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**Formula Sheet**

**Definition 1.1**

This finds the mean of a sample:

**Definition 1.2**

This finds the variance of a sample:

**Definition 1.3**

**This finds the standard deviation of a sample of measurements:**

Corresponding population standard deviation is denoted by:

**Theorem 2.1**

Gets the m elements and n elements to form pairs containing one element from each group:

**Definition 2.6**

S is a sample space associated with an experiment. To every event A in S (A is a subset of S), we assign a number, P(A), called the probability of A, so that the following axioms hold:

Axiom 1: .

Axiom 2: .

Axiom 3: If , , ,... form a sequence of pairwise mutually exclusive events in S (that is, ∩ = ∅ if ),

**Definition 2.7 and Theorem 2.2**

The number of ways of ordering n distinct objects taken r at a time called *Permutation*:

Symbolized by:

Equation:

**Theorem 2.3**

Number of ways of partitioning n distinct objects into k distinct groups containing , *…*  objects, where each object appears in exactly one group.

Equation:

**Definition 2.8 and Theorem 2.4**

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

symbolized by:

Equation:

**Definition 2.9**

*Conditional probability* of an event A, given an event B has occurred is equal to

Provided .

**Definition 2.10**

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

,

,

.

Otherwise, events are said to be *dependent*.

**Theorem 2.5**

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

Equation:

If A and B are independent then:

Equation:

**Theorem 2.6**

The Additive Law of Probability is the probability of the union of two events A and B:

Equation:

If A and b are mutually exclusive events, then:

and

**Theorem 2.7**

If A is an event then:

Equation:

**Definition 2.11**

For some positive integer k, let the sets , *…* such that

Then the collection of sets is said to be a *partition* of S

**Theorem 2.8**

Assume that {, *…* } is a partition of S such that P() > 0, for I = 1,2…,k. Then, for any Event A:

Equation:

**Theorem 2.9**

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

Equation:

**Definition 3.2**

The probability that Y takes on the value y, P(Y = y), is defined as the sum of the probabilities of all sample points in S that are assigned the value y. We will sometimes denote P(Y = y) by p(y).

**Definition 3.3**

The probability distribution for a discrete variable Y can be represented by a formula, a table, or a graph that provides p(y) = P(Y = y) for all y.

**Theorem 3.1**

For any discrete probability distribution, the following must be true:

1. for all y.
2. , where the summation is over all values of y with nonzero probability

**Definition 3.4**

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:

Equation:

**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:

Equation:

**Definition 3.5**

If Y is a random variable with mean , the variance of a random variable Y is defined to be the expected value of. That is,

Equation: .

The *standard deviation* of Y is the positive square root of V(Y ).

**Theorem 3.3**

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

**Theorem 3.4**

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:

Equation:

**Theorem 3.5**

Let Y be a discrete random variable with probability function p(y) and be k functions of Y . Then:

Equation:

**Theorem 3.6**

Let Y be a discrete random variable with probability function p(y) and mean ; then:

Equation:

**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:

Equation:

**Theorem 3.7**

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

**Definition 3.8**

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

Equation:

**Theorem 3.8**

If Y is a random with a geometric distribution:

Equation:

Equation:

**Definition 3.10**

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

Equation:

where y is an integer 0, 1, 2,..., n, subject to the restrictions and .

**Theorem 3.10**

If Y is a random variable with a hypergeometric distribution:

Equation:

Equation:

**Definition 3.9**

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

Equation:

**Theorem 3.9**

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

Equation:

Equation: