Overview

In this lab you will be introduced to using JMP to fit two separate regression lines using Fit Model and Fit Y by X.

Warm-up Exercise

When fitting multiple regression models with a dummy (indicator) variable and an interaction term, the result is two separate prediction equations. Fit Model allows you to assess the statistical significance of difference between the two prediction equations while Fit Y by X allows you to plot the two lines on the scatterplot of the data.

In class we introduced the example involving the amount of natural gas used to heat an un-insulated/insulated house and the average outdoor temperature. The response variable, Y, is the amount of natural gas (1000 cubic feet) used (Gas). The explanatory variable is the average outdoor temperature (Temp). The dummy variable, Insul, takes on the value 0 for the un-insulated house and the value 1 for the insulated house. The data is available on the course web page

www.public.iastate.edu/~wrstephe/stat301.html

Go to the course web page and open the data for the temperature and gas usage example with JMP.

1. In JMP go to Analyze and Fit Model. Cast Gas into the role of Y: Response. Cast Temp, Insul, and Temp*Insul into Construct Model Effects box. Go to the red triangle pull down menu next to Model Selection and un-check the Center Polynomials option. Be sure that the Personality is Standard Least Squares and the Emphasis is Minimal Report. Click on OK. The output will contain a Summary of Fit, Analysis of Variance, Lack of Fit (which you can hide) and Parameter Estimates.

2. All of the parameter estimates are statistically significant and are interpretable within the context of this problem.
   - Intercept: The predicted amount of gas used for the un-insulated house (Insul = 0) for a week when the average outdoor temperature is zero degrees Celsius is 6,854 cubic feet.
   - Temp: For an un-insulated house (holding Insul constant at zero), each additional 1 degree C increase in temperature is associated with a 393 cubic feet decrease in the amount of natural gas used, on average.
   - Insul: For a week when the average outdoor temperature is zero (holding Temp constant at zero) an insulated house uses 2,263 cubic feet less gas than an insulated house.
   - Temp*Insul: The difference in the average amount of gas used per degree of temperature between an un-insulated and an insulated house. An un-insulated house uses 144 cubic feet of gas per degree more than an insulated house.

3. The prediction equation is:

\[ \text{Predicted Gas} = 6.8538 - 0.3932 \times \text{Temp} - 2.2632 \times \text{Insul} + 0.1436 \times \text{Temp} \times \text{Insul} \]
This can be written as two separate equations, one for an uninsulated house (Insul = 0) and one for an insulated house (Insul = 1).

Un-insulated house (Insul = 0)

\[ \text{Predicted Gas} = 6.8538 - 0.3932 \times \text{Temp} \]

Insulated house (Insul = 1)

\[ \text{Predicted Gas} = 4.5906 - 0.2496 \times \text{Temp} \]

4. You can use **Fit Y by X** to produce and plot these two equations on the scatter plot of the data. Go to **Analyze – Fit Y by X**. Cast Gas into Y, Response and cast Temp into X, Factor. Click on OK. This will produce the scatter plot of gas usage versus temperature. From the red triangle pull down next to Bivariate Fit of Gas by Temp select **Group By …** and click on Insul and OK. You will not notice any change in the plot. Now go to the red triangle pull down next to Bivariate Fit of Gas by Temp and select **Fit Line**. Two separate lines will be fit to the data.

**Bivariate Fit of Gas By Temp**

![Bivariate Fit of Gas By Temp](image)

**Linear Fit Insul==0**

\[ \text{Gas} = 6.8538277 - 0.3932388 \times \text{Temp} \]

**Linear Fit Insul==1**

\[ \text{Gas} = 4.5906175 - 0.2496268 \times \text{Temp} \]