Stat22200 Additional Exercises for Chapter 3 & 4

1. The table below shows the start of an ANOVA table. Fill in the whole table from what is given here. How many groups were there? Is there evidence that the group means are different?

Source	df	Sum of Squares	Mean Squares	F-statistic	P-value
Treatment	?	?	?	?	?
Error	24	35088	?		
Total	31	70907			

2. (**Exercise 3.2**, p.60, Oehlert textbook) An experimenter randomly allocated 125 male turkeys to five treatment groups: control and treatments A, B, C, and D. There were 25 birds in each group, and the mean results were 2.16, 2.45, 2.91, 3.00, and 2.71, respectively. The sum of squares for experimental error was 153.4. Test the null hypothesis that the five group means are the same against the alternative that one or more of the treatments differs from the control.

   Create an ANOVA table based on the information provided and answer the question. Show your work.

   To find the p-value, you can use the R command `pf`

   `1 - pf(F, df1, df2)`,

   where `F` is the value of the F-statistic and `df1` , `df2` are the two degrees of freedom.

3. (**Problem 4.1 on p. 75-76, Revised**) A consumer testing agency obtains **four** cars from each of six makes:

	Make	Domestic	Manufacturer	Expensive	$\overline{y}_{i\bullet}$
1	(Ford)	domestic	Ford	N	4.6
2	(Chevrolet)	domestic	GM	N	4.3
3	(Nissan)	imported	Other	N	4.4
4	(Lincoln)	domestic	Ford	Y	4.7
5	(Cadillac)	domestic	GM	Y	4.8
6	(Mercedes)	imported	Other	Y	6.2

   Make 1 and 4 are Ford products, while 2 and 5 are GM products. We wish to compare the six makes on their oil use per 100,000 miles driven. The mean responses by make of car were 4.6, 4.3, 4.4, 4.7, 4.8, 6.2, and the sum of squares for error (SSE) was 2.25.

   (a) Compute the ANOVA table for this experiment. What would you conclude?

   (b) Make pairwise comparisons of all six makes. (i) Explain why the standard errors of the mean difference between all pairs of makes are all the same. (ii) How large the sample mean difference $\overline{y}_{j\bullet} - \overline{y}_{i\bullet}$ needs to be so that is can be significant at 5% level using a t-test (This is called the "least significant difference (LSD)")? (iii) Identify all the pairs of makes that are significant at 5% level. (v) Finally, create an underline diagram to summarize the result.

   (c) Consider the contrast for comparing the mean oil use of domestic cars and imported cars as follows:

$$C = \frac{\mu_{Ni} + \mu_{Me}}{2} - \frac{\mu_{Fo} + \mu_{Ch} + \mu_{Li} + \mu_{Ca}}{4}.$$

   Give a 95% confidence interval for this contrast.

   (d) Define a contrast for comparing the mean oil use of Ford cars (Ford and Lincoln) versus GM cars (Chevrolet and Cadillac). Test if this contrast is 0 at 5% significance level.