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Probability and Statistics Definitions

**Chapter 1**

Mean:

|  |
| --- |
| The mean |
| n = the number of numbers in the list |
| The number in the list of the current interval |

Simple: Take the sum of a list of numbers and divide it by the

number of numbers in that list

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Variance:

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| --- |
| = Variance |
| n = The number of numbers in the list |
| The number in the list of the current interval |
| The mean (of the list of numbers) |

Simple: subtract the mean (of the list of numbers) from each number, square each number, add them up, and divide them by the number of numbers in the list minus 1

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Standard Deviation:

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| --- |
| S = standard deviation |
| Variance |

Simple: take the square root of the variance

Chapter 2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Experiment: the process in which an observation is made.

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Simple Event: an event that cant be decomposed. Each simple event corresponds to a single sample point. Usually denoted by E with a subscript.

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Sample Space: The space associated with an experiment, containing all the possible sample points, Usually denoted by S.

Discrete Sample Space: contains a finite or countable number of sample points

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Event: in a discrete sample space S, it is the collection of sample points. Also known as a subset of S

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Probability: Suppose S a sample space associated with an experiment. To every event A in S is assigned a number, P(A), the probability.

If form a sequence of pairwise mutually exclusive events in S (that is, = if I j),

then

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The sample point method: How

1. Define the experiment clearly and determine how to describe one simple event
2. List the simple events associated with the experiment and test each one to make sure it cannot be decomposed, this will define the sample space S
3. Assign reasonable probabilities to the sample point in S, making certain that ) 0 and
4. Define an event of interest, A, as a specific collection of sample points.
5. Find P(A) by summing the probabilities of sample points in A

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mn Rule: with elements and elements , it is possible to form mn = m n pairs containing one element from each group

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Permutation: an ordered arrangement of distinct objects, the number of ordering n distinct objects taken r at a time will be designated by

In factorial

Where and 0! = 1

Simple:

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Partition: The number of putting distinct objects into k distinct groups containing objects, respectively, where each object appears in exactly group and is

Combinations: objects taken at a time is the number of subsets each of the size of r, that can be formed from n objects this is denoted by

The number of unordered subsets of size r from n available objects is

Conditional Probability: the chance of event A, given B has occurred is equal to

Independent: Two events are independent if any one of the following holds

Otherwise said events are dependent

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

If A and B are independent then

Additive Law of Probability: The probability of the union of two sets is

If A and B are mutually exclusive events, , and

If A is an event, then

Event Composition Method:

1. Define the experiment
2. Visualize the nature of the sample points
3. Write an expression describing the event of interest (typically A) as a composition of two or more events (Using that use the same Set of sample points
4. Apply multiplicative/additive laws of probability

Partition: For some positive integer K, let Sets such that

1. S =
2. for

Then the collection of Sets { is a partition of S

Assuming that { is a partition of S such that P(, for 1, 2, . . ., k. Then for any event A

Bayes Rule: Assume that {is a partition of S such that P(, for 1, 2, . . ., k. Then

Random Variable: A real valued function for which the domain is the sample space

Random Sample: Let N and n represent the number of elements in the population and sample respectively. If sampling is conducted in a way that each of the samples have equal probability of being selected, the sampling is said to be random, and the result is a random sample

Discrete: If a random variable Y can assume only a finite or countably infinite number of distinct values

Sum of the Probabilities of All Sample Points: the probability that Y takes on the value y, P(Y = y), is defined as the sum of probabilities of all sample points in S that are assigned the value y. sometimes P(Y = y) is denoted as p(y)

Probability Distribution: for a discrete variable Y, it can be represented by a formula, table, or graph that provides p(y) = P(Y = y) for all y.

For any Discrete Probability Function the following must hold true

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

Expected Value: Let Y be a random variable with the probability function p(y). Then the expected value is

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

Standard Deviation: If Y is a random variable with mean E(Y) =, the variance of a random Y is defined to be the expected value of (Y - . That is,

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

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

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

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

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

Binomial experiment: possesses the following properties

1. Experiment consists of a fixed number n of identical trials
2. Each trial results in one of two outcomes, S (success) or F (failure)
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 failure (assigned to some value q) is equal to q = (1 – p)
4. Trials are independent
5. The random variable of interest is Y, the number of successes during n trials

Binomial Distribution: A random variable Y is said to have a binomial distribution based on n trials with success probability p if and only if

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

Geometric Probability Distribution: A random variable Y is said to have a Geometric Probability Distribution if and only if

If Y is a random variable with a geometric distribution

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

Simple: y(trials), r(successes), p(prob favorable), q(1 – p)

Hypergeometric probability distribution:

Simple: we want r many of ~~~and were choosing y many, subtract leftovers into the other brackets and denominator is overall how many options choose how many we choose

Poisson probability distribution:

Simple: (number of events in a period), y(asked # of events occurring in a period)

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Tchebyscheffs:

Simple:

Chapter 4

Distribution Function:

Continuous Distribution Function: if F(y) is said to be continuous

Probability density Function: for a continuous distribution function

All integrations = 1

Expected:

Given g(Y) of Y exists then the expected of g(Y) is

Variance

If c is a constant and we have continuous functions of Y with then

1. E(c) = c
2. E[cg(Y )]= cE[g(Y )].
3. E[g1(Y )+g2(Y )+· · ·+gk (Y )]= E[g1(Y )]+E[g2(Y )]+· · ·+E[gk (Y )].

Uniform probability distribution: continuous distribution that takes values between a range

Expected:

Variance:

Gamma distribution: random variable Y with parameters

Expected:

Variance:

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Let ν be a positive integer. A random variable Y is said to have a chi-square

distribution with ν degrees of freedom if and only if Y is a gamma-distributed

random variable with parameters α = ν/2 and β= 2.

Exponential Distribution: If a gamma distribution has and

Expected:

Variance:

**Chapter 5**

Joint probability function: for and which are discrete random variables, is given by

Joint distribution function:

Joint probability density function: continuous random variables with joint distribution function

Marginal probability functions:

Marginal density function: