Monte Carlo Simulations

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What?

- Method for simulating physical systems with uncertain inputs
- Use random numbers and probability distributions to examine a problem.

Who?

- Astronomers, Physicists, Economists, Chemists, Financial Analysts, Mathematicians, etc.
- Anyone who studies complex systems with lots of unknowns.

When?

- Any problem that can't be solved analytically
- When we know the probability distribution of different sources of uncertainty
- Want to understand how the uncertainties of the inputs affect the result

How?

- Assume a probability distribution for each input
- Create a random array for each input
- Calculate the result from these inputs

Determining Mass of Sun M = (v²*R/G)

; define constants

d = 1.496d13 ; distance to sun in cm
G = 6.67d-8 ; gravitation constant cm²/s²*g
t = 365.*24.*3600. ; time in seconds for earch to go around sun

; assume uniform uncertainty in the time; assume gaussian dist of distance to sun; assume gaussian dist in gravitation constant

Time = t - 100. + randomu(D,20000)*200 grav = G + randomn(S,20000)*.0001*G ; we know it pretty well dist = d + randomn(W,20000)*1d12 ; assume pretty large vel = 2*!pi*dist/(t)

mass = (vel^2)*dist/grav



Mean = 2.019E33, SD = 4.03E32

;Now lets say I improve my measurement of the distance to sun distnew = d +randomn(C,20000)*1d10 velnew = 2*!pi*distnew/time massnew = (velnew^2)*(distnew)/grav



Mean = 1.99E33, SD = 3.999E30

References

- <u>http://en.wikipedia.org/wiki/Monte_Carlo</u>
 <u>method</u>
- <u>http://www.chem.unl.edu/zeng/joy/mcla</u>
 <u>b/mcintro.html</u>
- <u>http://physics.gac.edu/~huber/envision/i</u> <u>nstruct/montecar.htm</u>
- <u>http://www.youtube.com/watch?v=7Zkd</u>
 <u>DHHkVQ8</u>