Problem set 1: AWK

Random number generators

Awk has a built-in random number generator called rand()
which we will test in this exercise.

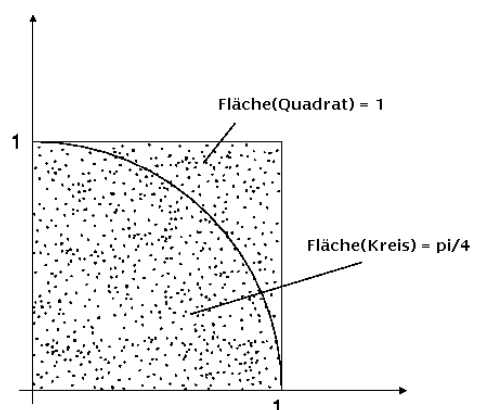   a. Generate 100000 random numbers and save the
output. (What happens if you add "| sort" ?)

   b. Write an awk-program which calculates the average value, the
variance and the error of the mean of the data.
Hint: VAR=($\langle X^2\rangle - \langle X\rangle^2$), ERR=(sqrt(VAR/n)).

   c. Uniformity Test: Create a histogram of the data with 100 bins and
display it using xmgrace or gnuplot (Hint: Use the int() function)

   d. Screen Pixel Test: Save 2*100000 random numbers in two columns.
Visualize the result.

   e. Program your own linear congruental random number generator:
Hints: X_{n+1} = (a*X_n+c) % m
Numerical Recipes in C advocates:
a=1664525, c=1013904223, m=2^{32}.

Your first Monte Carlo Simulation

Check out: http://www.eveandersson.com/pi/monte-carlo-circle
Write a Monte Carlo Program with awk which calculates π.

Fläche(Quadrat) = 1

Fläche(Kreis) = pi/4

Hint: Use data from 1d

Homework: 1. Extend 1b to calculate the auto-correlation as well.
2. Finish whatever is left.

Picture credits:
wikipedia
http://www.tuhh.de/rzt/tuinfo/programmentwicklung/parallel/Junglas/mpi-1-kurs/node9.html