

Q1(40 points) We collected a sample grade of midterm and final exam. See data below

$i$	midterm, $x_i$	final, $y_i$	$x_i^2$	$y_i^2$	$x_i y_i$	$\hat{y}_i$	$e_i^2$
1	1.5	2.5					
2	4	3.5					
3	3	4					
4	3	2.5					
5	4.5	5					
6	2	1.5					
<b>sum</b>							
<b>mean</b>							

Manually solve the following, do NOT use SAS ( $\alpha = 0.1$ ). Keep four digits decimals for any calculation.

1. (5 points) Fill the table.
2. (4 points) Fit the data to a simple linear regression model, calculate the least squares point estimates for  $\beta_0, \beta_1$ . And interpret the model (slop, y-intercept).
3. (2 points) Calculate the error sum of squares and the residual mean square.
4. (9 points) Calculate the 90% confidence intervals for  $\beta_0, \beta_1$ . And interpret the confidence interval of the slop.
5. (3 points) Apply a  $t$ -test to test  $H_0 : \beta_0 = 0$ ,  $H_a : \beta_0 \neq 0$ . Solve using reject point.
6. (4 points) Apply a  $t$ -test to test  $H_0 : \beta_1 = 0$ ,  $H_a : \beta_1 \neq 0$ . Solve using  $P$ -value.
7. (1 points) Calculate the prediction value of  $y$ , given  $x = 3$ .
8. (3 points) Calculate the 90% confidence interval for the expected value of  $y$ , given  $x = 3$ .
9. (2 points) Calculate the 90% prediction interval for  $y$ , given  $x = 3$ .
10. (4 points) Calculate the simple coefficient of determination and the simple correlation coefficient based on the regression model. And use the simple correlation coefficient to interpret the relations between midterm grade and final grade.
11. (3 points) Apply a  $F$ -test to test  $H_0 : \beta_1 = 0$ ,  $H_a : \beta_1 \neq 0$ . Note  $F_{0.1}^{(1,4)} = 4.5448$ .