

Math 3080 § 1.  
Treibergs

Chrysanthemum Data:  
Single Factor ANOVA

Name: Example  
March 15, 2010

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Data File Used in this Analysis:

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```
# Math 3080 - 1      Chrysanthemum Data      March 15, 2010
# Treibergs
#
# From Walpole, Myers, Myers, Ye " Probability and Statistics for Engineers
# and Scientists, 7th ed" & Sci 7th ed"
# From a study "Effect of Magnesium Ammonium Sulphate on the Height of
# Chrysathemums." Different amounts of fertilizer applied to 10 plants
# each. Y = change in heights (cm) in four weeks
# Treatments are conc MgNH4Po4 in (g/bu)
#
"Treatment" "Height-Change"
50 1.320000000E+01
50 1.240000000E+01
50 1.280000000E+01
50 1.720000000E+01
50 1.300000000E+01
50 1.400000000E+01
50 1.420000000E+01
50 2.160000000E+01
50 1.500000000E+01
50 2.000000000E+01
100 1.600000000E+01
100 1.260000000E+01
100 1.480000000E+01
100 1.300000000E+01
100 1.400000000E+01
100 2.360000000E+01
100 1.400000000E+01
100 1.700000000E+01
100 2.220000000E+01
100 2.440000000E+01
200 7.800000000E+00
200 1.440000000E+01
200 2.000000000E+01
200 1.580000000E+01
200 1.700000000E+01
200 2.700000000E+01
200 1.960000000E+01
200 1.800000000E+01
200 2.020000000E+01
200 2.320000000E+01
400 2.100000000E+01
400 1.480000000E+01
400 1.910000000E+01
400 1.580000000E+01
400 1.800000000E+01
400 2.600000000E+01
```

```
400 2.110000000E+01
400 2.200000000E+01
400 2.500000000E+01
400 1.820000000E+01
```

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**R Session:**

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R version 2.10.1 (2009-12-14)  
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Natural language support but running in an English locale

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[R.app GUI 1.31 (5537) powerpc-apple-darwin9.8.0]

```
> tt <- read.table("M3081DataChrysanthemum.txt", header=TRUE)
> tt
```

	Treatment	Height.Change
1	50	13.2
2	50	12.4
3	50	12.8
4	50	17.2
5	50	13.0
6	50	14.0
7	50	14.2
8	50	21.6
9	50	15.0
10	50	20.0
11	100	16.0
12	100	12.6
13	100	14.8
14	100	13.0
15	100	14.0
16	100	23.6
17	100	14.0
18	100	17.0
19	100	22.2
20	100	24.4

```

21      200          7.8
22      200         14.4
23      200         20.0
24      200         15.8
25      200         17.0
26      200         27.0
27      200         19.6
28      200         18.0
29      200         20.2
30      200         23.2
31      400         21.0
32      400         14.8
33      400         19.1
34      400         15.8
35      400         18.0
36      400         26.0
37      400         21.1
38      400         22.0
39      400         25.0
40      400         18.2
> attach(tt)
> tapply(Height.Change,Treatment,summary)
$`50`
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
12.40  13.05   14.10   15.34  16.65   21.60

$`100`
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
12.60  14.00   15.40   17.16  20.90   24.40

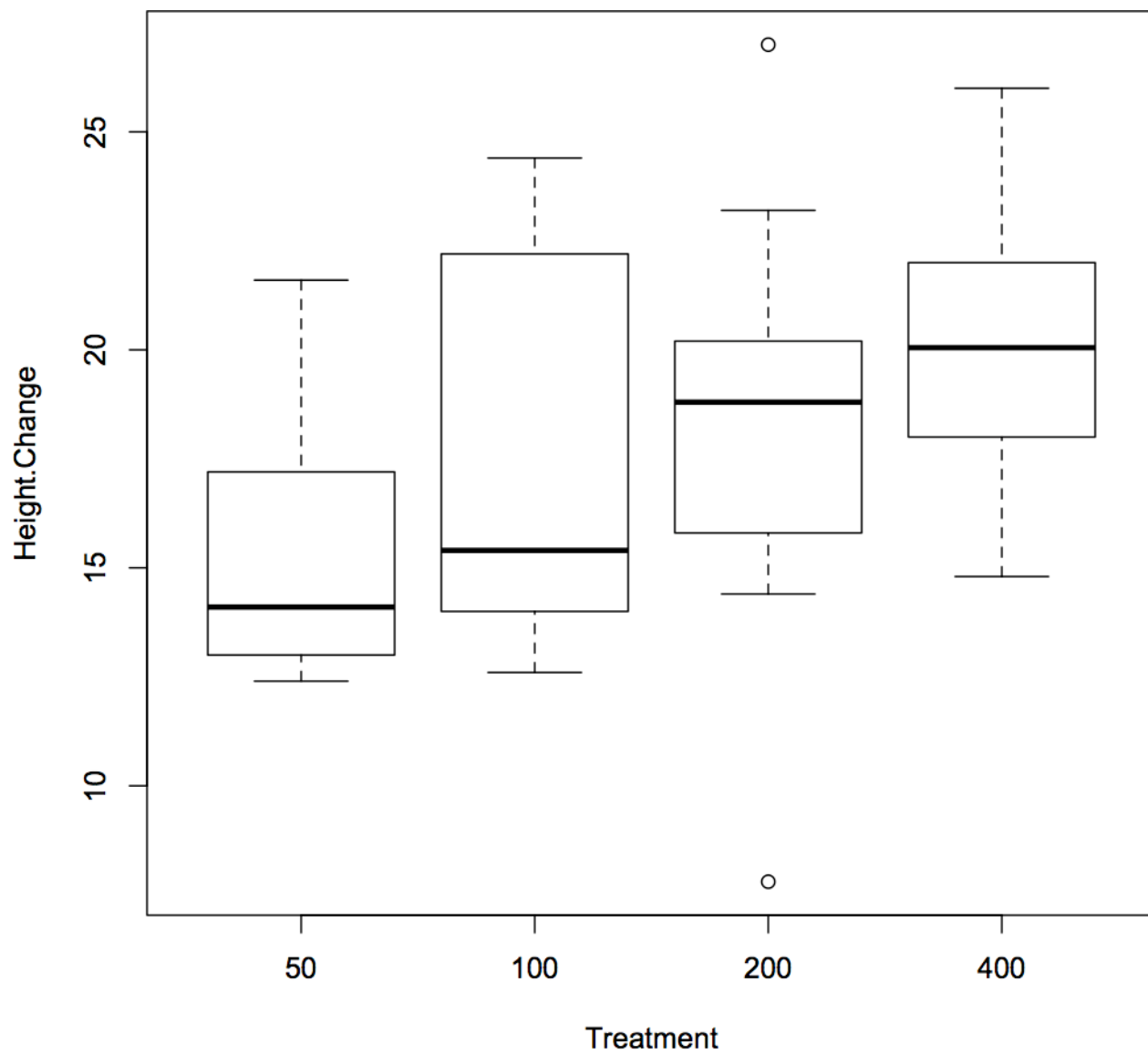
$`200`
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 7.80  16.10   18.80   18.30  20.15   27.00

$`400`
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
14.80  18.05   20.05   20.10  21.78   26.00

>#=====MAKE treatmnt AN ORDERED FACTOR=====
> treatmnt <- ordered(Treatment)

>#=====MAKE BOXPLOT=====
> plot(Height.Change~treatmnt,xlab="Treatment")

```



```

>#=====RUN ANALYSIS OF VARIANCE=====
> f1 <- aov(Height.Change ~ treatmnt);summary(f1)

          Df Sum Sq Mean Sq F value Pr(>F)
treatmnt   3  119.79   39.929   2.2522 0.09893 .
Residuals 36  638.25   17.729
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>#=====USUAL DIAGNOSTIC PLOTS=====
> layout(matrix(1:4,ncol=2))

> intr <- 1+log(Treatment/50)/log(2)
> plot(intr,rstudent(f1), ylab="Student. Resid.", xlab="Treatment", xaxt="n",
      ylim=max(abs(rstudent(f1)))*c(-1,1))
> abline(h=c(0,-2,2),lty=c(2,3,3))
> axis(1,1:4,c(50,100,200,400))

> plot(rstudent(f1)~fitted(f1), xlab="Predicted Height Change", ylab="Student. Resid.",
      ylim=max(abs(rstudent(f1)))*c(-1,1))
> abline(h=c(0,-2,2),lty=c(2,3,3))

> plot(fitted(f1)~Height.Change,ylab="Predicted Height Change",xlab="Observed Height Change")
> abline(0,1,lty=2)

> qqnorm(rstudent(f1),ylab="Student. Resid")
> abline(0,1,lty=4)

>#=====SHAPIRO-WILK TEST FOR NORMALITY=====
> shapiro.test(rstudent(f1))

Shapiro-Wilk normality test

data:  rstudent(f1)
W = 0.9561, p-value = 0.1234

>

```

