Definition 1.1

The **mean** of a sample of n measured responses $y_1 y_2 ... y_n$ is given by

$$\overline{y} = \frac{1}{n}\sum_{i=1}^{n}\left(y_1\right)$$

The corresponding population mean is denoted μ.

Definition 1.2

The **variance** of a sample of measurements $y_1 y_2 ... y_n$ is the sum of the square of the differences between the measurements and their mean, divided by n − 1. . Symbolically, the sample variance is

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(y_{1-}\overline{y}\right)^2$$

The corresponding population variance is denoted by the symbol σ^2.

Definition 1.3

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

$$s = \sqrt{(s)^2}$$

The corresponding population standard deviation is denoted by $\sigma = \sqrt{(\sigma)^2}$

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 P_n^r

P_n^r = n (n – 1) (n − 2) ⋯ (n − r + 1) = $\frac{n!}{(n-r)}$

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 C_r^n or $\binom{r}{n}$.

P^{r}_{n}= n (n – 1) 0(n − 2) ··· (n − r + 1) = $\frac{n!}{(n-r)}$

Definition 2.9

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

P(A|B) = $\frac{P(A \cap B)}{P(B)}$, provided P(B) > 0. [The symbol P(A|B) is read "probability of A given B."]

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 $P(y) = \binom{n}{y} P^{y} Q^{n-y}, \ y = 0, 1, 2,..., \ n \ and \ 0 \leq p \leq 1.$

Definition 3.8

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

$P(y) = Q^{y-1}, \ y = 0, 1, 2,..., \ 0 \leq p \leq 1.$

Definition 3.10

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

$$P(y) = \frac{\binom{r}{y}\binom{N-r}{n-y}}{\binom{N}{n}}$$

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

Definition 3.11

A random variable Y is said to have a **Poisson probability distribution** if and only if$P(y) = \frac{\lambda^{y}}{y!}e^{-\lambda}$, y = 0, 1, 2... λ > 0.

Definition 3.14

Tchebysheff's Theorem Let Y be a random variable with mean μ and finite variance μ^{2}. Then, for any constant K>0, $P(|Y - \mu| < k\sigma) > 1 - \frac{1}{k^{2}} \ or \ P(|Y - \mu| \geq k\sigma) \leq \frac{1}{k^{2}}$

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 < ∞.

Definition 4.2

A random variable Y with distribution function F(y) is aid to be **continuous** if F(y) is continuous, for

$-\infty < y < \infty^{2}$

Definition 4.3

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

$$f(y) - \frac{dF(y)}{dy} = F'(y)$$

Wherever the derivative exists, is called the **probability function** for the random variable y.

Theorem 4.2

Property of Density Function If f(y) is a density function for a **continuous random variable**, then

1. $f(y) \geq 0\ for\ all\ y,\ -\infty < \infty.$

2. $\int_{-\infty}^{\infty} f(y)\, dy = 1.$

Definition 4.6

If $_1 <\ _2$ a random variable Y is said to have a continuous **uniform probability distribution** on the interval ($_1,\ _2$) if and only if density function Y is

f(y) = $\{\frac{1}{_1 \_\ _2},\quad ^1 < y <\ ^2 0.\qquad elsewhere$

Theorem 4.6 (Uniform Distribution)

If ${}_1 <$ ${}_2$ and Y is a random variable uniformly distributed on the interval (${}_1 <$ ${}_2$), then

$$\mu = E(Y) = \frac{{}_1 + {}_2}{2} \; and \; \sigma^2 = V(Y) = \frac{({}_2 - {}_1)^2}{12}$$