

## SOLUTIONS

King Fahd University of Petroleum & Minerals  
Department of Mathematics & Statistics  
STAT-212-Term063-Quiz6

Name:

ID:

Serial:

**(1+2+1+2+2+3+3+2=16 points)**

A sample of computer hardware companies was taken from the *Stock Investor Pro*, to study the effect of the Book Value per share ( $X_1$  in \$), the Return on Equity per share ( $X_2$  in %), and the Company Type ( $X_3 = \begin{cases} 1, & \text{Old company} \\ 0, & \text{New company} \end{cases}$ ) on the Price per share ( $Y$  in \$). Use the Minitab output below to answer the questions that follow:

### Regression Analysis: Y versus X1, X2, X3

The regression equation is

$$Y = 1.71 + 2.50 X_1 + 0.497 X_2 + 7.25 X_3$$

Predictor	Coef	SE Coef	T	P	VIF
Constant	1.707	6.412	0.27	0.792	
X1	2.4987	0.5283	4.73	0.000	1.0
X2	0.4974	0.1167	4.26	0.000	1.0
X3	7.253	5.772	1.26	0.220	1.0

### Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	8918.2	2972.7	12.55	0.000
Residual Error	26	6157.9	236.8		
Total	29	15076.1			

### Predicted Values for New Observations

New Obs	Fit	SE Fit	95.0% CI	95.0% PI
1	51.84	8.90	( 33.54, 70.14)	( 15.30, 88.39)

### Values of Predictors for New Observations

New Obs	X1	X2	X3
1	2.33	74.5	1.00

<p>1. The standard error of the regression model is <math>S_{\varepsilon} = \sqrt{\frac{SSE}{n - k - 1}}</math></p>	$S_{\varepsilon} = \sqrt{\frac{6157.9}{30 - 3 - 1}} = 15.3897$
<p>2. If the Book Value = the Return on Equity % = 0 and the Company Type is New, then the predicted average Price  <math>= \hat{y} = 1.71 + 2.50(0) + 0.497(0) + 7.25(0) = 1.71</math></p>	<p style="text-align: center;"><b>1.71 Or 1.707</b></p>
<p>3. What is the estimated coefficient of the Company Type?</p>	<p>Coefficient = <math>b_3 = 7.25</math></p>
<p>4. Interpret the coefficient in part (3)</p>	<p><b>Interpretation: The price per share(in\$) will increase by \$7.25 for old companies for the same Book Value per share and same Return on Equality per share more than new companies</b></p>
<p>5. The coefficient of determination  is <math>R^2 = \frac{SSR}{SST} = \frac{8918.2}{15076.1} = 0.5915</math></p>	<p><math>R^2 = 0.5915</math> or 59.15%</p>
<p>6. The adjusted coefficient of determination is  <math>R_A^2 = 1 - (1 - R^2) \left( \frac{n - 1}{n - k - 1} \right) = 1 - (1 - .5915) \left( \frac{29}{26} \right) = 0.5444</math></p>	<p><math>R^2</math>-adj = 0.5544 or 55.44%</p>
<p>7. Is any of the three independent variables not significant? Why?  <b>Yes: which is <math>X_3</math> because the <math>P</math>-value = 0.220 <math>\times</math> <math>\alpha</math> = 0.05</b></p>	
<p>8. Is the overall model significant? Why?  <b>Yes, because from ANOVA table <math>P</math>-value = 0.000 <math>&lt;</math> <math>\alpha</math> = 0.05</b></p>	
<p>9. If the Book Value is \$2.33, the Return on Equity percentage is 74.5%, and the Company is Old, then a 95% CI for the average Price per share is</p>	<p>[ <b>33.54</b> , <b>70.14</b> ]</p>

Question Two (4-Points)

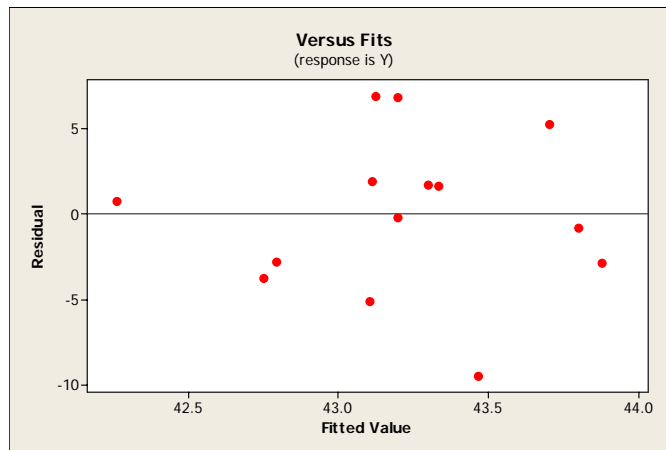
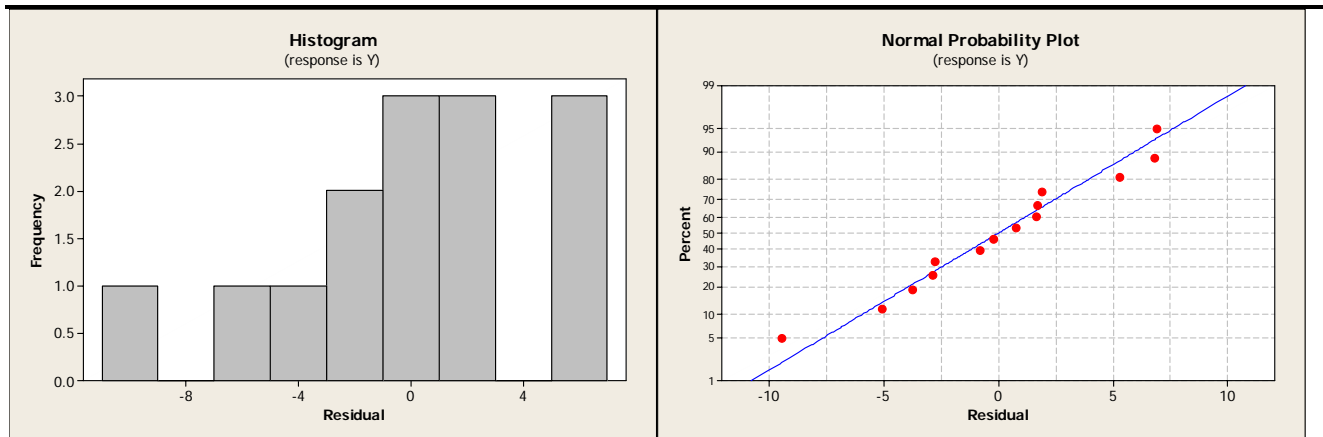
You are given the following MINITAB output of one dependent and two independent variables, the correlation matrix and two residual graphs.

**Correlations: Y, X1, X2, X3**

	Y	X1	X2
X1	0.584 0.046		
X2	0.734 0.007	0.629 0.028	
X3	0.930 0.000	0.448 0.144	0.525 0.080

a. Which variable will enter the model-by forward selection method – and why?

**X<sub>3</sub>, because it has the highest correlation coefficient with the dependent variable Y**



b. What can you conclude about the error assumptions ?

- 1. The errors are not normally distributed, because the histogram shape is not normal and the normal probability plot is not linear**
- 2. Errors variance not constant , because the plot of residuals against fitted values has a cone (or V) shape**