STA 3431 (Monte Carlo Methods), Fall 2021

Homework #2 Assignment: worth 18% of final course grade.

Due: On Quercus by 11:00 p.m. **sharp** (Toronto time) on Friday October 29.

NOTE: All of the "GENERAL NOTES" from HW#1 still apply here, too.

THE ACTUAL ASSIGNMENT:

1. [6] Run a Metropolis algorithm on the state space $\mathcal{X} = \mathbf{R}$ for the unnormalised target density $g(x) = e^{-x^4/6}$, with proposal distribution $Y_n \sim N(X_{n-1}, \sigma^2)$, for three different choices of σ^2. Use each of your chains to estimate $\mathbf{E}_\pi(X^2)$ as best as you can. Include discussion of burn-in, mixing, accuracy, uncertainty, standard errors, confidence intervals, etc., as well as which choice of σ^2 appears to be the best.

2. [6] For this question, let $g : \mathbf{R}^5 \to [0, \infty)$ and $\pi : \mathbf{R}^5 \to [0, \infty)$ be as in HW#1 Question 3. Again estimate $\mathbf{E}_\pi[(X_1 + X_2^2)/(2 + X_3 X_4 + X_5)]$, using a full-dimensional Metropolis algorithm of your choice, and obtain the best estimate you can. Include discussion of the reasons for your choices, and your results' accuracy, uncertainty, standard errors, confidence intervals, etc. Also, discuss the advantages and disadvantages of your approach compared to the methods that you used for this problem on Homework #1.

3. [6] Repeat the previous question, using a componentwise Metropolis algorithm of your choice, again discussing your reasons, results, comparisons, etc.

[END; total points = 18]