Assignment 7.

Given May 5, due the Thursday after final exam day

Objective: Monte Carlo.

1. Write a program to implement the Box Muller method for generating standard normal random variables. Check that your distribution is correct by computing the empirical distribution function for a million of your standard normals and comparing it to the actual distribution funtion for the standard normal. You can compute by the exact distribution function by integration, but be careful to do it accurately enough so that all the disagreemtnt between the exact and empirical is statistical error in the empirical.

2. Write a standard Monte Carlo program that uses your standard normals from part 1 to estimate $A_p = E[X^{2p}] = (2p-1)\cdot(2p-3)\cdot\cdots\cdot 5\cdot 3$ for $p = 1, 2, 3, 4, 6$. Comment on the relative error in the Monte Carlo estimates for larger p. Take a range of N values at least to 10^7. For this you will need to compute bars.

3. Write an adaptive Monte Carlo program that keeps doubling N until the error bar is less than a specified tolerence. See whether you are able to achieve .1% accuracy in the estimates of A_p for large p on your computer.

4. Suppose $Y = X_1^2 + \cdots + X_l^2$ and we want $A = Pr(Y < al)$. Write a Monte Carlo program to do this. Apply your program with $a = .7$ and $l = 5$. Use the adaptive strategy from part 3 to achieve .1% relative error.