* **(Definition 1.1, page 9) Mean**
* **(Definition 1.2, page 10) Variance:**
* **(Definition 1.3, page 10) Standard Deviation:** 
  + Step 1: average set; is set and is mean
  + Step 2: subtract average from all elements
  + Step 3: square these deviations
  + Step 4: sum these squares
  + Step 5: divide by count; N is count
  + Step 6: square root
* **Empirical Rule (page 10): used for normal distribution problems (Gaussian Distribution, Bell curves) where is the “expected” (or average) and is the standard deviation**
  + contains 68% of the measurements
  + contains 95% of the measurements
  + contains 99.7% of the measurements
* **Distributive Laws in Set Theory (page 25)**
* **De Morgan’s Laws in Set Theory (page 25)**
* **Corollaries**
* **Calculating Probability of Event / Sample-Point method (page 36)**
  + Determine common events (S=E1,E2,…En)
  + Assign probabilities to each event (P(E1)=x)
  + Pick out with events are of interest (A)
  + Use in probability equation (P(A)=?)
* **(Theorem 2.2, page 43) Permutations:** an ordered arrangement of r distinct objects
* **(Theorem 2.3, page 44) Multinomial Coefficients:** the number of ways of partitioning n distinct objects into **k** disjoint subsets of sizes **n1,n2,…nk**
* **(Definition 2.9, page 52) Conditional Probability:** the probability of A if B has already occurred
  + **as long as P(B)>0**
  + Note: This formula is not reversible
* **(Definition 2.10, page 53) Independent Events: If any of the following are true, then the events are independent, meaning the probability of A is unaffected by the probability of B.**
* **(Theorem 2.5, page 57) Multiplicative Law of Probability: the probability of the intersection of two events A and B,**
  + **If independent:**
  + **Otherwise:**
* **(Theorem 2.6, page 58) General Addition Rule/The Additive Law of Probability** 
  + **If mutually exclusive (where ):**
  + **Otherwise:**
  + **With three events:**
* **(Theorem 2.8, page 70) Theorem of Total Probability: assuming ,**
* **(Theorem 2.9, page 71) Bayes Theorem:** used to make probability statements concerning an event B that has not been observed, but A has been observed
  + **With P(A)>0 and P(B)>0:**
  + **If 0<P(B)<1:**
* **Probability Mass Function:** the function that records how probability is distributed across points in R, where (Y=y) represents the set of all points in S assigned the value y by random variable Y, and P(Y=y) represents the probability that Y takes on the value of y
  + p(y) must be 0≤p(y)≤1 for all y
  + the summation over all y values must equal to 1
* **(Definition 3.4, page 91) Expectation of a discrete random variable**
* **(Definition 3.5, page 93)**
  + **Variance of a discrete random variable:**
  + **Standard Deviation:**
* **(Definition 3.6, page 101) Binomial Experiment requirements:**
  + **Rule 1:** must consist of a fixed number, **n**, of identical trials
  + **Rule 2:** trial results in one of two outcomes: either success (S) or failure (F)
  + **Rule 3:** the probability of success on a single trial is equal to some value **p** and remains the same from trial to trial and the probability of failure is equal to **q=(1-p)**
  + **Rule 4:** The trials are independent
  + **Rule 5:** The random variable of interest, **Y**, is the number of success observed during n trials
* **(Definition 3.7, page 103) Binomial Distribution pmf**
* **(Theorem 3.7, page 107) Expected and Variance of Binomial Distributions**
  + Expected:
  + Variance:
* **(Definition 3.8, page 115) Geometric Distribution:** 
  + Success occurs on or before the nth trial:
  + Success occurs before the nth trial:
  + Success occurs on or after the nth trial:
  + Success occurs after the nth trial:
* **(Theorem 3.8, page 116) Expected and Variance of Geometric Distribution**
  + **Expected:**
  + **Variance:**
* **(Definition 3.10, page 126) Hypergeometric Distribution**
* **(Theorem 3.10, page 127) Expected and Variance of Hypergeometric Distribution**
  + **Expected:**
  + **Variance:**
* **(Definition 3.11, page 132) Poisson Distribution**
* **(Theorem 3.11, page 134) Expected and Variance of Poisson Distribution**
  + **Expected:**
  + **Variance:**
* **(Theorem 3.14, page 146) Tchebysheff’s Theorem**
* **(Definition 4.1, page 158) Continuous Random Variable Distribution Function:** Let Y denote any random variable. The distribution function of Y, denoted by F(y), such that
* **(Theorem 4.1, page 160) Distribution Function Properties:**
  + 1)
  + 2)
  + 3) F(y) is a nondecreasing function of y; if x and y are any values such that x < y then F(x) ≤ F(y)
* **(Definition 4.3, page 161) Probability Density Function:** Let F(y) be the distribution function for a continuous random variable Y.
* **(Theorem 4.2, page 162) Probability Density Function Properties:** If f(y) is a density function for a continuous random variable, then
  + 1)
  + 2)
* **(Definition 4.5, page 170) Expected and Variance of Continuous Random Variables**
  + **Expected:**
  + **Variance:**
* **(Definition 4.6, page 174) Uniform Probability Distribution:** If a < b, a random variable Y is said to have a continuous uniform probability distribution on the interval (a,b) if and only if the density of Y is
* **(Theorem 4.6, page 176) Expected and Variance of Uniform Probability Distribution**
  + **Expected:**
  + **Variance:**
* **(Definition 5.1, page 225) Joint Probability Function:** Let X and Y be discrete random variables. The joint (or bivariate) probability function for X and Y is given by
* **(Theorem 5.1, page 225) Properties of Joint Probability Functions:** If X and Y are discrete random variables with joint probability function p(x,y) then:
  + 1) p(x,y) ≥ 0 for all x, y
  + 2) , where the sum is over all values (x,y) that are assigned nonzero probabilities
* **(Definition 5.2, page 226) Joint Distribution Function:** For any random variables X and Y, the joint (or bivariate) distribution function for F(x,y) is
* **(Definition 5.3, page 227) Joint Probability Density Function:** Let X and Y be continuous random variables with joint distribution function F(x,y). If there exists a nonnegative function f(x,y) such that for all -∞ < x < ∞ and -∞ < y < ∞, then X and Y are said to be jointly continuous random variables
* **(Definition 5.4a, page 236) Marginal Probability Function:** Let X and Y be jointly discrete random variables with probability function p(x,y)
* **(Definition 5.4b, page 236) Marginal Density Function:** Let X and Y be jointly continuous random variables with joint density function f(x,y)
* **(Definition 5.5, page 239) Conditional Discrete Probability Function:** If X and Y are jointly discrete random variables with joint probability function p(x,y) and marginal probability function p1(x) and p2(y), respectively, then
* **(Definition 5.6, page 240) Conditional Distribution Function:** If X and Y are jointly continuous random variables with joint density function f(x,y), then
* **(Definition 5.7, page 241) Conditional Density Function:** Let X and Y be jointly continuous random variables with joint density f(x,y) and marginal densities f1(x) and f2(y), respectively.
  + For any y such that f2(y)>0, the conditional density of X given (Y=y) is given by
  + For any x such that f1(y)>0, the conditional density of Y given (X=x) is given by
* **(Definition 5.8, page 247) Independent Random Variables:** Let X have distribution function F1(x), Y have distribution function F2(y), and X and Y have joint distribution function F(x,y). Then X and Y are said to be independent if and only if
  + for every pair of real numbers (x,y)
* **(Theorem 5.4, page 247) Independent Random Variables:** 
  + If X and Y are discrete random variables with joint probability function p(x,y) and marginal probability functions p1(x) and p2(y), respectively, then X and Y are independent if and only if
    - for all pairs of real numbers (x,y)
  + If X and Y are continuous random variables with joint density function f(x,y) and marginal density functions f1(x) and f2(y), respectively, then X and Y are independent if and only if
    - for all pairs of real numbers (x,y)
* **(Theorem 5.5, page 250) Independent Random Variables:** Let X and Y have a joint density f(x,y) that is positive if and only if a ≤ x ≤ b and c ≤ y ≤ d, for constants a, b, c, and d; and f(x,y) = 0 otherwise. Then X and Y are independent random variables if and only if
  + where g(x) is a nonnegative function of x alone and h(y) is a nonnegative function of y alone