**Poisson Distribution**

**Poisson Distribution Expected**

**Poisson Distribution Variance**

**Poisson Distribution Standard Deviation**

**Tchebysheff’s Theorem**

Let Y be a random variable with mean and finite variance . Then, for any constant k > 0,

**Distribution Function (cdf)**

**Properties of a Distribution Function**

1. is a nondecreasing function of y. (If y1 and y2 are any values such that y1 < y2, then )

**Probability of Density Function**

Let be the distribution function for a continuous random variable Y. Then f(y), given by,

**Properties of a Density Function**

**Interval Probabilities**

**Requirements for Interval Probability**

For to be a legitimate probability density function,

**Expected for Continuous Random Variables**

**Theorem 4.4 (Expected for a function instead of the random variable)**

**Continuous Random Variable Axioms**

Let c be a constant and let be functions of a continuous random variable Y. Then the following results should hold:

1. .

**Variance for Continuous Random Variables**

**Uniform Probability Distribution**

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

**Uniform Probability Distribution (shortcut)**

**Expected for Uniform Probability Distribution**

**Variance for Uniform Probability Distribution**

**Rule**

**Gamma Probability Distribution**

A random variable is said to have a *gamma di*stribution *with parameters* if and only if the density function of is

where

**Expected for Gamma Probability Distribution**

**Variance for Gamma Probability Distribution**

**Chi-square**

Let be a positive integer. A random variable is said to have a *chi-square* *distribution with degrees of freedom* if and only if is a gamma-distributed random variable with parameters and .

**Expected for Chi-square**

**Variance for Chi-square**

**Exponential Distribution of the Gamma Function**

A random variable is said to have a *exponential di*stribution *with parameters* if and only if the density function of is

**Expected for Exponential Distribution of the Gamma Function**

**Variance for Exponential Distribution of the Gamma Function**

**Normal Probability Distribution**

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

**Expected for Normal Probability Distribution**

**Variance for Normal Probability Distribution**

**Beta Probability Distribution**

A random variable *Y* is said to have a *beta probability distribution with parameters* if and only if the density function of *Y* is

where

**Expected for Beta Probability Distribution**

**Variance for Beta Probability Distribution**

**Joint (Bivariate) Probability Function**

Let be discrete random variables. The for is given by

**Joint (Bivariate) Probability Axioms**

If are discrete random variables with joint probability function , then

1. , where the sum is over all values that are assigned nonzero probabilities.

**Discrete Bivariate Function**

For any random variables , the joint (bivariate) distribution function is

**Joint (Multivariate) Probability Function**

For more than two variables, define the joint probability function:

**Joint Probability Density Function**

Let be continuousrandom variables with joint distribution function **.** If there exists a nonnegative function **,** such that

For all , then are said to be *jointly continuous* *random variables.* The function  **i**s called the *joint probability density function*.

**Joint Distribution Function Axioms**

If are random variables with joint distribution function , then

1. If and , then

**Joint Density Function Axioms**

If are jointly continuous variables with a joint density function given by , then

1. for all

**Marginal Probability Functions**

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

**Marginal Density Functions**

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

**Conditional Probability with Joint Probability**

**Conditional Discrete Probability Function**

If are jointly random variables with joint probability function and marginal probability functions and , respectively, then the *conditional d*i*screte probability function* of is

Provided that .

**Conditional Distribution Function**

If are jointly continuous variables with joint density function, then the *conditional distribution function* of is

**Conditional Density**

Let be jointly continuous variables with joint density function, and marginal densities and , respectively. For any such that , the conditional density of is given by

And, for any such that , the conditional density of is given by

**Independent Random Variables for a Distribution Function**

Let have distribution function have distribution function and have joint distribution function . Then are said to be *independent* if and only if

For every pair of real numbers

If are not independent, they are said to be *dependent*.

**Independent Random Variables for a Mass Function**

If are discrete random variables with joint probability function and marginal probability functions and respectively, then are *independent* if and only if

For every pair of real numbers

**Independent Random Variables for a Density Function**

If are continuous random variables with joint density function and marginal density functions and respectively, then are *independent* if and only if

For every pair of real numbers

**Independent Random Variables for a split function**

Let have a joint density function that is positive if and only if , for constants a, b, c, and d; and otherwise. Then are independent random variables if and only if

Where is a nonnegative function of alone and is a nonnegative function of alone.