Let's assume we have model:

Model: $\sin(ct + \phi)$

We don't know c and ϕ, but we know model.

But we know some bounds for them:

$$c \in [1, 10]$$

$$\phi \in [0, 2\pi]$$

Now assume that we have some measurements and from those measurements we would like to estimate the values of c and ϕ.

To test MCMC, let's assume that we have true estimates something like that:

$$c = 2, \quad \theta = \pi/2$$

Generate N random observations from those values between $t = [0, 1]$

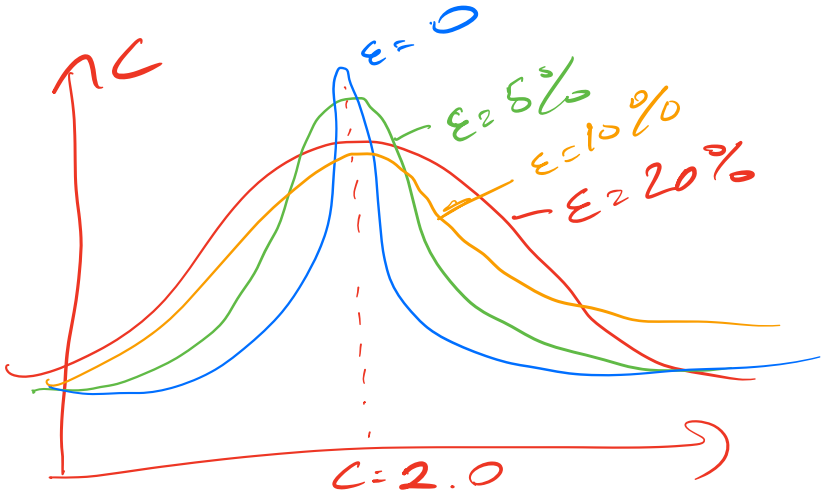
Once you generate observation data (true data) please add some observation noise:

Let's say: $\varepsilon = 0,\ 0.05,\ 0.10,\ 0.20$

$\varepsilon = 0$: no extra error

$\varepsilon = 0.20$: 20% error.

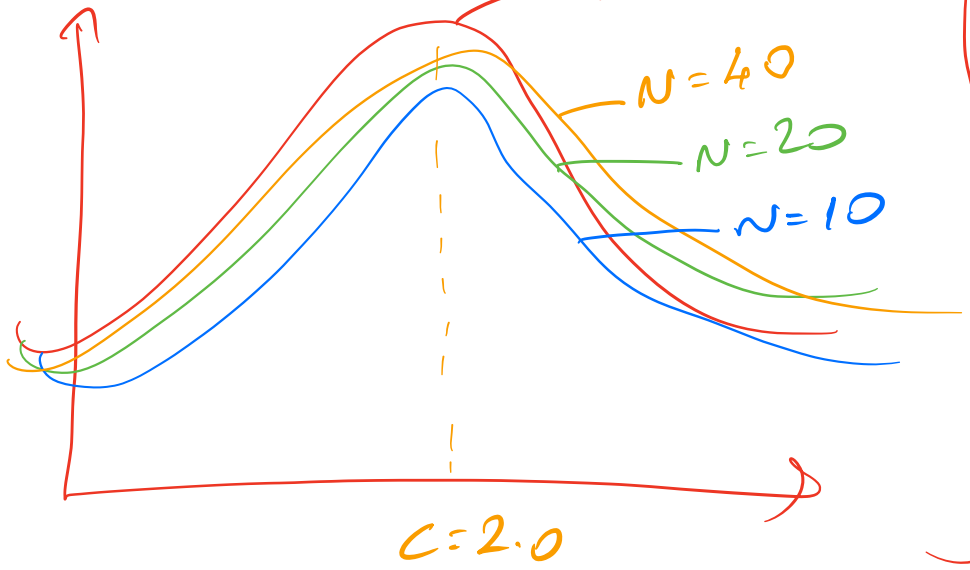
Now I would like to see how MCMC performs to unknown parameters from those observations. You can plot the following PDFs.



On these plots we used $N = 100$ observation points.

And the same plot for Θ.

Now repeat the same procedure for collecting different N data points. and plot the PDFs for different N points.



In these plots we used $\varepsilon = 0$ (no extra error introduced)

And same plot for θ variable.