

# Stat 610 Homework 9

Wednesday, November 20, 11:59pm

## Assignment

1. The beta distribution  $\text{Beta}(\alpha, \beta)$  is a continuous distribution that takes values in  $[0, 1]$ . The probability density function for  $\text{Beta}(\alpha, \beta)$  is

$$\frac{x^{\alpha-1}(1-x)^{\beta-1}}{\Gamma(\alpha)\Gamma(\beta)/\Gamma(\alpha+\beta)}.$$

Implement an accept-reject algorithm where the proposal distribution is uniform on  $[0, 1]$  and the target distribution is (a)  $\text{Beta}(2, 2)$  or (b)  $\text{Beta}(10, 10)$ .

In your version of the accept-reject algorithm, include code that allows you to monitor how many times you had to propose a value before one was accepted.

For each type of beta distribution, plot a histogram of the accepted values you obtained from the algorithm and report the average number of proposals per accepted sample. Write a small description of what accounts for the difference in the number of accepted proposals between (a) and (b).

Some notes that might be helpful:

- Notice that when  $\alpha = \beta$ , the pdf is symmetric.
- If they are both also greater than 1, the pdf takes its maximum value at  $1/2$ .
- The  $\Gamma$  function is a generalization of the factorial function, and is available in R as `gamma`.
- You can use the `hist` function to plot a histogram.

## Submission parameters

Submit two files:

- A pdf or html containing your plots and answers to the questions.
- An Rmd or R file containing the code you used.