

Time	Group	Submission in Moodle; Mails with subject: [SMD2022]
Th. 12:15–13:00	A	lukas.beiske@udo.edu and jean-marco.alameddine@udo.edu
Fr. 8:15–9:00	B	samuel.haefs@udo.edu and stefan.froese@udo.edu
Fr. 10:15–11:00	C	david.venker@udo.edu and lucas.witthaus@udo.edu

Exercise 7 *Maximum-Likelihood*

5 p.

A random variable x is to be subject to a uniform distribution

$$f(x) = \begin{cases} 1/b & 0 \leq x \leq b \\ 0 & x < 0 \text{ oder } x > b \end{cases}$$

- (a) Determine an estimator for the parameter b using the maximum likelihood method from a sample x_1, x_2, \dots, x_n .
- (b) Is this estimate biased? If yes, how can the estimator be corrected in this case?

Exercise 8 *Likelihoodkurve*

5 p.

Tree samples are taken from a Poisson distribution, namely the numbers 13, 8 and 9.

- (a) Calculate the negative log-likelihood function as a function of the single parameter λ and plot it.
- (b) At what value of λ is the minimum of $-\ln \mathcal{L}_{\max}$?
- (c) For which values of λ does $-\ln \mathcal{L}$ take the values

$$\begin{aligned} & -\ln \mathcal{L}_{\max} + \frac{1}{2} \quad , \\ & -\ln \mathcal{L}_{\max} + 2 \quad \text{und} \\ & -\ln \mathcal{L}_{\max} + \frac{9}{2} \end{aligned}$$

and what do these values tell us?

- (d) Compare these values with the 2nd order Taylor expansion by plotting the approximation together with the likelihood and by determining the values from (c). What might the approximation be useful for?