Data Analysis in Astronomy and Physics (SoSe22)

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Exercise Set 4

Due: **10:00 2 May 2022**
Discussion: **13:00 6 May 2022**
Online submission at via ILIAS in the directory Exercises / Übungen -> Submission of Exercises / Rückgabe des Übungsblätter

1. Samples & Sampling Simulation [60 points]

Write a numerical simulation code that reproduces the behaviour of the following simulation.
Draw N samples of size n from a population with $\mu = 5$ and $\sigma = 1$. Compute the confidence intervals (CI) of each sample distribution and the sampling distribution and visualize it in a similar manner. Test your simulation against your theoretical expectations. Make sure to test your result and to confirm that the result is as expected. (i.e. About 5 % of the samples not overlapping with the confidence interval, or 5% of all simulations with the population mean not part of the confidence interval.) **60 Points**

2. Poisson statistics [40 points]

Perseids are a meteor showers associated with the comet Swift–Tuttle. In astronomy, the zenithal hourly rate (ZHR) of a meteor shower is the number of meteors a single observer would see in an hour of peak activity. Assume that today the Perseids have a ZHR = 120. Assume that the occurrence of every single meteor is distributed according to Poisson statistics.
a. Find the probability that no meteor is observed during a given minute **10 Points**
b. What is the expected number of meteors occurring in two minutes **10 Points**
c. Find the probability that this expected number actually are observed in a given two-minute period. **10 Points**
d. Plot a histogram of the probabilities for the number of meteors for each 2 minute period. **10 Points**