

Tutorial 4

1. An output of a simple linear regression model

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i, \quad i = 1, \dots, 10$$

is as follows

Coefficients:				
	Estimate	Std. Error	t value	P-value
(Intercept)	-0.07727	0.12005	-0.644	0.537814
x	0.97295	0.14345	6.783	0.000140
Residual standard error: 0.3761 on 8 degrees of freedom				
Multiple R-squared: 0.8519, Adjusted R-squared: 0.8333				
F-statistic: 46 on 1 and 8 DF, p-value: 0.0001403				

- (a) find $b_0, b_1, s(b_0), s(b_1), t(b_0), t(b_1), R^2, \hat{\sigma}, r_{XY}$ and the F-statistic (or F-value)
- (b) based on the output (alone), set up the ANOVA table
- (c) Using t-statistic, test $H_0 : \beta_1 = 1$ with $\alpha = 0.05$

2. Sales Growth

	i	1	2	3	4	5	6	7	8	9	10
X_i : Year		0	1	2	3	4	5	6	7	8	9
Y_i : Sales		98	135	162	178	221	232	283	300	374	395

- (a) prepare a scatter plot of the data. does a linear relation appear adequate here?
- (b) Use the transformation $Z = \sqrt{Y}$ and obtain the estimated linear regression for the transformed data.
- (c) Does the regression line appear to be good to the transformed data?
- (d) obtain the residuals and plot them against the fitted values. Also plot the histogram. What do your plots show?

3. blood pressure

	i	1	2	3	4	5	6	7	8
X_i : age		5	8	11	7	13	12	12	6
Y_i : blood pressure		63	67	74	64	75	69	90	60

- (a) Assuming normal error regress mode is adequate, obtain the estimated regression function and plot the residuals e_i against X_i . What does your residuals plot show?

- (b) Omit case 7 from the data and obtain the estimated regression based on the remaining seven cases. compare this estimated regression to that obtained in part (a). What can you conclude about the effect of case 7?
- (c) Using your fitted regression in part (b), obtain a 99% prediction interval for a new Y with $X = 12$. Does observation Y_7 fall outside this prediction interval?

4. write the details for

$$b = (X'X)^{-1}X'Y$$

5. Show that the R^2 is the same whether Y is regressed on X or X is regressed on Y .