# Reference Sheet

## Probability

### Addition Rule

The likelihood that either event **and/or** occurs.

**Note:** if and are Disjoint then

### Multiplication Rule

For *Independent* Processes

General Rule for *both* dependant and independend processes

For Three Events

### Complement Rule

### Conditional Probability

The probability that occurs given has occurred

### Law of Total Probability

Suppose a sample space is partitioned in 3 disjoint events . Then for any event

### Sum of Conditional Probabilities

### Complement Rule for Conditional Probability

### Bayes’ Theorem

### To find

1. Calculate
2. Then calculate using

## Random Variables

### Expectation of a Random Variable

The sum of each outcome multiplied by its coorresponding probability

### Variability of Random Variables

#### Standard deviation

### Linear Combinations of Random Variables

For two independant variables

## Probability Distributions

### Normal Distributions

: = mean of the distribution, = standard deviation.

#### Z Scores

#### Comparing Data to Normal Distribution

evaluates to a probability, you then use this value to calculate the Z Score of each data point and plot data point vs Z value, the closer to a linear distribution the data is, the more linear the data plot is.

### Bernoulli Trial

with two possible outcomes (success and failure)

success on one trial

failure on one trial

#### Bernoulli Random Variable

<- Pass

<- Fail

#### Geometric Distributions

If W is the waiting time for first success, which is the number of the trial on which the first success appeared

For

$$E(W)=\mu ={1\over p}$$

$$\sigma = \sqrt{1-p\over p^2}$$

### Combinatorics

#### Rule 1: Multiplication

For a set of events where:

* Event 1 can be options
* Event 2 can be options
  + Event can be options

The total number of combinations of each event is

#### Rule 2: Permutations

The number of permutations of a set defines the number of unique combinations of length including unique orders that the set can create

if k=n then

#### Rule 3: Combinations

The number of combinations is defined as the number of unique unordered subsets of a set, this can also be viewed as number of permutations regardless of order

$$(^n\_k)={(n)\_k\over k}={n!\over k!(n-k)!}$$

## Foundations of Inference

The distribution of a **sample mean** is well approximated by a normal distribution if: the events are independent, and the sample size is appropriate

$\bar{x}\approx N(\mu , {\sigma \over \sqrt{n}})$

${\sigma \over \sqrt{n}}$ is the standard error or

### Confidence Intervals

Z is the ‘Z score’ we want to get (% likely within from table)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Confidence Coefficient (1-) |  |  |  |  |
| 0.90 | 0.1 | 0.05 | 1.645 |  |
| 0.95 | 0.05 | 0.025 | 1.96 |  |
| 0.98 | 0.2 | 0.01 | 2.33 |  |
| 0.99 | 0.01 | 0.005 | 2.58 |  |

### Margin of Error

is the **Margin of error**

### p-value

to find p-value you must first find the # of Standard Error away from the sample mean the null hypothesis is

(s - sample variance, SE - Sample Error, n - sample size)

The p(x) is then calculated by looking at the table and finding the corresponding % chance that this variable would be observed

## linear Regression

Model perameters= Explanatory variable: Response variable: Error:

Required: Sample mean and , Stdv x and y

### Residuals

Residual: e\_i, Measured value: , Predicted value:

### Correlation

-1 neg lin association, 1 = pos lin association, 0= no linear association

is just above squared