PubH 7401: Elements of Biostatistical Inference I
Homework 9 (Final Exam), due December 9.

Be sure to define any population parameters in your writeup. Be clear in your writing and include relevant plots and tables.

1. Chapter 12, problem 26 (p. 510). This is a randomized block design. Just do a parametric analysis using `aov()`. Be sure to look at a histogram of the residuals and comment. Perform the three pairwise comparisons using Tukey's procedure.

2. Chapter 12, problem 30 (p. 511). This is a randomized block design.

3. **Reanalysis of insecticide data**. Instead of using the survival time Y_{ijk} (in hours, divided by 10), **use the reciprocal** rate $R_{ijk} = 1/Y_{ijk}$. Obviously, higher "death rates" are better.

   (a) Obtain an interaction plot; are the mean profiles approximately parallel?

   (b) Fit the model with main effects and interaction; formally test that the interaction is zero at the 10% level.

   (c) Fit the additive model. Obtain Tukey 95% CI's for comparing the three doses with an overall FER$\leq$ 0.05. Are there significant differences in death rates across doses? Are there significant differences among insecticide types? Group the insecticides according to the results of the pairwise comparisons. Are there pairs that are not significantly different? Which insecticide has the best "death rate?"

   (d) Check the additive modeling assumptions: (a) look at the residuals r_{ijk} versus fitted values $\widehat{E(R_{ijk})}$; (b) look at a histogram of the residuals r_{ijk}; (c) look at the spread of the residuals versus both `type` and `dose`. The `R` code for these might look something like:

```
d=read.table("http://www.biostat.umn.edu/~hanson/FundBiostat/insect.txt",header=F)
dose=factor(d[,1]); type=factor(d[,2]); time=d[,3]; rate=1/time
fit=aov(rate~dose+type+dose*type); summary(fit)
interaction.plot(rate,dose,type)
fit=aov(rate~dose+type); summary(fit)
TukeyHSD(fit)
plot(fit$fit,fit$res)
hist(fit$res)
plot(type,fit$res)
plot(dose,fit$res)
```