

## Homework 3

Answer the following questions using: R.

Submitted homework solutions should be well written and should include all R code and R output. R Markdown is a useful tool for doing this nicely.

1. The data in the table are dry matter content (in kilograms) of hay obtained from experimental plots. The experiment was designed as a randomized complete block, and the treatments are three cutting dates.

```
dat<-data.frame(kg=c(1.5,2.1,1.9,2.8,1.4,1.8,
                    1.8,2.0,2.0,2.7,1.6,2.3,
                    1.9,2.5,2.5,2.6,2.1,2.4),
               date=factor(rep(c("Sept 1","Sept 15","Sept30"),each=6)),
               block=factor(rep(1:6,3)))
dat
```

##	kg	date	block
## 1	1.5	Sept 1	1
## 2	2.1	Sept 1	2
## 3	1.9	Sept 1	3
## 4	2.8	Sept 1	4
## 5	1.4	Sept 1	5
## 6	1.8	Sept 1	6
## 7	1.8	Sept 15	1
## 8	2.0	Sept 15	2
## 9	2.0	Sept 15	3
## 10	2.7	Sept 15	4
## 11	1.6	Sept 15	5
## 12	2.3	Sept 15	6
## 13	1.9	Sept30	1
## 14	2.5	Sept30	2
## 15	2.5	Sept30	3
## 16	2.6	Sept30	4
## 17	2.1	Sept30	5
## 18	2.4	Sept30	6

- (a) Test for differences among cutting dates using a permutation test for a randomized complete block design.
- (b) Apply Friedman's test to the data from the previous problem.
- (c) Analyze using ANOVA for a randomized complete block and compare with the previous answers.
- (d) Perform multiple comparisons to test for significant differences between pairs of groups using Tukey's HSD procedure.

2. From book: Page 301, Problem 1.
3. From book: Page 301, Problem 3.
4. (GRAD ONLY) From book: Page 302, Problem 7.
5. (GRAD ONLY) Generate the permutation distribution for Spearman's  $r_s$  and Kendall's  $\tau$  based on the following data:

```
height<-c(68,70,74)
weight<-c(145,155,160)
```

6. The data below are ages (in days) of concrete cylinders and the compressive strengths of the cylinders.

```
age<-c(3,7,15,24,85,180,360)
strength<-c(2500,3200,4300,5300,5900,6700,6900)
```

- (a) Plot the data to show a non-linear relationship. Compute Pearson's correlation, Spearman's correlation, and Kendall's  $\tau$ .
- (b) (**UNDERGRAD ONLY**) Test for significant association using the Spearman correlation from the previous part.
- (c) (GRAD ONLY) Test for significant association using each of the measures from the previous part.