

## EE325 HW 2 (Additional Questions highlighted in blue)

Use 4 decimal places for numerical answers

1. In Table 1.a.  $X_i$  is total microeconomics exam point (total points are 100) and  $Y_i$  is GPA of each student.

**Table 1.a**

| Student | $Y_i$ | $X_i$ |
|---------|-------|-------|
| 1       | 2.8   | 63    |
| 2       | 3.4   | 72    |
| 3       | 3     | 78    |
| 4       | 3.5   | 81    |
| 5       | 3.6   | 87    |
| 6       | 3.0   | 75    |
| 7       | 2.7   | 75    |
| 8       | 3.7   | 90    |

- 1.1 Now consider the two-variable model  $Y_i = \beta_0 + \beta_1 X_i + u_i$ ,  $u_i \sim NIID(0, \sigma^2)$  Use OLS to find the estimator of  $\beta_0$  and  $\beta_1$ . Interpret the regression.
- 1.2 Find  $\hat{Y}_i$  and  $\hat{u}_i$  and show that  $\sum_{i=1}^n \hat{u}_i \approx 0$
- 1.3 Find  $\text{var}(\hat{u}_i)$ ,  $\text{var}(\hat{\beta}_0)$ , and  $\text{var}(\hat{\beta}_1)$
- 1.4 Test the hypothesis that total microeconomics exam point has no influence on GPA at  $\alpha = 5\%$
- 1.5 What percentage of the total variation in Y explained by the regression model?

2. Data is listed in the table

| $X_i$ | $Y_i$ |
|-------|-------|
| 10    | 0     |
| 12    | 2     |
| 14    | 5     |
| 16    | 6     |
| 18    | 7     |
| 22    | 10    |
| 24    | 10    |
| 26    | 15    |
| 28    | 16    |
| 30    | 20    |

- 2.1 From the simple regression model  $Y_i = \beta_0 + \beta_1 X_i + u_i$ ,  $u_i \sim NIID(0, \sigma^2)$  Find estimators of  $\beta_0$  and  $\beta_1$  from the OLS method and interpret the meaning.
- 2.2 Find the value of  $\hat{Y}_i$  and  $\hat{u}_i$ . Show that  $\sum \hat{u}_i \approx 0$
- 2.3 Plot graph and draw regression line. Does the line pass  $(\bar{X}, \bar{Y})$ ?
- 2.4 If  $X_i = 16$ , what is the predicted Y?
- 2.5 Find  $\text{var}(\hat{u}_i)$ ,  $\text{var}(\hat{\beta}_0)$ ,  $\text{var}(\hat{\beta}_1)$

3. Given  $Y$  is wages per hour (\$),  $X$  is year of schooling (years) from a sample of 528 observations

$$\begin{aligned}\hat{Y}_t &= 0.7437 + 0.6416X_t \\ se &= (0.8355)(0.0664) \\ r^2 &= 0.8944, \hat{\sigma}^2 = 0.8040\end{aligned}$$

3.1 Test the hypothesis that year of schooling has a positive influence on wages per hour at  $\alpha = 1\%$

3.2 Interpret the regression.

3.3 If Miss Lily has 8 years of schooling, what is the predicted average on wages per hour (\$)?