whole numbers that are in simplest terms. (No common factors).

If the odds against an event occurring are a to b, then the odds in favor of an event occurring are b to a or $b:a$.

$$\text{Odds in favor of event } E = \frac{P(E)}{P(\text{not } E)} = \frac{P(\text{success})}{P(\text{failure})} = \frac{b}{a}$$

Examples

Odds to Probabilities

Odds against event E occurring are a to b then (Odds in favor event E are b to a)

$$P(E) = \frac{\text{number of times event } E \text{ occurs}}{\text{total number}} = \frac{b}{a+b}$$

$$\left[P(\text{not } E) = \frac{\text{number of times event } E \text{ does not occur}}{\text{total number}} = \frac{a}{a+b} \right]$$

Examples