Statistics and Sensor Data Fusion

– Winter Term 2023/2024 –

Worksheet 1

Prof. Dr.-Ing. Gernot Fabeck

Exercise 1. At a specific production line station, the processing times of 50 consecutive manufacturing steps were taken. The raw data is given by the following values (in seconds):

$(x_1, x_2, \ldots, x_{50}) = (40, 20, 22, 15, 18, 51, 37, 42, 31, 58, 33, 39, 49, 22, 23, 62, 42, 53, 43, 44, 19, 49, 39, 36, 37, 38, 22, 24, 32, 29, 41, 40, 39, 38, 27, 51, 52, 54, 28, 22, 64, 19, 50, 40, 18, 68, 51, 41, 48, 57)$

(a) Determine mode, median, 0.9-quantile and arithmetic mean of the processing times.

(b) Calculate range, mad (based on the median), empirical variance, standard deviation and coefficient of variation.

Exercise 2. The following table indicates the density of students (number of students/number of residents) for five different city districts A, B, C, D and E:

District	A	B	C	D	E
Number of students	300	1500	200	800	700
Density of students	0.15	0.3	0.04	0.05	0.1

Determine the overall **average density of students** in the city across all districts.

Exercise 3. A bank offers a savings bond running for six years with mutating interest rates. For the first two years the customer receives 1 percent annual interest rate, for year three to five the customer receives 5 percent, and for the final year six the customer receives 28 percent annual interest rate. Determine the **average annual rate of interest**.

Exercise 4. For the purpose of traffic control, the Schweinfurt Police Department has performed velocity measurements on vehicles (in km/h) on five consecutive days:

Day	1	2	3	4	5
Measurements	180	270	200	160	190
Arithmetic mean	48.2	46.5	47.1	49.1	47.6
Variance	36	22	48	29	41

Compute the **overall arithmetic mean** and the **overall standard deviation** of the velocity measurements. Which kind of variation in the measurements has the main influence on the overall variance?