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Probability and Applied Statistics

Formula Sheet

The ***mean*** of a sample:

The ***variance*** of a sample:

The ***standard deviation*** of a sample:

The ***permutation*** of a sample:

The ***combination*** of a sample:

The ***conditional probability*** of an event A, given that even B occurred:

Two events A and B are said to be ***independent*** if any one of the following holds:

**The Multiplicative Law of Probability**

The probability of the ***intersection*** of two events A and B is:

If A and B are ***independent***, then:

**The Additive Law of Probability**

The probability of the ***union*** of two events A and B is:

If A and B are mutually exclusive events,

and

***Bayes’ Rule*** If {B­1, B2, …, Bk} is a partition of S such that P(Bi) > 0, for i = 1, 2, …, k. Then,

Let Y be a discrete random variable with the probability function p(y). Then the expected value of Y, E(Y), is defined to be:

A random variable Y is said to have a ***binomial distribution*** based on ***n*** trials with success probability ***p*** if and only if: ,

A random variable Y is said to have a ***geometric distribution*** if and only if:

,

If Y is a random variable with a ***geometric distribution***,

A random variable Y is said to have a ***hypergeometric probability distribution*** if and only if:

, where y is an integer 0,1, 2,…,n, subject to the restrictions:

.

If Y is a random variable with a ***hypergeometric distribution***, ,

A random variable Y is said to have a ***negative binomial probability distribution*** if and only if:

,

If Y is a random variable with a ***negative binomial distribution***

A random variable Y is said to have a ***Poisson Probability Distribution*** if and only if:

, With p(y) = 0 for other values of y, and e = 2.7182818

**Tchebysheff’s Theorem**:

**The Uniform Probability Distribution**

If , a random variable Y is said to have a continuous *uniform probability distribution* on the interval if and only if the density function of Y is:

**The Normal Probability Distribution**

A random variable Y is said to have *normal probability distribution* if and only if, for and , the density function of Y is:

**The Exponential Distribution**

A random variable is said to have an *exponential distribution with parameter* if and only if the density function of Y is:

, ,

Let and be discrete random variables. The *joint* (or bivariate) *probability function* for and is given by:

If and are discrete random variables with joint probability function , then

1. for all .
2. , where the sum is over all values () that are assigned nonzero probabilities.

For any random variable and , the *joint* (bivariate) *distribution function*:

Let and be jointly discrete random variables with probability function . Then the *marginal* *probability function* of and , respectively, are given by:

and .

Let and be jointly continuous random variables with joint density function . Then the *marginal* *density function* of and , respectively, are given by:

and .