The first activity revisits the labeling of Fun Size bags of M&Ms by looking distributions of Total Weight of Fun Size bags and regular size bags (which have a label weight) of M&Ms. In activity 2 you will get a feel for fitting a straight line to data by doing “visual” regression on heights and hand spans. In activity 3 you will use JMP to compute least squares regression lines for heights and hand spans.

Activity 1: The JMP output (this is the same output from Lab #3) gives the distribution of the Total Weight of 325 Fun Size bags of plain M&Ms. In Lab #3 we determined that Total Weight could be modeled with a Normal model.

Fun Size bags of M&Ms are sold as part of a larger package. The Fair Packaging and Labeling Act says that Fun Size bags cannot be sold individually because they do not carry a label weight of contents. If we wanted to sell individual Fun Size bags of M&Ms we would need to determine an accurate label weight of contents.

a) Based on the distribution of Total Weight what should the label weight for an individual Fun Size bag be? Explain your choice briefly.

b) Using a Normal model with \( \mu = 19.8 \) g and \( \sigma = 1.4 \) g, what proportion of Fun Size bags have a Total Weight greater than the label weight you chose in a)?

c) M&Ms are also sold in larger individual packages that carry a label weight of contents. The distribution and summary statistics for the Total Weights of a sample of 100 regular size bags whose label weight is 47.9 g are given on a separate sheet. Comment on the label weight relative to the distribution of Total Weight.

d) Using a Normal model with \( \mu = 49.7 \) g and \( \sigma = 1.2 \) g, what proportion of regular size bags have a Total Weight greater than the label weight?

e) Given what you have discovered in c) & d) come up with a label weight for Fun Size bags that is consistent with the label weight of regular size bags. Explain the reasoning behind your choice of label weight.

f) The Fair Packaging and Labeling Act says:

Variations from the stated weight or mass, measure, or numerical count shall be permitted when caused by unavoidable deviations in weighing, measuring, or counting the contents of individual packages which occur in good packaging practice: Provided, that such variations shall not be permitted to such extent that the average of the quantities in the packages comprising a shipment or other delivery of the commodity is below the quantity stated, and no unreasonable shortage in any package will be permitted even though overages in other packages in the same shipment or delivery compensate for such shortage. Variations from stated quantity of contents shall not be unreasonably large.

Comment on whether or not your label weight in e) satisfies the Fair Packaging and Labeling Act.
Activity 2: In Lab #2 you measured heights and hand spans of the students in this class. Does the height of a person tell us something about that person’s right hand span? Does right hand span tell us something about left hand span? The focus of this activity is to get a feel for relating one variable to another using “visual” regression.

On the answer sheet you will see scatter plots of right hand span (response, \( y \)) versus height (explanatory, \( x \)) and left hand span (response, \( y \)) versus right hand span (explanatory, \( x \)). For each plot do the following:

a) Describe the general association between the explanatory variable, \( x \) and response variable, \( y \). Be sure to mention form, direction, strength and the presence of outliers.

b) Add a “visual” regression line to the plot. Use the ruler to locate a line by eye that you believe best captures the general trend in the relationship between explanatory and response variables. Be sure to extend your “visual” regression line so that it intersects the \( y \)-axis.

c) Give the \( y \)-intercept for your “visual” regression line.

d) Give the slope for your “visual” regression line.

e) Give the equation for your “visual” regression line.

Which “visual” regression line do you think will be closer to the corresponding least squares regression line? Explain your reasoning briefly.

Activity 3: Use JMP to calculate the least squares regression lines for right hand span on height and left hand span on right hand span. The data are in the file Height.JMP on the course web page under Laboratory 3.

Follow the directions in the Guide to Using JMP in Stat 101 on scatter diagrams and regression coefficients. Fit right hand span, \( y \) by height, \( x \) and fit left hand span, \( y \) by right hand span, \( x \). Turn in the JMP output with your lab. Use the output to answer the following questions about each regression equation.

a) Give the estimates of the \( y \)-intercept and slope for the least squares regression line.

b) Give an interpretation of the value of the slope within the context of the problem.

c) Give the least squares regression equation.

d) Give the value, and an interpretation, of \( R^2 \).

e) Describe the plot of residuals versus the explanatory variable. What does this plot tell you about the fit of the least squares regression line?

f) Based on the data, do you think a linear regression line is a good approximation for the relationship between the two variables? Explain briefly.
Distribution of the Total Weight for 325 Bags of Fun Size M&Ms

Quantiles

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Moments

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Distribution of the Total Weight for 100 Regular Size bags of M&Ms

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<td>0.0% minimum</td>
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f) Comment on whether or not your label weight in e) satisfies the Fair Packaging and Labeling Act.

Activity 2:

Right Hand Span and Height

a) Describe the general association between the explanatory variable, height and response variable, right hand span. Be sure to mention form, direction, strength and the presence of outliers.

b) Add a “visual” regression line to the plot. Use the ruler to locate a line by eye that you believe best captures the general trend in the relationship between explanatory and response variables. Be sure to extend your “visual” regression line so that it intersects the y-axis.

c) Give the y-intercept for your “visual” regression line.

d) Give the slope for your “visual” regression line.

e) Give the equation for your “visual” regression line.
Left Hand Span (cm) By Right Hand Span (cm)
Activity 2:

Left Hand Span and Right Hand Span

a) Describe the general association between the explanatory variable, right hand span and response variable, left hand span. Be sure to mention form, direction, strength and the presence of outliers.

b) Add a “visual” regression line to the plot. Use the ruler to locate a line by eye that you believe best captures the general trend in the relationship between explanatory and response variables. Be sure to extend your “visual” regression line so that it intersects the y-axis.

c) Give the y-intercept for your “visual” regression line.

d) Give the slope for your “visual” regression line.

e) Give the equation for your “visual” regression line.

Activity 3:

Right Hand Span and Height

a) Give the estimates of the y-intercept and slope for the least squares regression line.

b) Give an interpretation of the value of the slope within the context of the problem.

c) Give the least squares regression equation.

d) Give the value, and an interpretation, of $R^2$. 
e) Describe the plot of residuals versus the explanatory variable. What does this plot tell you about the fit of the least squares regression line?

f) Based on the data, do you think a linear regression line is a good approximation for the relationship between the two variables? Explain briefly.

**Left Hand Span and Right Hand Span**

a) Give the estimates of the \( y \)-intercept and slope for the least squares regression line.

b) Give an interpretation of the value of the slope within the context of the problem.

c) Give the least squares regression equation.

d) Give the value, and an interpretation, of \( R^2 \).

e) Describe the plot of residuals versus the explanatory variable. What does this plot tell you about the fit of the least squares regression line?

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