Institut für Mathematik
Abteilung Numerik
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1. Problem sheet for **Statistical Data Analysis**

Exercise 1 (2+2+2+2 Points)

Let X and Y be random variables. Show that

1. $\mathbb{E}[a + bX] = a + b\mathbb{E}[X], \quad a, b \in \mathbb{R},$
2. $\mathrm{Var}(X) = \mathbb{E}[X^2] - (\mathbb{E}[X]))^2,$
3. $\mathrm{Var}(a + bX) = b^2 \,\mathrm{Var}(X), \quad a, b \in \mathbb{R},$
4. $\mathrm{Var}(a) = 0, \quad a \in \mathbb{R}.$

Exercise 2 (3 Points)
Show that for the cumulative distribution function F(x) of the geometric distribution the following holds equation holds:

$$\sum_{i=1}^{x} p(1-p)^{i-1} = 1 - (1-p)^x. \tag{1}$$

Exercise 3 (4+5+3 Points)
Plot

1. the probability of a random variable that follows the Binomial distribution Bin(n,p) for different $p \in \{0.3, 0.5, 0.8\}$ and $n \in \{10, 50\}$
2. the probability of a random variable that follows the Geometric distribution Geom(p) and the corresponding cumulative distribution function F for different $p \in \{0.3, 0.5, 0.8\}$ for all $x \leq 11$
3. the probability of a random variable that follows the poisson distribution for different $\lambda \in \{0.3, 2, 6\}$ for $x \leq 16$

in a jupyter notebook.

 Due on the 05.11.2021 before midnight