**Stats Formula Sheet**

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**Definition 1.1**

**Definition 1.2**

**Definition 1.3**

**Definition 2.1**

An experiment is the process by which an observation is made.

**Definition 2.2**

A simple event is an event that cannot be decomposed. Each simple event corresponds to one and only one sample point. The letter E with a subscript will be used to denote a simple event or the corresponding sample point.

**Definition 2.3**

The sample space associated with an experiment is the set consisting of all possible sample points. A sample space will be denoted by S.

**Definition 2.4**

A discrete sample space is one that contains either a finite or a countable number of distinct sample points.

**Definition 2.5**

An event in a discrete sample space S is a collection of sample points—that is, any subset of S.

**Definition 2.6**

The probability of pairwise exclusive events is the sum of the probabilities.

**Definition 2.7**

An ordered arrangement of r 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

**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. This number will be denoted by

**Definition 2.9**

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

**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.

**Definition 2.11**

For some positive integer k, let the sets B1, B2,..., Bk be such that:

1.

2.

Then the collection of sets {, ,..., } is said to be a partition of S.

**Definition 2.12**

A random variable is a real-valued function for which the domain is a sample space.

**Definition 2.13**

Let N and n represent the numbers of elements in the population and sample, respectively. If the sampling is conducted in such a way that each of the samples has an equal probability of being selected, the sampling is said to be random, and the result is said to be a random sample.

**Definition 3.1**

A random variable Y is said to be discrete if it can assume only a finite or countably infinite1 number of distinct values.

**Definition 3.2**

The probability that Y takes on the value 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 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 for all y.

**Definition 3.4**

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

the expected value of , is defined to :

**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,

**Definition 3.6**

A binomial experiment possesses the following properties:

1. The experiment consists of a fixed number, n, of identical trials.

2. Each trial results in one of two outcomes: success, S, or failure, F.

3. The probability of success on a single trial is equal to some value p and

remains the same from trial to trial. The probability of a failure is equal to

q = (1 − p).

4. The trials are independent.

5. The random variable of interest is Y, the number of successes observed

during the n trials.

**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:

**Definition 3.8**

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

only if:

**Theorem 2.1**

With m elements a1, a2,..., am and n elements b1, b2,..., bn, it is possible to form mn = m × n pairs containing one element from each group.

**Theorem 2.2**

**Theorem 2.3**

The number of ways of partitioning n distinct objects into k distinct groups containing n1, n2,...,nk objects, respectively, where each object appears in exactly one group and is:

**Theorem 2.4**

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

**Theorem 2.5**

Multiplicative Law of Probability:

If independent:

**Theorem 2.6**

General Addition Rule

If mutually exclusive: P(A ∩ B) = 0

**Theorem 2.7**

**Theorem 2.8**

Assume that {, ,..., } is a partition of S (see Definition 2.11) such that P() > 0, for i = 1, 2,..., k. Then for any event A:

**Theorem 2.9**

Bayes Rule, Assume that {, ,..., } is a partition of S (see Definition 2.11) such that P() > 0, for i = 1, 2,..., k. Then for any event A:

**Theorem 3.1**

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

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

**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

**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.

**Theorem 3.5**

Let Y be a discrete random variable with probability function p(y) and

be k functions of Y . Then

**Theorem 3.6**

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

**Theorem 3.7**

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

**Immediate corollaries of the axioms**

**Permutation**

**Combination**

**Complement**

s ∈ A’ ⇐⇒ s ∈ S but s ∈/ A

A ⋂ A’ = Ø and A U A’ = S

**Distributive Laws**

**De Morgan’s Laws**

**Conditional Probability**