STAT 368 - Assignment 1 - due date is on course outline

1. 2-11 in the text. In (a), use both Bartlett's test and Levene's test.

2. 2-17.

3. 3-7. For (c), you should (i) look at the 4 individual qq-plots, (ii) look at boxplots of the data before and after doing a square root transformation (a square root transformation is often recommended for count data), (iii) carry out a nonparametric test of the hypothesis in (a) (using the untransformed data). Comment on whatever you find.

4. 3-16. (a), (b), (d) (Read §3-5.5 before attempting this part. Standardize the contrasts.), (e), (f) and

   (c) Consider 99% individual confidence intervals on $\mu_1-\mu_2$, $\mu_2-\mu_3$ and $\mu_1-\mu_3$. How large does $|\bar{y}_{i.}-\bar{y}_{j.}|$ have to be, in order that $\mu_i-\mu_j$ be declared significantly different from 0? This is known as the 'Least Significant Difference' (LSD), and a comparison of means done in this manner is known as 'Fisher's LSD' procedure. Which of the three differences do you declare to be significant, using this procedure? What can you say about the experimentwise error rate? (Give an upper bound on it.) What is the experimentwise error rate in (b)?

5. In the balanced one way model with n observations per treatment and

$$y_{ij}=\mu\ +\tau_i+\epsilon_{ij} \text{ with } \sum_{i=1}^{a}\tau_i=0,$$

   show that

$$E\left[MS_{Tr}\right]=\sigma^2+\frac{n\sum_{i=1}^{a}\tau_i^2}{a-1}.$$

   (Hint: first show that $\hat{\tau}_i=\tau_i+(\bar{\epsilon}_{i.}-\bar{\epsilon}_{..})$, and that $\frac{\sum_{i=1}^{a}(\bar{\epsilon}_{i.}-\bar{\epsilon}_{..})^2}{a-1}$ is the sample variance of $\bar{\epsilon}_{1.},...,\bar{\epsilon}_{a.}\overset{ind}{\sim}N(0,\sigma^2/n)$, hence is an unbiased estimate of ... .)

6. In a one way ANOVA, with unbalanced treatment groups of sizes $n_1,...,n_a$, show that

$$MS_E=\frac{\sum_{i=1}^{a}(n_i-1)S_i^2}{N-a},$$

   where S_i^2 is the sample variance of the observations in the ith group. What familiar quantity, when there are only two treatments, is generalized by this mean square? Simplify MS_{Tr} as well to show that when there are only two treatments we have $F_0=t_0^2$, where t_0 is the t-statistic used to test the equality of means when the variances are equal.