STAT 8010–003 Statistical Methods I
Homework 6

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Due Date: December 4, 1:25pm

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.

`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

(a) Identify the response variable (Y), the explanatory variable (X), and the sample size (n).

(b) Use the fact that $\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y}) = 1696$, $\sum_{i=1}^{n}(X_i - \bar{X})^2 = 182$, and $\bar{Y} = 693.6923$ to compute the estimated slope $\hat{\beta}_1$ and intercept $\hat{\beta}_0$

(c) Compute the fitted value and the associated residual value in year 1983.

(d) Compute $\hat{\sigma}$, the estimate of σ

(e) 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 $\alpha = 0.05$

(f) Construct the 90% confidence interval for E[`Lean`] in year 1984

(g) 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.