

Statistics and Sensor Data Fusion

– Winter Term 2023/2024 –

Worksheet 5

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Exercise 1. A tour operator offers charter flights on an Airbus A340-600 to South Africa. The tour operator has the experience that on average two percent of the flight tickets are canceled shortly before check in. Because of this, the tour operator accepts 347 bookings for a flight with 345 available seats. What is the probability that the flight is overbooked?

Exercise 2. A warehouse has in total 20000 pallets in stock. The certified accountant orders a spot check of 100 randomly selected pallets. If every pallet in the spot check has a correct inventory, the inventory taking is finished. If at least one pallet in the spot check has an incorrect inventory, a complete inventory taking of all pallets must be applied. What is the probability of a complete inventory taking if there are exactly two pallets in the warehouse with incorrect stock?

Exercise 3. The docking maneuver of a trailer truck is successful on the first try with a probability of 0.8. What is the probability that at least 9 of 10 docking maneuvers are successful on the first try?

Exercise 4. The probability mass function (pmf) of a discrete random variable X is given as follows:

| | | | | |
|--------------|---------------|---------------|---------------|---|
| x_i | 1 | 2 | 4 | 6 |
| $P(X = x_i)$ | $\frac{1}{3}$ | $\frac{1}{4}$ | $\frac{1}{6}$ | ? |

Add the missing value of the pmf. Compute the corresponding cumulative distribution function (cdf), the probabilities $P(X < 4)$, $P(X \geq 2)$, $P(2 \leq X < 6)$, the mean μ and the variance σ^2 .

Exercise 5. At the station of an assembly line with 24/7 operation four milkrun-trains arrive per hour on average. The number of milkrun-trains that arrive per hour is Poisson distributed. What is the probability that within a specific hour exactly three milkrun-trains arrive at the station?

Exercise 6. The life span of a series of light bulbs in years is exponentially distributed with parameter $\lambda = \frac{1}{3}$.

- (a) What is the average life span of a randomly selected light bulb?
- (b) A specific light bulb of this series is in use already for five years. What is the probability that this light bulb works for at least two more years?

Exercise 7. In the receiving area of a distribution center the total time required to process a ramp operation (docking, load transfer, etc.) in minutes is normally distributed with mean $\mu = 30$ and variance $\sigma^2 = 4$.

- (a) Compute the probability that the total time of a randomly selected ramp operation lies between 24 and 36 minutes.
- (b) What is the probability that the total time of a randomly selected ramp operation exceeds 35 minutes?
- (c) The ramp manager requests that a ramp operation should be completed with a probability of 0.98 within a given time slot. Compute the size of the slot.