

ANOVA Handout – STAT 509 – Fall 2011

For all these problems, show fully how you got your answers!

1. Four tire brands (A, B, C, D) were tested to see whether they differed in terms of mean tread life (measured in thousands of miles). The data gathered for 14 total measurements are as follows:

```
brand <- c('A', 'A', 'A', 'B', 'B', 'B', 'C', 'C', 'C', 'C', 'D', 'D', 'D', 'D')
life <- c(53.0, 49.2, 49.6, 52.5, 52.1, 51.9, 51.2, 51.7, 47.8, 49.1, 50.9, 50.1, 50.1, 55.2)
```

(a) Using the formulas or (preferably) using R, fill in an ANOVA table with the appropriate numerical values.

(b) Test whether the population mean tread life is equal for the three brands, using $\alpha = 0.10$.

2. Consider problem 4.47 in the book. Suppose that in addition to the WC and Steel samples, we had a third (independent) sample of Iron measurements with the following data values: 631, 527, 723, 593. Suppose we wish to determine whether the population mean peak temperature is equal for the three materials.

(a) Using the formulas or (preferably) using R, fill in an ANOVA table with the appropriate numerical values.

(b) Test whether the population mean peak temperature is equal for the three materials, using $\alpha = 0.05$.

(c) Interpret the following R output from Tukey's multiple comparisons procedure. What can you conclude about the pairwise differences in mean peak temperatures for the three materials?

```
Tukey multiple comparisons of means
 95% family-wise confidence level
Fit: aov(formula = lm(temp ~ mat))
      diff      lwr      upr      p adj
s-i 193.25  38.40377 348.09623 0.0170850
w-i 118.50 -36.34623 273.34623 0.1370324
w-s -74.75 -229.59623  80.09623 0.4060791
```

3. In an experiment, TV viewers were asked to watch one of three types of program (Violent, Sexual, Neutral) along with advertising commercials. They were then tested on their recall of the commercials. The question of interest was whether the mean recall score was the same across the three types of show. The following (partial) ANOVA table was obtained:

Source	df	SS	MS	F
Treatments	2		61.63	
Error	321	967.35		
Total	323	1090.62		

(a) Fill in the rest of the ANOVA table.

(b) Find the value of the F-statistic for the ANOVA F-test here. Show your work.

(c) Using $\alpha = 0.05$, what is your conclusion about the mean recall scores for the three groups, based on this F-statistic and an appropriate table value?

Selected Answers: (1) b) F = 0.9309 (2) b) F = 6.1744 (3) a) SST = 123.26, MSE = 3.01