1. Suppose that the posterior distribution of $\Delta$ is approximately $t(11)$ with $\mu = 7.4$ and $\sigma = 3.9$. Fill in the shaded blanks in the tTailArea.xls spreadsheet below to compute $P(\Delta > 10 \mid \text{Data})$. Put an “X” where you think $P(\Delta > 10 \mid \text{Data})$ will appear.

\[
\begin{align*}
\text{df} &= 11 & z &= (10 - 7.4)/3.9 = 0.67 \\
\text{Tail areas for } t(df) &\
\text{df} &= 11 & z &= 0.67 \\
\text{Left Tail} & P(t(df) \leq z) = & \phantom{X} \\
\text{Right Tail} & P(t(df) > z) = & X
\end{align*}
\]

2. In the box below, write the SAS commands needed to read the data into a SAS file called "CIData". The five variables are called Dev, Mo, Con, Snt, Wrд.

```sas
DATA CIData;
   INPUT dev $ mo con snt wrd;
DATALINES;
C  01 78.20 100.00 76.00  \\
C  02 64.10 67.10 40.00  \\
... etc ...  \\
C  19 80.80 95.60 74.00  \\
C  20 69.20 100.00 46.00  \\
N  21 20.95 13.00 8.00  \\
N  22 46.79 59.00 22.00  \\
... etc ...  \\
N  44 23.08 3.49 2.00  \\
N  45 7.69 .00 .00  \\
I  46 39.74 .00 .00  \\
I  47 42.31 45.50 6.00  \\
... etc ...  \\
I  69 33.33 19.00 2.00  \\
I  70 32.05 11.00 2.00  \\
;
```

3. Referring to the previous problem. Say what the following program computes:

```sas
PROC MEANS DATA=CIDATA;
   CLASS Dev;
   VAR Con;
   
a) A stemplot of the variable "Con".
b) A graph with the variable "Con" on the vertical axis and the variable "Dev" on the horizontal.
c) A table of means and standard deviations of the variable "Con" broken down by the variable "Dev".
d) A frequency table, or crosstabulation, showing a breakdown of patients according to "Dev" and "Con".
```
4. The WinBUGS code fragment reproduced below produced the following compiler error:

```
Made use of undefined node: ratio
```

```
Ratio <- mu.tilde.fem/mu.tilde.mal
pRatgt1.25 <- step(ratio-1.25)
pRatgt1.50 <- step(ratio-1.50)
```

Locate the error and say how to correct it.

WinBUGS is case-sensitive. In line that defines ratio, it is spelled "Ratio" with a capitol letter. The error message indicates that somewhere else in the program it is spelled "ratio". The simplest correction is to change "Ratio" to "ratio" in the definition.

5. Here is part of the output from the above,

<table>
<thead>
<tr>
<th>node</th>
<th>mean</th>
<th>sd</th>
<th>MC error</th>
<th>2.5%</th>
<th>median</th>
<th>97.5%</th>
<th>start</th>
<th>sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>delta.tilde</td>
<td>-9.416</td>
<td>5.168</td>
<td>0.03718</td>
<td>-20.43</td>
<td>-9.157</td>
<td>-0.1047</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>mu.tilde.fem</td>
<td>26.44</td>
<td>4.778</td>
<td>0.03523</td>
<td>18.02</td>
<td>26.11</td>
<td>36.85</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>mu.tilde.mal</td>
<td>17.02</td>
<td>2.021</td>
<td>0.0136</td>
<td>13.25</td>
<td>16.92</td>
<td>21.27</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>pDiffgt0</td>
<td>0.0235</td>
<td>0.1515</td>
<td>0.00106</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>pRatgt1.25</td>
<td>0.8387</td>
<td>0.3679</td>
<td>0.002692</td>
<td>0.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>pRatgt1.50</td>
<td>0.5537</td>
<td>0.4971</td>
<td>0.003702</td>
<td>0.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1001</td>
<td>20000</td>
</tr>
<tr>
<td>ratio</td>
<td>1.575</td>
<td>0.3425</td>
<td>0.00242</td>
<td>1.006</td>
<td>1.543</td>
<td>2.344</td>
<td>1001</td>
<td>20000</td>
</tr>
</tbody>
</table>

a) what is the numerical value of P(Ratio > 1.25 | Data)?
   0.8387
b) what is the numerical value of P(Ratio < 1.50 | Data)?
   1 – 0.5537 = 0.4463

c) how accurate is a)?
   MCErr = 0.0027

d) how can you compute a) more accurately if you need to?
   Run more updates