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**Definition 1.1**

The *mean* of a sample

=

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**Definition 1.2**

The *variance* of a sample

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**Definition 1.3**

The *standard deviation* of a sample

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**Definition 2.6**

The *probability* of event A in S

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**Definition 2.7**

An ordered arrangement of *r* distinct objects is called a *permutation*

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**Theorem 2.3**

The number of ways of partitioning *n* distinct objects into *k* distinct groups

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**Definition 2.8**

The number of *combinations* of *n* objects taken *r* at a time is the number of subsets, each of size *r,* that can be formed from the *n* objects

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**Definition 2.9**

The *conditional probability* of an event A, given that an event B has occurred, is equal to

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**Definition 2.10**

Two events A and B are said to be independent if any one of the following holds, otherwise, the events are said to be dependent

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**Theorem 2.8**

The Multiplicative Law of Probability The probability of the intersection of two events A and B is

If A and B are independent, then

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**Theorem 2.6**

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 (P(A ∩ B)=0) then,

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**Theorem 2.7**

If A is an event, then

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**Definition 2.11**

The *law of total probability*

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**Theorem 2.9**

The *Bayes Rule*

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**Definition 3.3**

The *probability distribution* for a discrete variable Y can be represented by a formula, a table, or a graph that provides

for all y

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**Definition 3.4**

the *expected value* of Y , E(Y ), is defined to be

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**Theorem 3.2**

Let Y be a discrete random variable with probability function p(y) and g(Y ) be a real-valued function of Y . Then the expected value of g(Y ) is given by

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**Definition 3.5**

If Y is a random variable with mean E(Y ) = μ, the *variance* of a random variable Y is defined to be

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**Definition 3.7**

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

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**Theorem 3.7**

Let Y be a binomial random variable based on n trials and success probability p. Then

And

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**Theorem 3.8**

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

And

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**Definition 3.9**

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

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**Theorem 3.9**

If Y is a random variable with a negative binomial distribution

and

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**Definition 3.10**

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

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**Theorem 3.10**

If Y is a random variable with a hypergeometric distribution,

And

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**Definition 3.11**

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

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**Theorem 3.11**

If Y is a random variable possessing a Poisson distribution with parameter λ, then

and

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**Theorem 3.14**

Tchebysheff’s Theorem - Let Y be a random variable with mean μ and finite variance . Then, for any constant k > 0

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**Definition 4.1**

Let Y denote any random variable. The distribution function of Y, denoted by F(y), is such that

F(y) = P(Y ≤ y) for −∞ < y < ∞

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**Definition 4.3**

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

wherever the derivative exists, is called the probability density function for the random variable Y

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**Theorem 4.3**

If the random variable Y has density function f (y) and a < b, then the probability that Y falls in the interval [a, b] is

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**Definition 4.5**

The expected value of a continuous random variable *Y* is

Provided that the integral exists

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**Theorem 4.4**

Let g(Y ) be a function of Y then the expected value of g(Y ) is given by

Provided that the integral exists

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**Defintion 4.6**

If θ1 < θ2, a random variable Y is said to have a continuous uniform probability distribution on the interval (θ1, θ2) if and only if the density function of Y is

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**Theorem 4.6**

If θ1 < θ2 and Y is a random variable uniformly distributed on the interval (θ1, θ2), then

and

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**Definition 4.9**

A random variable Y is said to have a gamma distribution with parameters α > 0 and β > 0 if and only if the density function of Y is

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**Theorem 4.8**

If Y has a gamma distribution with parameters α and β, then

and

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**Definition 4.11**

A random variable Y is said to have an exponential distribution with parameter β > 0 if and only if the density function of Y is

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**Theorem 4.10**

If Y is an exponential random variable with parameter β, then

and

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**Theorem 4.12**

Let Y be a random variable with density function f (y) and g(Y ) be a function of Y . Then the moment-generating function for g(Y ) is

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**Theorem 4.13**

Let Y be a random variable with finite mean μ and variance σ2. Then, for any k > 0,

or

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**Definition 5.1**

Let Y1 and Y2 be discrete random variables. The joint (or bivariate) probability function for Y1 and Y2 is given by

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**Definition 5.2**

For any random variables Y1 and Y2, the joint (bivariate) distribution function F(y1, y2) is

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**Definition 5.3**

Let Y1 and Y2 be continuous random variables with joint distribution function F(y1, y2). If there exists a nonnegative function f (y1, y2), such that

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**Definition 5.4**

Let and be jointly discrete random variables with probability function p(y1, y2). Then the marginal probability functions of and , respectively, are given by

and

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**Definition 5.4**

Let and be jointly continuous random variables with joint density function f (y1, y2). Then the marginal density functions of and , respectively, are given by

and

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**Definition 5.5**

If and are jointly discrete random variables with joint probability function p(, ) and marginal probability functions p1() and p2(), respectively, then the conditional discrete probability function of given is

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**Definition 5.6**

If and are jointly continuous random variables with joint density function f (, ), then the conditional distribution function of given = is

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**Definition 5.7**

Let Y1 and Y2 be jointly continuous random variables with joint density f (y1, y2) and marginal densities f1(y1) and f2(y2), respectively. For any y2 such that f2(y2) > 0, the conditional density of Y1 given Y2 = y2 is given by

and, for any y1 such that f1(y1) > 0, the conditional density of Y2 given Y1 = y1 is given by