# ISyE 6414 — Fall 2022

## Homework #2

Part I. The attached data set was reported by an article in *Technometrics* on the selling price, $y$, and the annual taxes, $x$ (local, school, county) for 24 houses. By using R (or any appropriate software you prefer), answer questions 1–5 and submit the relevant outputs.

1. Construct and submit a scatter plot of $y$ versus $x$. Does a simple linear regression model seem appropriate here?
2. Fit the simple linear regression model using the method of least squares, i.e., find the least squares line, $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$ by using the software. Submit your solution (output).
3. In plain English, interpret the meaning of the slope parameter $\beta_1$.
4. In plain English, interpret the meaning of the intercept $\beta_0$. Does it have a practical meaning here?
5. Report the value of $s$; and then calculate $s^2$ and $SSE$.

Part II. Suppose that you obtained the following summary quantities to estimate the parameters in a regression study. Assume that $x$ and $y$ are related according to the simple linear regression model $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$.

$$n = 14, \quad \sum_{i=1}^{n} y_i = 572, \quad \sum_{i=1}^{n} y_i^2 = 23530,$$

$$\sum_{i=1}^{n} x_i = 43, \quad \sum_{i=1}^{n} x_i^2 = 157.42, \quad \text{and} \quad \sum_{i=1}^{n} x_i y_i = 1697.80.$$

Answer the following questions.

6. Calculate the least squares estimates of the slope and the intercept.
7. Estimate $\sigma^2$. Hint: Use the following formula to calculate the sum of squared errors:
$$SSE = SS_{yy} - \hat{\beta}_1 SS_{xy}.$$
8. Use the equation of the fitted line to predict $y$ at $x = 3.7$. Suppose that the observed (actual) value of $y = 46.1$ when $x = 3.7$. Calculate the corresponding residual.