The Central Limit Theorem - Assignment #2 - 24/10/2022 - 14/11/2022

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If N independent random variables $x_1; x_2; \cdots ; x_N$ have means μ_n and finite variances σ_n^2, then, in the limit of large N, the sum $\sum_n x_n$ has a distribution that tends to a normal (Gaussian) distribution with mean $\sum_n \mu_n$ and variance $\sum_n \sigma_n^2$.

This assignment is based on Exercise 2.16 of BK3 (look at the solutions in case of problems!)

(Q1) Two ordinary dice with faces labelled 1, … , 6 are thrown. What is the probability distribution of the sum of the values? What is the probability distribution of the absolute difference between the values?

(Q2) One hundred ordinary dice are thrown. What, roughly, is the probability distribution of the sum of the values? Sketch the probability distribution and estimate its mean and standard deviation.

(Q3) How can two cubical dice be labelled using the numbers {0, 1, 2, 3, 4, 5, 6} so that when the two dice are thrown the sum has a uniform probability distribution over the integers 1-12? Plot the pdf.

(Q4) Is there any way that one hundred dice could be labelled with integers such that the probability distribution of the sum is uniform?

(Q5) Can you plot the probability distribution function for the cases in Q1 when the number of dice is Ndice > 2? When Ndice = 2, 3, 4, 10, 20 looks like a gaussian pdf? If not, why?

(Q6) Can you plot the probability distribution function for the cases in Q4 when the number of dice is Ndice > 2? When Ndice = 2, 3, 4, 10, 20 looks like a gaussian pdf? If not, why?