

Problem 1

A company manufactures an electronic device to be used in a very wide temperature range. The company knows that increased temperature shortens the life time of the device, and a study is therefore performed in which the life time is determined as a function of temperature. The following data is found:

Temperature	10	20	30	40	50	60	70	80	90
Life time	420	365	285	220	176	117	69	34	5

Nine simultaneous realizations of variables X and Y were observed. We obtain the results:

$$\sum_{i=1}^9 x_i = 450, \quad \sum_{i=1}^9 y_i = 1691, \quad \sum_{i=1}^9 x_i y_i = 52670, \quad \sum_{i=1}^9 x_i^2 = 28500$$

1. Does a linear adjustment seem justified?
2. Determine a regression equation by specifying what are the explanatory variable and the explained variable?
3. Calculate the residuals and verify the property that the mean of the residuals is zero.
4. Calculate the error variance estimator.
5. Calculate the variance estimators of β_0 and β_1 .
6. Construct a 95% confidence interval for the parameter β_0 .
7. Construct a 95% confidence interval for the parameter β_1 .
8. Test the hypothesis $H_0: \beta_0 = 0$ (against $H_1: \beta_0 \neq 0$) with a significance threshold $\alpha = 5\%$.
9. Establish the ANOVA table associated with this regression. What can we conclude about parameter β_1 ?
10. Calculate the coefficient of determination R^2 of this regression.