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# Definition 1.1

**Mean of a sample**

# Definition 1.2

**Variance**

# Definition 1.3

Standard Deviation

s=

# Empirical Rule

# 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

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, ∩ = ∅ if i j ), then*

# Theorem 2.1

# 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

# 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 or

# Theorem 2.4

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

# Definition 2.9

The conditional probability of an event A, given that an event B has occurred,

is equal to

P(A|B)=

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

# Definition 2.10

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 2.5

The Multiplicative Law of Probability The probability of the intersection of

two events A and B is

P(A ∩ B)= P(A)P(B| A)

= P(B)P(A|B).

If A and B are independent, then

P(A ∩ B)= P(A)P(B).

# Theorem 2.6

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

P( A ∪ B)= P( A) + P(B)− P( A ∩ B).

If A and B are mutually exclusive events, P( A ∩ B)= 0 and

P( A ∪ B)= P( A) + P(B).

# Theorem 2.7

If A is an event, then

P(A)= 1− P().

# Definition 2.11

1.

2. = ∅, for i j.

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

# Theorem 2.9

**Baye’s Rule**

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

# 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, 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. 0 ≤ p(y) ≤ 1 for all y.

# 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

# 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

# Definition 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 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 E(c)= c.

# 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

# Theorem 3.6

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

# 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

, y= 0, 1, 2, . . . , n and 0 ≤ p ≤ 1.

# 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,