# An Introduction to Basic Statistics and Probability



Basic probability concepts Conditional probability

Discrete Random Variables and Probability Distributions

Continuous Random Variables and Probability Distributions

Sampling Distribution of the Sample Mean Central Limit Theorem



Chance behavior is unpredictable in the short run, but has a regular and predictable pattern in the long run.

The probability of any outcome of a random phenomenom is the proportion of times the outcome would occur in a very long series of repetitions.



Sample Space - the set of all possible outcomes of a random phenomenon

Event - any set of outcomes of interest

Probability of an event - the relative frequency of this set of outcomes over an infinite number of trials

Pr(A) is the probability of event A



Suppose we roll two die and take their sum

*S* = {2*,* 3*,* 4*,* 5*, ..,* 11*,* 12}

Pr(*sum* = 5) = 4

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Because we get the sum of two die to be 5 if we roll a (1,4),(2,3),(3,2) or (4,1).



Let *A* and *B* denote two events.

*A* ∪ *B* is the event that either *A* or *B* or both occur. *A B* is the event that both *A* and *B* occur simultaneously.

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The complement of *A* is denoted by *A. A* is the event that *A* does not occur. Note that Pr(*A*) = 1 − Pr(*A*)*.*



*A* and *B* are mutually exclusive if both cannot occur at the same time.

*A* and *B* are independent events if and only if

Pr(*A* ∩ *B*) = Pr(*A*) Pr(*B*)*.*



Multiplication Law: If *A*1*, , Ak* are independent events, then

· · ·

Pr(*A*1 ∩ *A*2 ∩ · · · ∩ *Ak*) = Pr(*A*1) Pr(*A*2) · · · Pr(*Ak*)*.*

Addition Law: If *A* and *B* are any events, then

Pr(*A* ∪ *B*) = Pr(*A*) + Pr(*B*) − Pr(*A* ∩ *B*)

Note: This law can be extended to more than 2 events.

The conditional probability of *B* given *A*

P

Pr(*B*|*A*) =

r(*A* ∩ *B*)

Pr(*A*)



*A* and *B* are independent events if and only if

Pr(*B*|*A*) = Pr(*B*) = Pr(*B*|*A*)