

ECN 102, Spring 2020

Midterm 2 Review Sums

Question 1

$$\sum_{i=1}^{10} (x_i - \bar{x})^2 = 10$$

$$\sum_{i=1}^{10} (y_i - \bar{y})^2 = 90$$

$$\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 20$$

$$\sum_{i=1}^{10} (y_i - \hat{y}_i)^2 = 50$$

$$\bar{x} = 1$$

$$\bar{y} = 20$$

Calculate the OLS intercept and slope coefficients.

$$b_2 = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2} = \frac{20}{10} = 2$$

$$b_1 = \bar{y} - b_2 \bar{x} = 20 - 2(1) = 18$$

Question 2

$$\sum_{i=1}^{10} (x_i - \bar{x})^2 = 10$$

$$\sum_{i=1}^{10} (y_i - \bar{y})^2 = 90$$

$$\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 20$$

$$\sum_{i=1}^{10} (y_i - \hat{y}_i)^2 = 50$$

$$\bar{x} = 1$$

$$\bar{y} = 20$$

Calculate the standard error of the regression.

$$s_e = \sqrt{\frac{\text{RSS}}{n-2}} = \sqrt{\frac{50}{8}} = 2.5$$

Question 3

$$\sum_{i=1}^{10} (x_i - \bar{x})^2 = 10$$

$$\sum_{i=1}^{10} (y_i - \bar{y})^2 = 90$$

$$\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 20$$

$$\sum_{i=1}^{10} (y_i - \hat{y}_i)^2 = 50$$

$$\bar{x} = 1$$

$$\bar{y} = 20$$

Calculate the R^2 of the regression.

~~$$R^2 = \frac{ESS}{TSS}$$~~

$$R^2 = 1 - \frac{RSS}{TSS} = 1 - \frac{50}{90} = 0.4444$$

Question 4

$$\sum_{i=1}^{10} (x_i - \bar{x})^2 = 10$$

$$\sum_{i=1}^{10} (y_i - \bar{y})^2 = 90$$

$$\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 20$$

$$\sum_{i=1}^{10} (y_i - \hat{y}_i)^2 = 50$$

$$\bar{x} = 1$$

$$\bar{y} = 20$$

Calculate the correlation coefficient r_{xy} .

Know that $R^2 = r_{xy}^2$, so

$$0.4444 = r_{xy}^2 \implies r_{xy} = \sqrt{0.4444} = \pm 0.6666$$

Third sum is positive, which implies that covariance is positive, which implies correlation is positive. (Equivalently, $b_2 > 0$ as well.) So $r_{xy} = 0.6666$.