Exercises for Computational Physics (physik760)
WS 2019/2020

B. Kostrzewa and C. Urbach

Exercises for the week from 21st to 25th of October 2019.

3 Distributions and Measures of Distributions

1: For n independent random variables $X_i \sim \mathcal{N}_{\mu,\sigma_i}$, $i = 1, \ldots, n$ show that the weighted sum $Z = w_1 X_1 + \cdots + w_n X_n$ is normally distributed. What is its variance in terms of $\sigma_1, \ldots, \sigma_n$? Taking $w_1 + \cdots + w_n = 1$, for which system of weights does Z have minimal variance?

2: Let X, Y be **iid** normal distributed random variables (definition 2.2.5) with mean $\mu = 0$ and variance σ^2. Show that $Z = X + Y$ is a normal distributed random variable with mean $\mu = 0$ and variance $2\sigma^2$.

3: Write a computer programme that implements the algorithm in example 2.5.1 of the script. Compute mean and variance of Z_n for $n = 1, \ldots, 25$ with 10000 observations each. Visualise your result. Can you distinguish with the knowledge of mean and variance reliably between uniform and normal distribution?