

STAT 8010 Statistical Methods I

Homework 5

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Due Date: June 22, 11:59pm

Problem 1 Leaning Tower of Pisa

The following table provides the annual measurements of the lean (the difference between where a point on the tower would be if the tower were straight and where it actually is) from 1975 to 1987. The variable **Lean** are coded as tenths of a millimeter in excess of 2.9 meters, so that the 1975 lean was actually 2.9642 meters. The variable **Year** are coded as the last two digits of the year (e.g. 85 means the year of 1985). We would like to characterize lean over time by fitting a simple linear regression.

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|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Year | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 |
| Lean | 642 | 644 | 656 | 667 | 673 | 688 | 696 | 698 | 713 | 717 | 725 | 742 | 757 |

- Identify the response variable (Y), the explanatory variable (X), and the sample size (n).
- Compute the estimated slope $\hat{\beta}_1$ and intercept $\hat{\beta}_0$
- Compute the fitted value and the associated residual value in year 1983.
- Compute $\hat{\sigma}$, the estimate of σ
- Find the 95% confidence interval for β_1

- (f) Test the following hypothesis: $H_0 : \beta_1 = 0$ vs. $H_a : \beta_1 \neq 0$ with $\alpha = 0.05$

- (g) Construct a 90% confidence interval for $E[\text{Lean}]$ in year 1984

- (h) Calculate the ANOVA table and perform the F test with $\alpha = 0.05$.

Problem 2 Residual Analysis

Use a statistical software to plot e_i 's vs. x_i 's to assess the model assumptions.