BATCH MEANS

PROBLEM: samples $X_1, \dots X_N$ of the DTMC from MCMC method are CORRELATED!

How do I estimate $E[f(X)]$ using correlated samples?

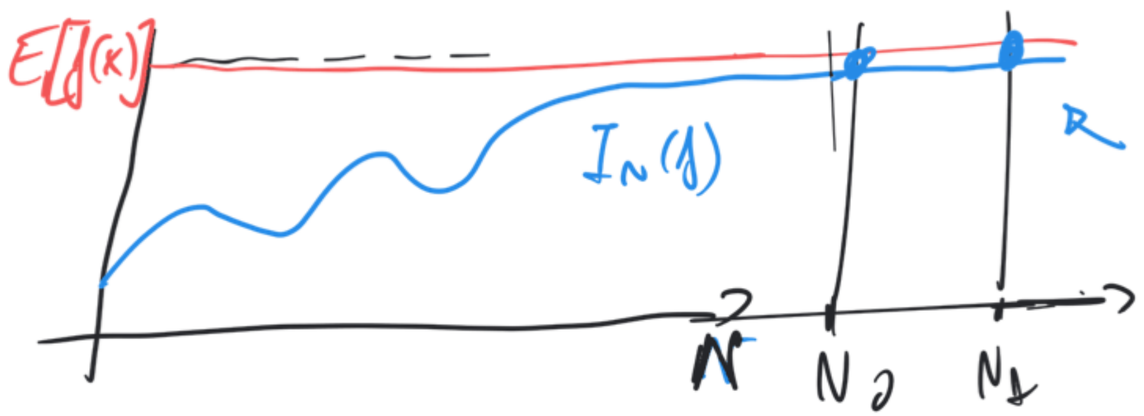
ISSUE: I need my chain to be at steady state

SOLUTION: DISCARD the first few samples (few thousand)

ERGODIC THEOREM: $$E_p[f(x)] = \lim_{N\to\infty} \frac{1}{N}\sum_{i=1}^{N} f(x_i) = I_N(f)$$

TIME AVERAGE

PLOT $I_N(f)$ AS A FUNCTION OF N



→ I can check stability of $I_N(f)$!

lag-k AUTOCOVARIANCE

$$\gamma_K = \mathrm{COV}\left[f(X_i), f(X_{i+k})\right]$$

We assume X_i at steady state
OR
X_n IS STATIONARY.

I can estimate it as

$$\hat{\gamma}_K = \frac{1}{N}\sum_{i=1}^{N-K}\left[f(x_i) - I_N(f)\right]\left[f(X_{i+k}) - I_N(f)\right]$$

One can prove that the variance of $I_N(f)$ is σ^2/N

$$\sigma^2 = \mathrm{VAR}\left[f(X_i)\right] + \sum_{K\geq 1}\gamma_K$$