Psyc 3101, Homework 11

Semantic priming involves presenting a word very briefly (e.g., for 20 ms) before presenting another word that the subject has to identify. The prime word (i.e., the first word) can be identical to the target word (the second word), they can be different but semantically related (e.g., *nurse-doctor*), or they can be unrelated. The primary question in a priming experiment is whether the time it takes the subject to identify the target word is affected by the prime. Here are some data from four subjects in this type of experiment.

	Response Time (ms)			
Subject	Identical	Related	Unrelated	Mean
A	401	394	405	400
B	415	406	427	416
C	419	409	429	419
D	405	371	415	397
Mean	410	395	419	408

1. Calculate the mean for each condition, the mean for each subject, and the grand mean, and write these in the table.

2. Calculate the total sum of squares.
$SS_{total} = (401-408)^2 - (394-408)^2 - \ldots - (415-408)^2 = 2658$

3. Calculate the sum of squares explained by the type of prime.
$SS_{treatment} = 4\cdot(410-408)^2 + 4\cdot(395-408)^2 + 4\cdot(419-408)^2 = 1176$

4. Calculate the sum of squares explained by individual differences.
$SS_{subject} = 3\cdot(400-408)^2 + 3\cdot(416-408)^2 + 3\cdot(419-408)^2 + 3\cdot(397-408)^2 = 1110$

5. Find the residual sum of squares.
$SS_{residual} = 2658 - 1176 - 1110 = 372$

6. Convert the sums of squares from Questions 3-5 to mean squares. The degrees of freedom for the treatment are one less than the number of conditions. The degrees of freedom for $SS_{subject}$ are one less than the number of subjects. The residual degrees of freedom are the product of $df_{treatment}$ and $df_{subject}$.
$MS_{treatment} = 1176/2 = 588$
$MS_{subject} = 1110/3 = 370$
$MS_{residual} = 372/6 = 62$

7. Calculate the F statistic for testing whether the means differ reliably across conditions.
$F = 588/62 = 9.48$

8. The critical value for F (with $\alpha = 5\%$) is 5.14. Write a sentence (about the effect of prime words on recognition of target words, not about hypotheses) describing your conclusion.
Subjects' mean response time to the target differs reliably across different types of primes.

9. Now imagine this was a between-subjects design, meaning we had 12 different subjects, each experiencing only one type of prime. Using only your answers to Questions 2-5, what is the new residual sum of squares?
$SS_{residual} = SS_{total} - SS_{treatment} = 2658 - 1176 = 1482$

10. The residual degrees of freedom are now 9. Find the new values for $MS_{residual}$ and F.
$MS_{residual} = 1482/9 = 164.67$
$F = 588/164.67 = 3.57$

11. The new critical value for F is 4.26. Write a sentence describing what you conclude now.
There is not enough evidence to conclude that subjects' mean response time to the target differs across different types of primes.

1000 people in all 50 states are asked how happy they are, on a scale of 1 to 7. Each person is surveyed in the winter, spring, summer or fall. The following ANOVA table summarizes the results.

Effect	*SS*	*df*	*MS*	*F*	F_{crit}
State	249.41	49	5.09	2.05	1.37
Season	43	3	14.33	5.79	2.62
State:Season	343	147	2.33	0.94	1.22
Residual	1981.59	800	2.48		

12. Fill in the sum of squares explained by State.
$MS_{State} = SS_{State}/df_{State}$
$SS_{State} = MS_{State}*df_{State}$

13. The total sum of squares is 2617. Fill in $SS_{residual}$.
$SS_{residual} = SS_{total} - SS_{State} - SS_{Season} - SS_{State:Season}$

14. Fill in the columns in the table for *MS* and *F*. (Remember there's no *F* for the residual.)

15. Write a sentence describing your conclusion regarding the effect of State on happiness.
Mean happiness differs reliably across states.

16. Write a sentence describing your conclusion regarding the effect of Season on happiness.
Mean happiness differs reliably across seasons.

17. Write a sentence describing your conclusion regarding the interaction between State and Season.
We retain the null hypothesis that effects of season on happiness are the same in every state.