Experiments

Help Center

To emphasize that our focus is on methods that are suitable for scientific studies, these experiments are suggested for each lecture. These are optional, but may be enlightening to some students. If you don't program, you still might profit by reading the discussion forums.

The experiments below are not to be submitted or graded and are meant for self-assessment and to focus discussion in the forums. Please discuss the experiments in the appropriate forum: Experiments.

Lecture 1

Program I.1 Determine the choice of four coins that maximizes the number of ways to change a dollar.
Program I.2 Write programs that estimate the rate of growth of the Cayley numbers and the partition numbers (H_n/H_{n-1} and P_n/P_{n-1}). See Note I.43.

Lecture 2

Program II.1 Write a program to simulate the Ehrenfest mode (see Note II.11) and use it to plot the distribution of the number of balls in urn A after 10^3, 10^4 and 10^5 steps when starting with 10^3 balls in urn A and none in urn B.

Lecture 3

Program III.1 Write a program that generates 1000 random permutations of size N for N = 10^3, 10^4, ... (going as far as you can) and plots the distribution of the number of cycles, validating that the mean is concentrated at H_N.

Lecture 4

Program IV.1 Compute the percentage of permutations having no singelton or doubleton cycles and compare with the asymptotic estimate from analytic combinatorics, for N = 10 and N = 20 .
Program IV.2 Plot the derivative of the supernecklace GF (see Note IV.28) in the style of the plots in Lecture 4. Click here for access to the Java code in the lecture.

Lecture 5

Program V.1 In the style of the plots in the Lecture 6, plot the GFs for the set of bitstrings having no occurrence of the pattern `0000000001`. Do the same for `0101010101`. (See Web Exercise V.1 and Program IV.2).

Lecture 6

Program VI.1 In the style of the plots in Lecture 6, do r- and θ-plots of $1/\Gamma(z)$ in the unit square of size 10 centered at the origin (see Program IV.2)

Lecture 7

Program VII.1 Do r- and θ-plots of the GF for bracketings (see Web Exercise VII.1).

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