Chapter V

Correlation and Regression
(Exercises)

5. 1.

The following table shows the annual income [€] andyears of education of 10 persons:

Person	Income [€]	Years of Education
1	125000	19
2	100000	20
3	40000	16
4	35000	16
5	41000	18
6	29000	12
7	35000	14
8	24000	12
9	50000	16
10	60000	17

Find and interpret the corresponding correlation coefficient

5. 2.

The following table shows the results of 8 students in "Business Mathematics" and "Statistics":

Business Mathematics [%]	68	54	19	72	50	44	92	37
Statistics [%]	51	76	32	85	62	25	74	59

Find and interpret the value of Spearman's rank correlation coefficient

5. 3.

The following table shows the hours studied for a test and the number of correct answers made on the test by each of the five employees in a company:

Employee	Hours studied	Number of correct answers
A	1	2
B	2	10
C	6	20
D	7	14
E	5	11

It is the dependency of the number of correct answers on the hours studied to be investigated.

a) Plot a scatter diagram on a chart.
b) Compute the linear regression equation by the least square method.
c) Draw the regression line based on the equation on the chart.
d) Estimate the number of correct answers for an employee who has studied three hours for the test.

5. 4.

The following table shows the output x of a certain product depending on the input r :

Output	1.54	1.64	1.70	1.80	1.86	1.90	1.98
Input	5.0	5.5	6.0	6.5	7.0	7.5	8.0

1. Determine the regression function in the form:

$$x(r) = a_0 \cdot r^{a_1}$$

2. Find the probable value of output for an input of 8.3.

5. 5.

The following table shows the variable costs C (in 1000 €) of a firm depending on its output x :

Output	Costs
10	102.01
15	103.06
20	104.10
25	105.14
30	106.20
35	107.21

.

1. Determine the regression function in the form:

$$C(x) = a_0 e^{a_1 x}.$$

2. Find the probable costs for an output of 37 units.

5. 6.

Crickets make their chirping sounds by rapidly sliding one wing over the other. The faster they move their wings, the higher the chirping sound that is produced. Scientists have noticed that crickets move their wings faster in warm temperatures than in cold temperatures. Therefore, by listening to the pitch of the chirp of crickets, it is possible to tell the temperature of the air.

The table below gives the recorded pitch (in vibrations per second) of a cricket chirping recorded at 15 different temperatures (in Fahrenheit):

Chirps/Second	20	16	20	18	17	16	15	17	15	16	15	17	16	17	14
Temperature	89	72	93	84	81	75	70	82	69	83	80	83	81	84	76

What if someone asked you what the temperature was, but you couldn't use a thermometer? Could you use the crickets?

5. 7.

The following table shows the dependency of the output x on the input r for a certain product.

Output	1.54	1.64	1.70	1.80	1.86	1.90	1.98
Input	5.0	5.5	6.0	6.5	7.0	7.5	8.0

1. Determine the regression function in the form:

$$x(r) = a_0 \cdot r^{a_1}$$

2. Predict the value of the output for an input of 8.3 units.

5. 8.

Suppose an analyst takes a random sample of 10 recent truck shipments made by a company and records the distance in kilometres and delivery time to the nearest half-day from the time that the shipment was made available for pick-up:

Sampled shipment	1	2	3	4	5	6	7	8	9	10
Distance [km]	825	215	1070	550	480	920	1350	325	670	1215
Delivery [days]	3.5	1.0	4.0	2.0	1.0	3.0	4.5	1.5	3.0	5.0

The analyst would like to know the dependency of the delivery time on the distance.

1. Plot a scatter diagram on a chart.
2. Compute the linear regression equation by the least square method. (to 4 decimal points.)
3. Draw the regression line based on the equation on the chart.
4. Find and interpret the coefficients of correlation and determination.

5. 9.

The following table presents sample data relating the number of study hours spent by students outside of class for a course in statistics and their scores in an examination given at the end:

Sampled student	1	2	3	4	5	6	7	8
Study hours	20	10	34	23	27	32	18	22
Examination grade	64	61	84	70	88	92	72	77

The analyst would like to know the dependency of the study hours on the scores.

1. Plot a scatter diagram on a chart.
2. Compute the linear regression equation by the least square method. (to 4 decimal points.)
3. Draw the regression line based on the equation on the chart.
4. Find and interpret the coefficients of correlation and determination.

5. 10.

The following table gives informations about the price [€] and sales of a product in 7 consecutive weeks:

Price	160	180	200	220	240	260	280
Sales	126	103	82	75	82	40	20

1. Calculate the *average rate of increase* of prices in the 7 consecutive weeks.
2. Develop a scatter diagram representing the dependency of sales on price.
3. Approximate the data by a simple linear regression function.
4. Find and interpret the coefficient of determination.

3. 11.

The average value of a single family residence in a small US village [thousands of dollars] in recent years is given in the following table

Year	2001	2003	2005	2007	2009
Value	42	51	63	77	93

1. Develop a scatter diagram for the data.
2. Approximate the data by the trend function.

$$y^* = a_0 \cdot a_1^x$$

3. Predict the value of a single family residence for 2011.
4. Plot the regression function.

(Last revised: 17.08.2010)