Stat 230 - Probability **Fall 2016**

Lecture 3: September 14, 2016

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3.1 Sample Spaces Continued

From Last Lecture

When calculating probability, a sample space is a collection of all possible possibilities where each possibility has an equal chance of occurring and each possbility only appears at most once. In addition, sample spaces can be discrete or continuous.

$$S = \{\dots\}$$

3.1.1 Events

An event is any collection (subset) of outcomes contained in the sample space S.

- **Simple** if it consists of exactly one outcome (point).
- **Compound** if it consists of more than one outcome

3.2 Probability Notation

The notation P(event) = p to denote the probability of an event occurring and (1-p) it will not occur.

3.3 Odds

Definition 3.1 *The odds in* ***in favour*** *of an event A is defined by :* $\frac{P(A)}{P(A^c)} = \frac{P(A)}{1-P(A)}$

Definition 3.2 *The odds* ***against*** *event A is defined by :* $\frac{P(A^c)}{P(A)} = \frac{1-P(A)}{P(A)}$

3.4 Rule of Probability

1. Probability distribution on S : $\sum_{\text{all } i} p(a_i) = 1, P(S) = 1$
   - Proof : $P(S) = \sum_{a \in S} P(a) = \sum_{\text{all} a} P(a) = 1$

2. For any event A, $0 \le P(A) \le 1$
   Probabilities are always between 0 and 1 where, 0 = a event never happens and 1 = event always happens.
   - Proof : $P(A) = \sum_{a \in A} P(a) \le \sum_{a \in S} P(a) = 1$ and since each $P(a) \ge 0$, We have $0 \le P(A) \le 1$
3. If A and B are two events with $A \subset B$, Then $P(A) \le P(B)$
   - Proof : $P(A) = \sum_{a \in A} P(a) \le \sum_{a \in B} P(a) = P(B)$, So $P(A) \le P(B)$

3.5 Mutually Exclusive or Disjoint Events

- Two events are events are **mutually exclusive**
  - If they cannot happen simultaneously
  - If they cannot occur at the same time
  - When they have no outcomes in common.
  - $A \cap B = \varnothing$
- Another word that means **mutually exclusive** is **disjoint**