|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Distribution | pmfpdf | Mean | Variance | Moment Generating Function: | Notes |
|  |  |  |  |  | binary event w/ |
|  |  |  |  |  | of successes in trials. |
|  |  |  |  |  | of events occurring in a fixed time-period with a known rate *.* |
|  |  |  |  |  | of unsuccessful trials preceding the first success |
|  |  |  |  |  | population size ,  of selections ,  of successes .  NO REPLACEMENT. |
|  |  |  |  |  | of failures that occur before the success. |
|  |  |  |  |  |  |
|  |  |  |  |  | Memoryless Distribution: |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| CHI-SQUARE DIST.  degrees of freedom. |  |  |  |  |  |
| t-DISTRIBUTION |  |  |  |  | and : |

|  |  |  |
| --- | --- | --- |
| Prior : | Likelihood : | Posterior : |
|  |  |  |
|  |  |  |
|  |  |  |
|  | is known. | ; |

**Theorem**  : Suppose that the random variables form a random sample from a distribution for which the pdf is . Suppose also that the value of the parameter is unknown and the prior pdf of is . Then the posterior pdf is given by,

Where is the marginal joint pdf of . Furthermore, we can depict equation equivalently:

Where the proportionality symbol is used to convey that the left-hand side is equal to the right-hand side except possibly up to a constant. The appropriate constant can be determined by using the fact that or .

**Definition**  : . Let be conditionally given with common pdf . Let be a family of possible distributions over the parameter space . Suppose that no matter which prior distribution we choose from , no matter how many observations we observe, and no matter what are their observed values , the posterior distribution is a member of . Then is called a *conjugate family of prior distributions under sampling* from the distributions . It is also said that the family is *closed under sampling* from the distributions . Finally, if the distributions in are parameterized by further parameters, then the associated parameters for the prior distribution are called the *prior hyperparameters* and the associated parameters of the posterior distribution are called the *posterior hyperparameters*.

**Definition**  : . Let be a nonnegative function whose domain includes the parameter space of a statistical model. Suppose that . If we pretend as if is the prior pdf of , then we are using an *improper prior* for .

**Definition**  : . Let be a loss function. For each possible value of let be a value of such that is minimized. Then is called a *Bayes estimator* of . Once is observed is called a *Bayes estimate* of .

**Definition**  : . The loss function is called the *squared loss error*.

**Corollary**  : Let be a real-valued parameter. Suppose that the squared error loss function is used and the posterior mean of , , is finite. Then the Bayes estimator of is .

**Definition**  : . The loss function is called the *absolute error loss*.

For every observed value , the Bayes estimate will now be the value of for which the expectation is a minimum. This is when is the median of the posterior distribution.

*Consider a distribution for which the pdf is , where belongs to some parameter space . It is said that the family of distributions obtained by letting vary over all values in is an exponential family, if can be written as follows for and all values of :*

*Here and are arbitrary functions of , and and are arbitrary functions of .*