Minitab Express™

Simple Regression

A materials engineer at a furniture manufacturing site wants to assess the stiffness of the particle board that the manufacturer uses. The engineer measures the stiffness and the density of a sample of particle board pieces.

The engineer uses simple regression to determine whether the density of the particles is associated with the stiffness of the board.

1. Open the sample data, ParticleBoard.MTW.
2. Open the simple regression dialog box.
    - Mac: **Statistics > Regression > Simple Regression**
    - PC: **STATISTICS > Simple Regression**
3. In **Response (Y)**, enter *Stiffness*.
4. In **Predictor (X)**, enter *Density*.
5. On the **Options** tab, select **Display 95% confidence interval** and **Display 95% prediction interval**.
6. On the **Graphs** tab, select **Residual plots**.
7. Click **OK**.

Interpreting the results

The p-value for density is less than 0.0001, which is less than the significance level of 0.05. These results indicate that the association between stiffness and density is significant. However, there appears to be an outlier in the top right corner of the scatterplot. This point corresponds to observation 21, which is shown in the table of Fits and Diagnostics for Unusual Observations. Because the outlier could have a strong effect on the results, the engineer should investigate this point to determine its cause.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	11552.7685	11552.7685	146.86	<0.0001
Density	1	11552.7685	11552.7685	146.86	<0.0001
Error	27	2123.9756	78.6658		
Lack-of-Fit	26	2123.5679	81.6757	200.33	0.0558
Pure Error	1	0.4077	0.4077		
Total	28	13676.7441			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
8.86937224	84.47%	83.89%	80.83%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-21.534	4.735	-4.55	0.0001	
Density	3.5405	0.2922	12.12	<0.0001	1

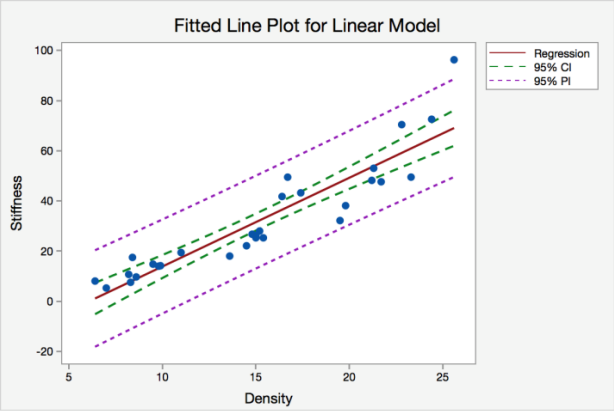
Regression Equation

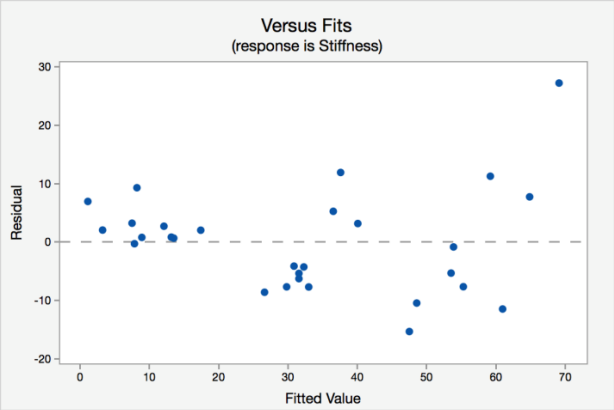
Stiffness = – 21.534 + 3.5405 Density

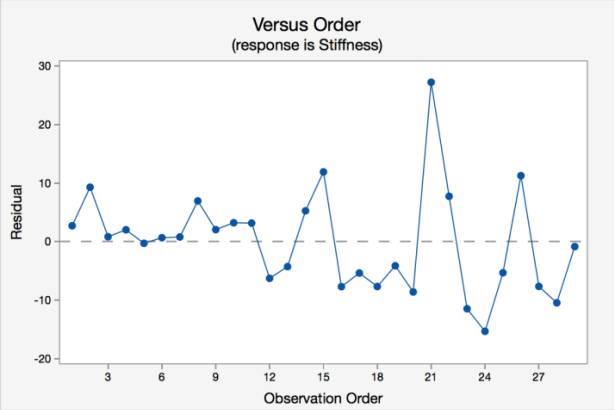
Fits and Diagnostics for Unusual Observations

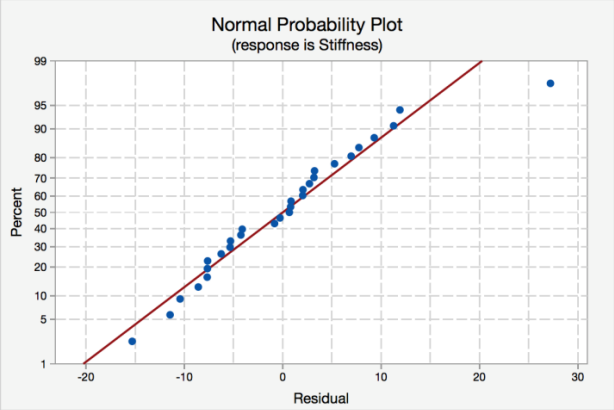
Obs	Stiffness	Fit	Resid	Std Resid	
21	96.305	69.1039991	27.2010009	3.33	R

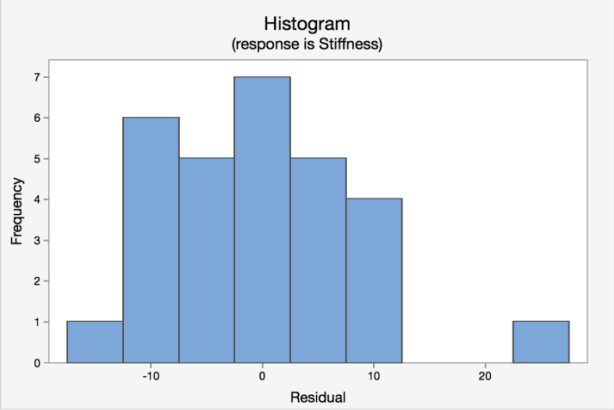
R Large residual


Fitted Line Plot for Linear Model
Regression
95% CI
95% PI
Stiffness
Density


Versus Fits
(response is Stiffness)
Residual
Fitted Value


Versus Order
(response is Stiffness)
Residual
Observation Order


Normal Probability Plot
(response is Stiffness)
Percent
Residual


Histogram
(response is Stiffness)
Frequency
Residual