

Tutorial 7

1. A researcher conducted a study with $n = 15$ participants to investigate strength gains from exercise. The participants were divided into three groups and given one of three treatments. Participants' strength gains were measured. The measurements are presented in the following table:

Treatment	I	II	III
Ranks:	7	13	12
	2	1	5
	4	7	16
	11	8	9
	15	3	14

Use a Kruskal-Wallis test with $\alpha = 0.05$ to determine if one or more of the groups are significantly different.

2. An experiment to compare the retention of two different forms of iron was performed as follows: 108 subjects were randomly divided into 6 groups of 18 each. 3 groups were given Fe^{3+} in 3 different concentrations, 10.2, 1.2 and 0.3 millimolar, and the other 3 groups were given Fe^{2+} at the same concentrations. The percentage of the iron retained (after a certain time) was measured for each subject. The average for each group is given in the 3×2 table below:

	Fe^{3+}	Fe^{2+}
10.2	3.7	5.9
1.2	8.2	9.6
0.3	11.7	12.6

- (a) Write out a formula for an additive decomposition.
- (b) Compute an additive decomposition using medians starting with a column sweep.

Computer Exercise 7

Suppose we want to compare fuel economy obtained by 3 different types of automobiles and by 6 different types of drivers. In particular, we are interested in the effect of driver age, so the drivers are divided into age classes: 1 (25 and under); 2 (26-35); 3 (36-45); 4 (46-55); 5 (56-65); 6 (Over 65). The following table gives the results of the experiment with fuel efficiency measured in mpg (miles per gallon):

Driver	C1	C2	C3
1	25.1	23.9	26
2	24.7	23.7	25.4
3	26	24.4	25.8
4	24.3	23.3	24.4
5	23.9	23.6	24.2
6	24.2	24.5	25.4

(a) Enter the data into R. You may use the command:

```
mpg = read.table(file = url("http://www.maths.usyd.edu.au/stat2912/r/mpg.txt"))
```

- (b) Obtain estimates of all the parameters in a two-way layout decomposition using means. Which age group had the most significant effect on fuel efficiency?
- (c) Obtain the residual matrix after fitting the means and plot the residuals vs. the fitted values.
- (d) Repeat part (b), but now fit medians. Use the built-in command `medpolish`.
- (e) Repeat part (d) by calculating the first two step of the `medpolish` command “manually”. At each iteration check that the sum of the absolute values of the residuals is as reported by R.
- (f) Obtain the residual matrix after fitting the medians and plot the residuals vs. the fitted values.