STAT 217: Quiz 13

1. Fill in the blanks on this incomplete two way ANOVA table.

Source	Df	Sum Sq	Mean Sq	F-Value	Pr(>F)
supp	1	205	___	12.32	0.00089
dose	__	2224	556	133.42	<2e-16
supp:dose	__	390	___	___	0.02463
Residuals	__	934	___		
Total	19	____			

2. Use the above table to answer the following questions.

   (a) How many levels of the factor 'dose' were there in the study?

   (b) What was the total sample size?

3. Remember this problem last class: suppose a statistics teacher gave an essay final to his class. He randomly divides the classes in half such that half the class writes the final with a blue-book and half with notebook computers. In addition the students are partitioned into three groups, no typing ability, some typing ability, and highly skilled at typing. Answers written in blue-books will be transcribed to word processors and scoring will be done blindly. Not with a blindfold, but the instructor will not know the method or skill level of the student when scoring the final. The dependent measure will be the score on the essay part of the final exam.

   The first factor will be called Method and will have two levels, blue-book and computer. The second factor will be designated as Ability and will have three levels: none, some, and lots. Each subject will be measured a single time.

   Use the following R output to answer these questions.

```
## Anova Table (Type II tests)
##
## Response: y
##           Sum Sq Df F value  Pr(>F)
## ability    300.1  2   15.51 0.00028 ***
## method      34.7  1    3.59 0.07901 .
## Residuals  135.4 14
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4. Interpret the p-value in the ability row in the abova Anova.
   A. After controlling for method, there is about a .028% chance we would observe differences in average scores like we did or more extreme across the three ability levels (None, Some, Lots) if all of the true mean scores were different.
   B. After controlling for method, there is about a .028% chance we would observe differences in average scores like we did or more extreme across the three ability levels (None, Some, Lots) if all of the true mean scores were the same.
   C. After controlling for method, there is about a .028% chance we would observe differences in average scores like we did or more extreme across the three ability levels (None, Some, Lots) if at least one of the true means was different from the rest.
   D. After controlling for method, it is the probability of observing differences in average scores level like we did or more extreme across the three ability levels (None, Some, Lots) is 0.00028.

5. In the 'method' row of the above table, what distribution does the test statistic follow under the null hypothesis?

```
summary(lm.add)


##
## Call:
## lm(formula = y ~ ability + method)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -3.444 -2.431 -0.306  1.194  6.056
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)       22.61       1.47   15.42  3.5e-10 ***
## abilitynone        3.33       1.80    1.86    0.085 .
## abilitysome        9.83       1.80    5.48  8.2e-05 ***
## methodcomputer     2.78       1.47    1.89    0.079 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.11 on 14 degrees of freedom
## Multiple R-squared:  0.712,Adjusted R-squared:  0.65
## F-statistic: 11.5 on 3 and 14 DF,  p-value: 0.000447
```

6. Use the output above to answer the following questions.

   (a) What is the estimated mean score for those people with "some" ability in the blue book group?

(b) What is the estimated mean score for people with no ability in the computer group?

(c) What is the estimated difference in mean scores between computer and blue book groups?

(d) What is the estimated difference in mean scores between the "no ability" and the "some ability" groups?