Statistics and Sensor Data Fusion

– Winter Term 2023/2024 –

Worksheet 4

Prof. Dr.-Ing. Gernot Fabeck

Exercise 1. A fair die is tossed twice.

(a) What is the probability of getting a 4, 5, or 6 on the first toss and a 1, 2, 3, or 4 on the second toss?

(b) What is the probability of a 6 turning up at least once in the two tosses?

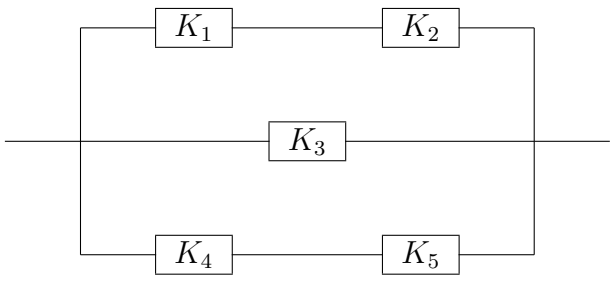
Exercise 2. On Saturday morning, Homer wants to go fishing and therefore has to choose one out of three possible lakes which are near his home (Lake 1, Lake 2, and Lake 3), where every lake has identical probability to be chosen by Homer. He is not aware of the fact that due to different fishing grounds, the probability to be successful at fishing is 0.4 at Lake 1, 0.6 at Lake 2, and 0.8 at Lake 3.

(a) Are the two events "Homer decides for Lake 3" and "Homer is successful at fishing" stochastically independent?

(b) Homer was indeed successful this day. What is the probability that Homer was fishing

(i) at Lake 1 (ii) at Lake 2 (iii) at Lake 3

Exercise 3. A communication network consists of five components allocated to three paths (see the figure below). The respective failure probabilities of the components $K_1, ..., K_5$ are $P(K_1) = 0.3$, $P(K_2) = 0.4$, $P(K_3) = 0.5$, $P(K_4) = 0.2$, $P(K_5) = 0.1$. The outage of the individual components should be stochastically independent.



The communication network is intact, if at least one path is intact. A path is intact, if all its components are intact. Calculate the probability that the communication network is intact.

Exercise 4. A logistics provider delivers turnkey ready sorter systems. In 60% of all the installations the customer requires a test before commissioning. Historical data reveals that 10% of all commissionings fail, if no test was performed ahead. If a test is performed without any reported problems, the commissioning will fail at a probability of only 2%. If a test is performed and shows only minor bugs, the commissioning will fail at a probability of 5%. Finally, if a test reveals substantial bugs the commissioning is canceled. 70% of all tests run without any reported problems, 20% of the tests run with minor bugs.

(a) What is the probability that for an installation the commissioning is canceled?

(b) What is the probability of a successful commissioning?

(c) What is the probability of a failed commissioning?

(d) What is the probability of a successful commissioning under the assumption that a test is required?

(e) Are the events "a successful commissioning is performed" and "a test is required by the customer" stochastically independent?

Hint: Visualize all possible combinations by a decision tree.