1. Weights and chest diameter (called heart girth) measurements were made on 539 cattle. The objective was to see if weights of these beasts can be estimated based on the chest measurements (which are easily made with a tape measure) and thereby avoid having to get the animals on a scale. Below are summary computations for the data, where $y$=weight in pounds and $x$=heart girth in inches.

$$n=539 \quad \Sigma x_i = 82790 \quad \Sigma y_i = 151669 \quad S_{xx} = 31093 \quad S_{xy} = 130837 \quad S_{yy} = 736962$$

(8) a. Set up computations for the slope and intercept of the equation for the regression line (that is, show how they are obtained from the summary computations).

Slope: $b_1 =$

Intercept: $b_0 =$

(8) b. Your equation for the regression line should be $\hat{y} = -365 + 4.21x$. Write interpretations for the slope and intercept (that is, describe what they mean in terms of weight and heart girth).

Slope:

Intercept:

(5) c. Sketch a graph of your regression line.

$y =$ weight

500

400

300

200

100

0

0  50  100  150  200

$x =$ heart girth
(5) d. The intercept is negative. Does its interpretation have any practical value? Why or why not? (The mean heart girth is $82790/539=153.6$ and the standard deviation is 7.6.)

(8) e. Write an analysis of variance for the data. Show your computations for the SS values.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>___</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>Error</td>
<td>___</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>Total</td>
<td>___</td>
<td>________</td>
<td></td>
</tr>
</tbody>
</table>

(7) f. Compute $R^2$, and write its interpretation in terms of variation in weight associated with variation in heart girth.

$R^2 =$

Interpretation:

(5) g. Set up computations for a 95% confidence interval for the mean weight of the subpopulation of animals that have heart girth equal to 160 inches. (Your answer should be $308.6 \pm 2.1$.)

(5) h. Set up computations for a 95% confidence interval for the weight of one particular animal whose heart girth is 160 inches. (Your answer should be $308.6 \pm 37.3$.)

(5) i. Assume you are manager of a feed lot where you fatten cattle for market. You buy calves that are guaranteed by the seller to each weigh at least 300 lbs. Do you think the weights can be adequately determined from heart girth to decide whether an animal meets the minimum weight? Explain your answer.
2. Left and right hand-span and heights were recorded for 41 students. The attached SAS printout shows two regression analyses, both with dependent variable $y = ht$. The first analysis has independent variable $x = lspan$. The second analysis has independent variables $x_1 = lspan$ and $x_2 = rspan$. All variables were measured in inches.

(5) a. Write the regression equation for the first analysis.

(5) b. Write an interpretation of the regression coefficient for lspan, i.e. the slope.

(5) c. Write the regression equation for the second analysis.

(7) d. Construct a 95% confidence interval for the regression coefficient of lspan using each analysis:

Analysis 1:

Analysis 2:

(7) e. A person has lspan = 8.5” and rspan = 8.5”. Compute predictions using each regression analysis.

Analysis 1: $\hat{y} =$

Analysis 2: $\hat{y} =$

(5) f. Using results of d. and e., state your conclusions about the effects of including both lspan and rspan, which are highly correlated, in a regression model.
3. Below is a table showing the counts of students in problem 2, classified according to gender (f or m) and college. Group the counts for all the colleges except agr and eng into another category, called “other.”

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<th>Cvm</th>
<th>Eng</th>
<th>Frc</th>
<th>Hhp</th>
<th>Las</th>
<th>Med</th>
<th>Phm</th>
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<td>1</td>
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<td>0</td>
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<td>2</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Agr</th>
<th>Eng</th>
<th>Other</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(5) a. Perform a test of independence for the classifications according to gender and college, and write your practical conclusion about the relationship between gender and college.

(5) b. Why was it necessary to combine the groups before making the test?