**Definition 1.1 The mean**:

**Definition 1.2 Variance:**

**Definition 1.3 Standard Deviation:**

**Empirical Rule:**

For a distribution of measurements that is approximately normal (bell shaped), it follows that the interval with end points µ ± σ contains approximately 68% of the measurements. µ ± 2σ contains approximately 95% of the measurements. µ ± 3σ contains almost all of the measurements

**Definition 2.1:** An experiment is the process by which an observation is made

**Simple event:**   
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: Sample Space:**  
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: Discrete Sample Space:**A discrete sample space is one that contains either a finite or a countable number of distinct sample points

**Definition 2.5: Event**:

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

**Definition 2.6: Event**:

Suppose 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: P(A) ≥ 0. Axiom 2: P(S) = 1. Axiom 3: If A1, A2, A3,... form a sequence of pairwise mutually exclusive events in S (that is, Ai ∩ Aj = ∅ if i != j), then

**THEOREM 2.1(M&N rule):**

**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:

**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 ni = n, is

**Theorem 2.4**

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

**Definition 2.9:**

**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.

**Theorem 2.5: The Multiplicative Law of Probability**

**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 and

**Theorem 2.7**

If A is an event, then:

P(A) = 1 − P().

**Definition 2.11:**

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

2.

**Theorem 2.8:**

**Theorem 2.9: Baye’s Rule**

**Definition 2.12: Random Variable**

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 countably infinite number of distinct values

**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

**Definition 3.4: Expected Value of a Random Variable**

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^2

**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 3.5:**

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:

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:

**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 E(Y ) = µ; then:

V(Y) = = =

**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

**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:

**Theorem 3.8:**

If Y is a random variable with a geometric distribution.