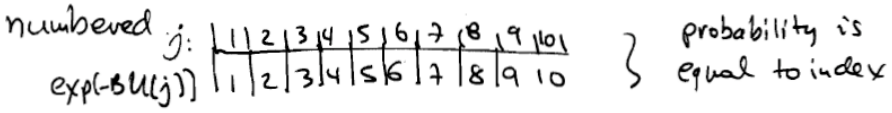
Assignment 1 – Due Oct. 6, 2009, by electronic submission to azp@princeton.edu

1. Write Fortran code implementing the "minimal standard" random number generator discussed in the notes to produce uniformly distributed numbers between 0 and 1. Obtain the average and standard deviation of (a) 1,000 and (b) 100,000 samples using this generator with seed = 99.

2. Perform the "spectral test" in 2 dimensions for the "minimal standard" generator as follows: set up a 100x100 square array and "cross out" cells corresponding to "random" x- and y-coordinates. Report the number of empty cells remaining after 1,2,…12 "passes" over the lattice sites and compare this to the theoretical expectation. Repeat for the "ran(iseed)" built-in random number generator.

3. Consider a simple 1-dimensional system with 10 microstates, each having a probability equal to the state index, as discussed in class:



Now consider a Monte Carlo algorithm that attempts to move, with equal probability, to the "left" or "right" state from the current state (periodic boundary conditions: state 1 is to the "right" of state 10). If the initial state is #10, how many steps are required for the Metropolis algorithm to reach the equilibrium probability distribution to within ±0.0001 in absolute deviation of the probability for any state? How many steps are required for the Barker algorithm? You may want to use Matlab or Excel to perform the matrix multiplications required to solve this problem. A quick primer on Matlab is given in http://paros/che201/.

Please submit your results and any code you write electronically, as a single .pdf file.