Algorithmical and Statistical Modeling, Fall 2012, Exercise Sheet 4 (lecture)

Please return Thursday Oct 18 in class

Problem 1 (20 pts). Referring to the lecture notes, after Eqn. 4.28: show that the Boltzmann acceptance function

$$A_i(x^* \mid \mathbf{x}) = g(x_1,...,x_{i-1},x^*,x_{i+1},...,x_n)/\big(g(x_1,...,x_{i-1},x^*,x_{i+1},...,x_n) + g(x_1,...,x_n)\big)$$

yields detailed balance if the proposal distribution is symmetric.

Problem 2 (80 pts). Download `exercise4Matlab.zip` from the homepage, unzip and place the contents in a directory. You find 4 files:

`crazyProtoPdf.m` is a function which takes a 20-dim real vector as input and returns a nonnegative real

`M1.mat`, `M2.mat` provide parameters for `crazyProtoPdf`. You don't need to care about these, and you must not alter them.

`masterScript.m` is the beginning of a script that enables the use of crazyfun.

The function *crazyProtoPdf* yields a proper (integrating to 1) pdf *crazyPdf* over the 20-dimensional unit hypercube $[0,1]^{20}$ by dividing it by its integral:

$$\text{crazyPdf}(\mathbf{x}) = \frac{\text{crazyProtoPdf}(\mathbf{x})}{\int_{[0,1]^{20}} \text{crazyProtoPdf}(\mathbf{x})\, d\mathbf{x}}$$

Your task: use Metropolis sampling to compute an approximate value of the integral

$$\int_{[0,1]^{20}} \|\mathbf{x}\| \,\text{crazyPdf}(\mathbf{x})\, d\mathbf{x}$$

of the norm of **x** over the 20-dim unit cube, with respect to the measure given by crazyPdf.

You should not only compute a single ad hoc estimate, but also try to assess the accuracy of your estimate.

Deliverable: a written report (possibly with figures) of about 1 page on your findings, including a discussion of difficulties encountered and lessons learnt.