Formula sheet

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# Def 1.1: Mean (pg. 9)

The **mean** of a sample of n measured responses y1, y2,..., yn is given by

The corresponding population mean is denoted μ.

# Def 1.2: Variance (pg. 10)

The **variance** of a sample of measurements y1, y2,..., yn is the sum of the square of the differences between the measurements and their mean, divided by n − 1.

Symbolically, the sample variance is

The corresponding population variance is denoted by the symbol .

# Def 1.3: Standard Deviation (pg. 10)

The **standard deviation** of a sample of measurements is the positive square root of the variance; that is,

The corresponding population standard deviation is denoted by

# Theorem 2.3: permutation partitions (pg. 44)

# Theorem 2.4: Unordered subsets (pg. 46)

The number of unordered subsets of size r chosen (without replacement) from n available objects is

# Def 2.7: Permutation (pg. 43)

An ordered arrangement of distinct objects is called a **permutation**. The number of ways of ordering n distinct objects taken r at a time will be designated by the symbol

# Def 2.8: Combination (pg. 46)

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. This number will be denoted by or

# Def 2.9: Conditional Probability (pg. 52)

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

provided P(B) > 0. [The symbol P(A|B) is read “probability of A given B.”]

# Def 2.10: Independence (pg. 53)

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

P(A|B) = P(A),

P(B|A) = P(B),

P(A ∩ B) = P(A)P(B).

Otherwise, the events are said to be **dependent**.

Theorem 2.9: Bayes’ Rule (pg. 71)

Assume that {B1, B2,..., Bk } is a partition of S (see Definition 2.11) such that P(Bi) > 0, for i = 1, 2,..., k. Then

# Theorem 3.2: Expected Random Variable (pg. 93)

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

# Theorem 3.5: Variance Random Variable (pg. 93)

If Y is a random variable with mean E(Y)=μ, the variance of a random variable Y is defined to be the expected value of (Y−μ)2.That is,

Let Y be a discrete random variable with probability function p(y),g(Y)be a function of Y,and c be a constant. Then

# Def 3.7: Binominal Distribution (pg. 103)

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

# Theorem 3.7: Expected and Variance of Binominal Distribution (pg. 107)

Let y be a binominal variable based on n trials and success probability p. Then

# Def 3.8: Geometric Distribution (pg. 115)

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

# Theorem 3.8: Expected and Variance of Geometric Distribution (pg. 116)

If Y is a random variable with a geometric distribution,

# Def 3.9: Negative binominal Distribution (pg. 122)

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

# Theorem 3.9: expected and variance of negative binominal distribution (pg. 123)

If Y is a variable with a negative binominal distribution,

And

# Def 3.10: Hypergeometric Distribution (pg.126)

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

# Theorem 3.10: expected and variance of hypergeometric distribution (pg. 127)

If y is a variable with hypergeometric distribution,

And

# Def 3.11: Poisson Probability Distribution (pg. 132)

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

, y = 0, 1, 2, …,

# Theorem 3.11: Expected and variance of Poisson Distribution (pg.134)

And

# Theorem 3.14: Tchebysheff’s Theorem (pg. 146)

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

Or

# Def 4.1: Distribution function (pg.158)

Let y denote any random variable. The distribution function of Y, dented b F(y), is such that F(y) = P(Y

# Theorem 4.1: properties of a Distribution Function (pg. 160)

2. (

3. F(y) is a nondecreasing function of y.

[If

# Def 4.3: Probability density function for variable Y. (pg. 161)

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.

# Theorem 4.2: Properties of a density function (pg. 162)

If f(y) is a density function for a continuous random variable, then

# Theorem 4.3: Density function f(y) and a < b (pg. 164)

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

# Def 4.5: Expected value of a continuous random variable (pg.170)

The expected value of a continuous random variable Y is

Provided the integral exists.

# Theorem 4.4: Expected value of g(Y) (pg. 170)

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

Provided the integral exists.

# Def 4.6: Uniform Probability Distribution (pg. 174)

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

# Theorem 4.6: Expected and Variance of Uniform Distribution (pg. 176)

If and Y is a random variable uniformly distributed on the interval , then

And

# Def 4.8: Normal Probability Distribution (pg.178)

A random variable Y is said to have normal probability distribution if and only if, for

F(y) =,

# Theorem 4.7: expected and variance of Normal Probability Distribution (pg. 178)

If Y is a normally distributed random variable with parameters, then

And

V(Y) =

# Theorem 4.8: Gamma Probability Distribution

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

where

# Def 4.11: Exponential Probability Distribution

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

# Theorem 4.12: Expected and Variance of Exponential Probability Distribution

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

And

# Def 5.1: Joint Probability Function

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

, ) = P(

# Theorem 5.1: if y1 and y2 are discrete random variables

If Y1 and Y2 are discrete random variables with joint probability function p(y1, y2), then

1. p(, ) ≥ 0 for all , .
2. p(, ) = 1, where the sum is over all values (, ) that are assigned nonzero probabilities.

# Theorem 5.2: Joint distribution function for any random variables

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

, ) = P(

# Def 5.3: Jointly continuous random variables

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

,)d

For all - < , , then and are said to be jointly continuous random variables. The function f( , is called the joint probability density function.

# Def 5.4: Marginal Density Functions

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

, and ,

# Def 5.5: Jointly discrete random Variables

,

# Def. 5.6: conditional Distribution Function

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

# Def 5.7: conditional densities

Let and be jointly continuous random variables with joint density f( , and marginal densities and , respectively. The conditional density is: