Some Random Algorithms for Random Things

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This first homework covers the main concepts behind bayesian inference and some related issues. In the **first** and **second** exercises we focus on conjugate analysis, a classical approach to bayesian inference, used in the special occasion where the posterior distribution has the same distribution of the likelihood function. In the **third** and **fourth** exercise we introduce the Integral Transformation Formula, which will be the core, with unifrom pseudo-random numer generator of exercises **fifth** and **sixth** Finally in the **seventh**, **eighth** and **nineth** exerices we introduce and use the acceptance and rejection algorithm and apply in in a variety of situations.

In summary we have nine exercises:

1. Fundamental ingredients to carry out Bayesian Inference
2. Dugongs: frequentist vs bayesian approach
3. Introduction and application of the Integral Transformation Method (ITF)
4. Mean and varaince of a transfromed distribution
5. Generate a sequence of i.i.d random veviates with a Pareto distribution from a Uniform one (using ITF)
6. Generate a sequence of i.i.d random veviates with a discrete distribution from a Uniform one (using ITF)
7. Simulate from a Beta(3,3) using Acceprance-Rejection algorithm.
8. General Acceprance-Rejection algorithm
9. Generate from a Normal distribution from a Cauchy distribution using A/R

Beta-Bernoulli Conjugate analysis

Parametric Space of Intrest

Definition 1.1 A *parametric space* is the set of all possible combinations of values for all the different parameters contained in a particular mathematical model

Given the previous definition the parametric space of interest, which is the probability of success of a single event, is $\Theta \in [0, 1]$