

Design and Analysis of Experiments

Homework #2

1 Polynomial regression

This is an experiment where pulp is battered for hours. After that, the so-called Schopper-Riegler freedom number is measured. These were the results from 13 runs:

Number of hours	1	2	3	4	5	6	7	8	9	10	11	12	13
Freedom number	17	21	22	27	36	49	56	64	80	86	88	92	94

1. Make a simple linear regression using `lm`. Make a plot of the data with the straight line inserted.
2. Make a cubic regression (remember $I(x^2)$ and $I(x^3)$ in the model specification). Make residual plots.
3. Make a plot with the data and the cubic curve, together with the mean response curve and the prediction curve, both at level 95%. (Hint: use the command `predict`; look at `predict.lm`)

2 Simple regression with replicates

Observations on the yield of a chemical reaction taken at various temperatures, each with 3 replicates, were recorded as follows:

Temp (°C)	Yield (%)		
150	77.4	76.7	78.2
200	84.1	84.5	83.7
250	88.9	89.2	89.7
300	94.8	94.7	95.7

1. Regarding the temperature as a factor (categorical), perform a one-way ANOVA.
2. Regarding the temperature as continuous, perform a simple linear regression analysis.
3. Test the model of linear regression, using a lack-of-fit test.
4. Make a plot where the data and the regression line are drawn, together with the mean response curve and the prediction curve, both at level 95%.