

1. Using Monte Carlo sampling, generate 5 blocks, each of 300 equilibrated samples of size 200, from a distribution with the following joint PDF

$$f(x, y) = c \cdot \exp(-x^4 - 2y^2 + 3x - y)$$

to estimate $\mathbb{E}(X \cdot Y)$; repeat with four different values of τ . Using quadratic regression, convert your 20 block-mean estimates into a single (unbiased) one; in your report, include the corresponding standard error, then compare your results with the true value of $\mathbb{E}(X \cdot Y)$. Also report the four (one for each τ) sample correlation coefficients between consecutive (iteration) estimates of $\mathbb{E}(X \cdot Y)$, this time using the full sequence of 1500.

2. Using Metropolis sampling, generate six blocks, each of 100 equilibrated samples of size 400, from the distribution of Q2 of the previous assignment, estimating the same ρ_{xy} ; report the grand mean estimate and the corresponding standard deviation (computed based on the six block averages), the six estimates of the first order serial correlation of the iteration estimates, and the six block averages of the rejection rate.