A. In order to assess whether medication condition has an effect on approach behavior, analyze these data using a one-way between subjects ANOVA. Please do the calculations by hand and show your work. Present the results in an ANOVA source table. Also be sure to indicate the statistical hypotheses (H_0 & H_1) that you are testing and whether or not you reject the null hypothesis.

$$H_0 : \forall \mu_i ; \mu_i = \mu_j \Rightarrow H_0 : \mu_{\text{zoloft}} = \mu_{\text{naltrexone}} = \mu_{\text{valium}}$$

$$H_1 : \exists i, j \ni \mu_i \neq \mu_j$$

Drug	Sample	Mean	SSW	MSW	SSB	MSB	$\frac{\text{MSB}}{\text{MSW}}$
		$\bar{Y}$	$(y-\bar{Y})^2$	$\frac{\sum(y_i-\bar{Y}_i)^2}{N-J}$	$n(\bar{Y}-\bar{\bar{Y}})^2$	$\frac{\sum n_j(\bar{Y}_j-\bar{\bar{Y}})^2}{J-1}$	$\frac{\frac{\sum n_j(\bar{Y}_j-\bar{\bar{Y}})^2}{J-1}}{\frac{\sum(y_i-\bar{Y}_i)^2}{N-J}}$

Drug	Sample	Mean	SSW	MSW	SSB	MSB	$\frac{MSB}{MSW}$
		$\bar{Y}$	$(y-\bar{Y})^2$	$\frac{\sum(y_i-\bar{Y}_i)^2}{N-J}$	$n(\bar{Y}-\bar{\bar{Y}})^2$	$\frac{\sum n_j(\bar{Y}_j-\bar{\bar{Y}})^2}{J-1}$	$\frac{\frac{\sum n_j(\bar{Y}_j-\bar{\bar{Y}})^2}{J-1}}{\frac{\sum(y_i-\bar{Y}_i)^2}{N-J}}$
Zoloft	9	10.40	1.960	11.622	34.844	135.033	11.619
	11		0.360				
	5		29.160				
	12		2.560				
	15		21.160				
	14		12.960				
	13		6.760				
	12		2.560				
	7		11.560				
	6		19.360				
Naltrexone	15	16.50	2.250		179.211		
	16		0.250				
	12		20.250				
	12		20.250				
	18		2.250				
	19		6.250				
	23		42.250				
	20		12.250				
	13		12.250				
	17		0.250				
Valium	9	9.90	0.810		56.011		
	11		1.210				
	12		4.410				
	5		24.010				
	13		9.610				
	15		26.010				
	11		1.210				
	8		3.610				
	6		15.210				
	9		0.810				

As an ANOVA source table, this is:

Source of Variation	Sum of Squares	df	Mean Square	F
Between	270.067	2	135.033	
Within	313.80	27	11.622	11.619
Total	382.65			

$_{0.999}F_{2,27} \cong 11.619 \geq 3.35 \cong {}_{0.95}F_{2,27}$, the null hypothesis is rejected.

B. Replicate your results by doing an ANOVA using SAS. Turn in both the SAS program and your output.

spider_analysis.sas is a simple SAS program to compute ANOVA on spider_data.csv. More interestingly, spider_analysis.r is a R program to do the same thing.

The output from R is:

```
Response: Response
          Df  Sum Sq Mean Sq F value    Pr(>F)
Drug       2 270.067 135.033  11.618 0.0002289 ***
Residuals 27 313.800  11.622

Signif. codes: 0 '***' 0.001 '**' 0.01 '**' 0.05 '.' 0.1 ' ' 1
```

3. One of the undergraduate students in your lab left the results of an ANOVA in your mailbox. Due to some really odd printer problem only some of the cells are legible. After unsuccessfully trying to contact the student you realize that you actually have enough information left to figure out what the missing cells have to be.

Source of Variation	Sum of Squares	df	Mean Square	F
Between		5		
Within			10.60	3.22
Total	382.65			

A. Fill in the blanks.

$$\frac{\underline{\text{MSB}}}{\underline{\text{MSW}}} \sim F_{J-1,N-J} \Rightarrow (F)\underline{\text{MSW}} = \underline{\text{MSB}} \Rightarrow (3.22)(10.60) = 34.132$$

$$\underline{\text{MSB}} = \frac{\text{SSB}}{J-1} = \frac{\text{SSB}}{\text{df}_{\underline{\text{SSB}}}} \Leftrightarrow (\underline{\text{MSB}})\text{df}_{\underline{\text{SSB}}} = \underline{\text{SSB}} \Rightarrow (34.132)(5) = 170.66$$

$$\underline{\text{SST}} = \underline{\text{SSB}} + \underline{\text{SSW}} \Leftrightarrow \underline{\text{SST}} - \underline{\text{SSB}} = \underline{\text{SSW}} \Rightarrow 382.65 - 170.66 = 211.99$$

$$\underline{\text{MSW}} = \frac{\text{SSW}}{N-J} = \frac{\text{SSW}}{\text{df}_{\underline{\text{SSW}}}} \Leftrightarrow (\underline{\text{SSW}})\text{df}_{\underline{\text{SSW}}} = \underline{\text{MSW}} \Rightarrow \frac{211.99}{10.60} \cong 20$$

Source of Variation	Sum of Squares	df	Mean Square	F
Between	170.66	5	34.132	
Within	211.99	20	10.60	3.22
Total	382.65			