Formula sheet

Chapter 1:

**Mean** of a sample of *n* measured responses y1, y2,…,yn is given by

= i

The corresponding population mean is denoted µ.

**Variance** of a sample of a sample of measurements y1, y2,…,yn is the sum of the square of differences between the measurements and their mean, divided by *n* – 1. Symbolically, the sample variance is

The corresponding population variance is denoted by σ2.

**Standard deviation** of a sample of measurements is the positive square root of the variance which is

The corresponding *population* standard deviation is

**Empirical Rule**

For a distribution of measurements that is approx. normal (bell shaped), the interval with end points

– contains approx. 68% of the measurements

– contains approx. 95% of the measurements

– contains almost all the measurements

Chapter 2:

**Sample spaces + Events**

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*:

*Axiom 2*:

*Axiom 3*: If *A*1, *A*1, *A*1, … form a sequence of pairwise mutually exclusive events in *S* (*A*i ⋂ *A­j =* ∅ if *i* ≠*j*), then

\*\*Additional notes:

**Permutations**

An ordered arrangement of *r* distinct objects. The number of ways of ordering *n* distinct objects taken *r* at a time will be designated by .

Expressed in factorials:

where and

\*\*order matters here

**Multinomial Coefficients**

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

**Combinations**

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

\*\*order doesn’t matter here

**Conditional Probability**

Probability of event A given event B has occurred:

as long as P(B) > 0

Events A and B are *independent* if any one of the following holds:

Otherwise, the events are *dependent*.

**Multiplicative Law of Probability**

Probability of intersection of events A and B is

If A and B are independent, then

**Additive Law of Probability**

Probability of union of events A and B is

If A and B are mutually exclusive events, and

**Theorem of Total Probability**

**Bayes’ Theorem**

For two events A and B in sample space S, with *P(A) > 0* and *P(B) > 0*,

*If 0 < P(B) < 1, we may write by the Theorem of Total Probability*:

Chapter 3

**Probability Distribution for a Discrete Random Variable**

The set of all points in S assigned the value y by the random variable Y:

The probability that Y takes on the value y, , is the *sum of all the probabilities of all sample points in S* that are assigned the value of y.

Sometimes can be denoted by p(y), which is sometimes called the *probability function*.

Probability Distribution for discrete variable Y:

A formula/table/graph that provides for all y.

PMF requirements:

1.) for all y.

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

**Expected Value of Random Variable/Function of Random Variable**

Let *Y* be a discrete random variable with probability function *p*(*y*). Then *expected value* of *Y*, *E*(*Y*), is

Variance:

Where

Standard deviation:

**Binomial Probability Distribution**

Based on *n* trials with success probability *p* if and only if

and

µ = E(Y) = np and σ2 = V(Y) = npq

**Geometric Probability Distribution**

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Expected and Variance:

Success occurring **on** or **before** nth trial:

Success **before** nth trial:

Success **on** or **after** nth trial:

Success **after** nth trial:

**Hypergeometric Probability Distribution pmf**

Expected and Variance:

**Poisson Distribution**

Expected Variance and

λ corresponds to “rate” at which successes occur in a continuous approx. to the experiment.

**Tchebysheff’s Theorem**

For any constant k > 0,

**Probability Density Function**

**Interval Probabilities**

**Cumulative Distribution Function**

**Expected Value of a Continuous Random Variable**

**Variance of a Continuous Random Variable**

**Joint Distribution Function**

**Marginal Probability Functions**

**Marginal Density Functions**

**Conditional Discrete Probability Functions**

**Conditional Density Functions**

and are said to be *independent* if and only if:

**Joint Distribution Function**

**Marginal Probability Functions**

**Marginal Density Functions**