Applied Regression in Natural Resources FOR 518
Homework #2

1) Perform the following matrix operations:

a) \[
\begin{bmatrix}
4 & 6 \\
3 & 0
\end{bmatrix} + \begin{bmatrix}
39 & 12 \\
31 & 74
\end{bmatrix} =
\]

b) \[
\begin{bmatrix}
94 & 57 \\
34 & -43
\end{bmatrix} - \begin{bmatrix}
35 & 67 \\
16 & -15
\end{bmatrix} =
\]

c) \[
\begin{bmatrix}
5 & 7 \\
4 & 0
\end{bmatrix} \ast \begin{bmatrix}
7 \\
12
\end{bmatrix} =
\]

d) \[
\begin{bmatrix}
2 & 1 \\
3 & 11
\end{bmatrix} \ast 3 =
\]

e) \[
\begin{bmatrix}
34 & 1 \\
12 & 3
\end{bmatrix} \ast \begin{bmatrix}
4 \\
0
\end{bmatrix} =
\]

e) \[
\begin{bmatrix}
3 & 7 \\
4 & 6
\end{bmatrix}^{-1} =
\]

g) \[
\begin{bmatrix}
3 & 6 & 8 \\
2 & 7 & 0
\end{bmatrix}^{-1} =
\]

h) \[
\begin{bmatrix}
4 & 3 \\
8 & 6
\end{bmatrix}^{-1} =
\]

i) transpose: \[
\begin{bmatrix}
23 & 45 & 67 & 0
\end{bmatrix}^T =
\begin{bmatrix}
9 & 12 & 73 & 16 \\
1 & 4 & 56 & 8
\end{bmatrix} =
\]
2) An ichthyologist hypothesized that the frequency of electrical impulses emitted from electrical fish is related to water temperature. This scientist collected the following data to test her hypothesis:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Impulse Frequency (number per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>225, 230, 239</td>
</tr>
<tr>
<td>22</td>
<td>251, 259, 265</td>
</tr>
<tr>
<td>23</td>
<td>266, 273, 280</td>
</tr>
<tr>
<td>25</td>
<td>287, 295, 302</td>
</tr>
<tr>
<td>27</td>
<td>301, 310, 317</td>
</tr>
<tr>
<td>28</td>
<td>307, 313, 325</td>
</tr>
<tr>
<td>30</td>
<td>324, 330, 338</td>
</tr>
</tbody>
</table>

You will do the following things to analyze the data, calculating all statistics by hand, except for item i):

a) Build the simple linear regression model that shows the relationship between electrical impulse frequency and water temperature (note: remember to plot the data).

b) Test the appropriate null and alternative hypotheses on the regression parameters to determine if they are significantly different from zero.

c) Compute a 95% confidence interval for the mean impulse frequency at 22.5 °C.

d) Compute a 95% prediction interval for the new observation at a water temperature of 29 °C.

e) Perform a lack of fit test to determine the appropriateness of the simple linear regression model.

f) Construct the ANOVA table for the regression model in a). Include all the error components for the lack of fit test.

g) What proportion of the variation in impulse frequency is explained by water temperature?

h) What is the standard error of the regression?

i) Fit the model in a) using SAS. Indicate on the computer output where all items calculated above are located (i.e., parameter estimates, MSE, RMSE, R-squared, hypothesis tests on parameters). Be sure to include the SAS code in your finished homework assignment.