Solutions

STAT 217: Quiz 14

1. Refer to the data below. Is this a replicated or an unreplicated design? Explain how you know.

```
##    strength pressure temperature
## 1      9.60      120         250
## 2      9.69      130         250
## 3      8.43      140         250
## 4      9.98      150         250
## 5     11.28      120         260
## 6     10.10      130         260
## 7     11.01      140         260
## 8     10.44      150         260
## 9      9.00      120         270
## 10     9.57      130         270
## 11     9.03      140         270
## 12     9.80      150         270
```

It is an unreplicated design because there is only one strength measurement for each pressure-temperature combination.

2. Is this a balanced design? Briefly explain how you know.

Yes - there is exactly one measurement in each treatment group

3. Below is a partial anova table. Fill in the missing blanks.

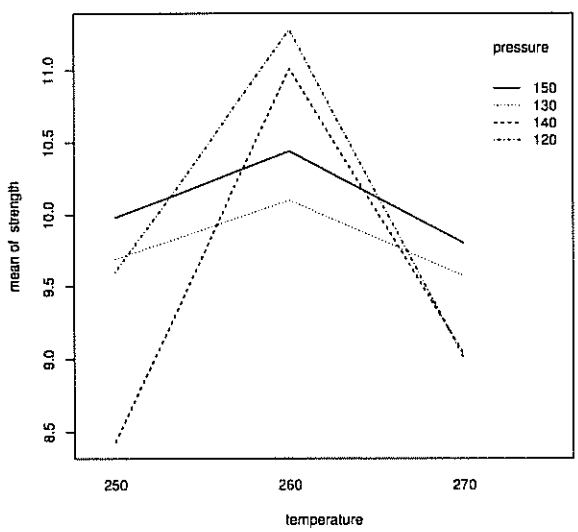
Source	df	SS	MS	F-~~Stat~~
pressure	3	.58		
temperature	2	4.66		
pressure*temperature	6	2.15		No F-test!
Residual	0	0	0	
Total	11			

4. What did you get in the residual row above? Specifically explain why this is an issue.

0 df and 0 SS. With no information to estimate SSE, we cannot do an F-test to test for an interaction effect

5. Below is the interaction plot for these data. How would **you** deal with the issue identified above?

```
with(adhesive, interaction.plot(temperature, pressure,strength))
```



Based on the interaction plot, there is visual evidence of an interaction because the lines aren't parallel. I would ask them to re-do the study with replication so that we could use an interaction model for inference.

6. Below is the additive model, fit with Anova(lm.adhesive). In the temperature row, what distribution does the test statistic follow under the null hypothesis?

T distribution w/ 2 + 6 df

```
## Anova Table (Type II tests)
##
## Response: strength
##             Sum Sq Df F value Pr(>F)
## pressure      0.58  3    0.54  0.673
## temperature   4.66  2    6.49  0.032 *
## Residuals     2.15  6
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7. Interpret the p-value in the temperature row of the Anova above. Refer to the example provided in class.

There is a 3.2% chance of obtaining a difference in averages across the levels of temperature (250, 260, 270) as or more extreme than what we observed if the true mean strengths across temperature are all the same.