

## Problem set 1: AWK



### Random number generators

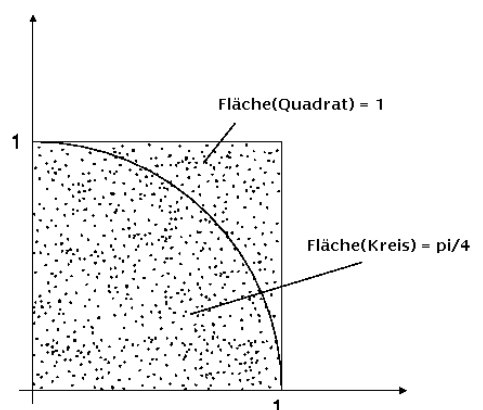
Awk has a built-in random number generator called rand() which we will test in this exercise.

- Generate 100000 random numbers and save the output. (What happens if you add "| sort" ?)
- Write an awk-program which calculates the average value, the variance and the error of the mean of the data.  
Hint:  $VAR = (\langle X^2 \rangle - \langle X \rangle^2)$ ,  $ERR = (\text{sqrt}(VAR/n))$ .
- Uniformity Test: Create a histogram of the data with 100 bins and display it using xmgrace or gnuplot (Hint: Use the int() function)
- Screen Pixel Test: Save 2\*100000 random numbers in two columns. Visualize the result.
- Program your own linear congruential 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  $\pi$ .



Hint: Use data from 1d

**Homework:** 1. Finish whatever is left.

Picture credits:

wikipedia

<http://www.tuhh.de/rzt/tuinfo/programmentwicklung/parallel/Junglas/mpi-1-kurs/node9.html>