**Formula Page**

**Algebra of set theory**

**Union**: ; **Intersection**: ; **Complement**:

**Commutative Laws**: ,

**Associative Laws**: ,

**Distributive Laws**: ,

**De Morgan’s Law**: ,

**Computing probabilities**

k samples from n objects

|  |  |  |
| --- | --- | --- |
|  | ordered | unordered |
| replacement |  |  |
| no replacement |  |  |

**Conditional probabilities、Bayes’ Theorem、Law of total probability**

**Addition Law**:

**Multiplication Law**:

**Bayes’ theorem**:

**Law of total probability**:

**Type of probabilities**:

|  |  |  |  |
| --- | --- | --- | --- |
| Events |  | … |  |
| Prior probabilities |  | … |  |
| Conditional probabilities |  | … |  |
| Joint probabilities | 、 | … | 、 |
| Posterior probabilities |  | … |  |

**Independence**

**Discrete rv**

,

**Bernoulli distribution**: X takes on only two values e.g. 0 and 1, with probabilities 1 − p and p.

, Mean: , Variance:

**Binomial distribution**: X is the sum of n variables that follow Bernoulli distribution.

, Mean: , Variance:

Limit: Poisson Distribution,

**Geometric distribution (total number of trials)**: X is the total trials until the first success.

, Mean: , Variance:

**Geometric distribution (number of failures)**: X is the total fail trials until the first success.

, Mean: , Variance:

**Poisson Distribution**: X is the number of times an event occurs in a given interval of time.

, Mean:, Variance:

Limit: Normal Distribution,

**Continuous rv**

**pth quantile** :

**Uniform Distribution**:

pdf: , cdf: , Mean:, Variance:

**Normal distribution**: , pdf: , Mean: , Variance:

**Exponential distribution**: the time until next event. : count per time unit

pdf: , cdf:

Mean: , Variance:

**distribution**: pdf: ; ,

**Joint Distribution**

**Covariance**

**Limiting Theorems**

**Chebyshev’s Inequality**:

Let X be a random variable with known and but unknown distribution

**Law of Large numbers**:

The sample mean will be close to if the sample size is sufficiently large.

**Central Limit Theorem**:

Let be a sequence of independent random variables having a common distribution with mean and variance . We can compute probabilities for the sample mean using the cdf of the Normal distribution: