

620-371: Linear Models

Practice Class 10

12th May, 2009

In a manufacturing plant, filters are used to remove pollutants. We are interested in comparing the lifespan of 5 different types of filters. Six filters of each type are tested, and the time to failure in hours is given in the dataset (on the website) `filters` (in `csv` format).

1. Use the `read.csv` function to read the data. Then convert the `type` component into a factor.
2. Construct X and \mathbf{y} matrices for this linear model.
3. Using the algorithm given in the lecture slides, find a conditional inverse for $X^T X$.
4. Use `ginv` to find another conditional inverse for $X^T X$.
5. Verify that $X(X^T X)^c X^T$ is the same for your two conditional inverses.
6. Find two solutions for the normal equations.
7. Express one of your solutions in terms of the other.
8. Is $\mu - \tau_1 + \tau_5$ estimable?
9. Is $\tau_1 - \frac{1}{2}\tau_3 - \frac{1}{2}\tau_4$ estimable?
10. Verify that your two solutions for the normal equations produce the same estimate of $\tau_4 - \tau_5$.
11. Calculate s^2 .
12. Calculate a 95% confidence interval for the difference in lifespan between filter types 3 and 4.
13. Fit a `lm` model to the data and verify your answers to questions 11 and 12.