2. Exercise

Out	Discussion
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Contact by questions
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Problem 1: Monte Carlo Simulation

Write a *Monte Carlo Simulation* program in your favorite programming language (Java, C/C++, Python) or use a spreadsheet tool like Excel or Openoffice.Calc to approximate the average distance $\mathtt{d}$ of any two points $\mathtt{p1}, \mathtt{p2}$ on a unit circle. The analytical result is $\mathtt{d} = \frac{128}{45\pi}\mathtt{r}$, where $\mathtt{r}$ is the radius.

a) Produce approximations for $\mathtt{d}$ with 100, 1000, 10000, and 100000 points. Measure the required time and calculate the difference to the analytical result.

b) Prepare histograms to show the distribution of the distance $\mathtt{d}$. Vary the bin size of the histograms, e.g., 0.01, 0.1, and 0.2. Can you identify the distribution of $\mathtt{d}$?

c) Can you derive the analytical solution?

Problem 2: Monte Carlo Simulation

Implement a coin tossing game simulation in your favorite programming language for two players A and B as follow. A game consists of $\mathtt{n} = 100$ coin tosses. When the coin lands head up player A wins \$1 from player B. When the coin lands tails up player B wins \$1 from player A.

a) Track the wins and losses of player A and B in one game.

b) How often is player A ahead of player B in one game?

Extend your simulation so that a particular number $\mathtt{k}$ of repetitions can be run. Identify important information and statistics that has to be collected.

a) Track the wins and losses of player A and B in an experiment with $\mathtt{k} = 10, 20, 30$ repetitions.

b) Prepare graphs to visualize the gained information.

c) Discuss the issues from the paper »On credibility of simulation studies of telecommunication networks« considering your implementation.

d) Discuss the complexity/architecture of the variants of your simulation.

Problem 3: Simulation models, reading

Download the paper »Difficulties in simulating the Internet« by Sally Floyd and Vern Paxson from the website of the class.

Discuss the paper and the findings of the authors. What are their main findings?