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**Computational Physics II**
**SS 2018**

**Deadline**: 23. April 2018

### 1.1. Dice

Generate a sequence of $n$ rolls of dice by mapping uniformly distributed random numbers into six intervals of equal size. Compare the number of occurrences of the six individual results, of all 36 pairs and of all 216 triplets.
Are your findings compatible with an honest dice?
How do the deviations from the predicted probabilities scale with the number $n$ of rolls?

### 1.2. Mäxchen or Mia

The game *Mäxchen* or *Mia* is played with two dice. The results are turned into decimal numbers, with the highest value given the factor of 10. Equal pairs and the value 21 are singled out and lead the ordering of results. Thus, the lowest outcome is 31, followed by 32, 41, 42, 43, 51, 52, 53, 54, 61, 62, 63, 64, 65, 11, 22, 33, 44, 55, 66, and, at the top, 21. Leaving out the psychological element of challenging the players claimed outcome, the aim of a simplified version of the game is to generate an increasing sequence of results. The "duration" is the number of consecutive rolls during which the outcome does not decrease.
Determine the distribution of durations of the game if it is repeated a million times.

### 1.3. Non-uniform random variables

Generate random numbers that are distributed over the interval $[0, 1]$ proportional to $x^\alpha$. Normalize the probability density, determine the integrated probability density function and program an algorithm that generates random variables with this distribution out of uniformly distributed random variables.
Are there restrictions on the possible values of $\alpha$?
Verify the distribution by comparing the results for many realizations with the expected values for a discrete set of bins (e.g. 10 or 100).