

Homework #1

Stat4DS2+DS

<https://elearning.uniroma1.it/course/view.php?id=7253>

deadline 15/05/2019 (23:55)

Your Last+First Name ____LLLLLLLLL____FFFFFF____ Your Matricola 99999

1) A-R algorithm

- a) show how it is possible to simulate from a standard Normal distribution using pseudo-random deviates from a standard Cauchy and the A-R algorithm
- b) provide your R code for the implementation of the A-R
- c) evaluate numerically (approximately by MC) the acceptance probability
- d) write your theretical explanation about how you have conceived your Monte Carlo estimate of the acceptance probability
- e) save the rejected simulations and provide a graphical representation of the empirical distribution (histogram or density estimation)
- f) derive the underlying density corresponding to the rejected random variables and try to compare it with the empirical distribution

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- 2) Marginal likelihood evaluation for a Poisson data model. Simulate 10 observations from a known Poisson distribution with expected value 2. Use `set.seed(123)` before starting your simulation. Use a `Gamma(1,1)` prior distribution and compute the corresponding marginal likelihood in 3 different ways:
- a) exact analytic computation
 - b) by Monte Carlo approximation using a sample from the posterior distribution and the harmonic mean approach. Try to evaluate random behaviour by repeating/iterating the approximation \hat{I} a sufficiently large number of times and show that the approximation tends to be (positively) biased. Use these simulations to evaluate approximately the corresponding variance and mean square error
 - c) by Monte Carlo Importance sampling choosing an appropriate Cauchy distribution as auxiliary distribution for the simulation. Compare its performance with respect to the previous harmonic mean approach.

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## This homework will be graded and it will be part of your final evaluation  
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## Last update by LT: Fri May 3 08:57:22 2019
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