Plotting means from an ANOVA

Module 6 Plotting

18 June 2016

Looking at a simple one way completely randomised ANOVA design getting output and looking at the mean separation. Using library(lattice),

Melon yield data from Mead and Curnow ONE Way ANOVA

```
melon <- read.csv("~/00ACIAR_Online/Module6/melon.csv")
# View(melon)


head(melon)  ## shows the data
```

```
##   Group Yield
## 1     A 25.12
## 2     A 17.25
## 3     A 26.42
## 4     A 16.08
## 5     A 22.15
## 6     A 15.92
```

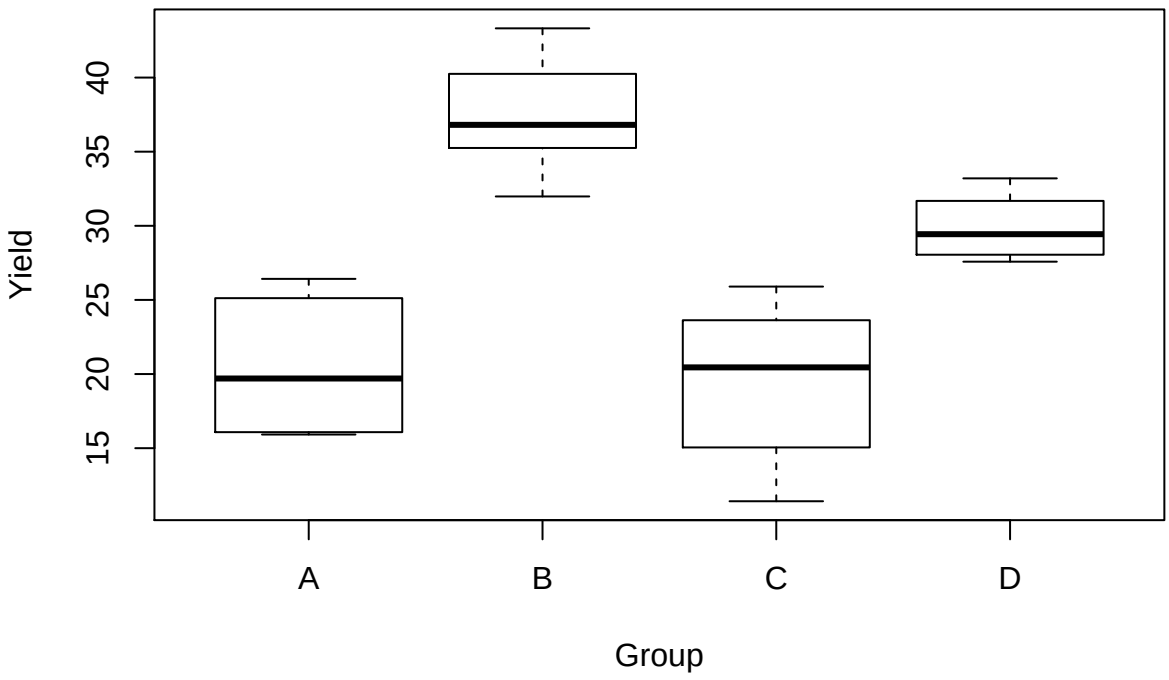
```
#str(melon)   ## not run; gives the data structure
## Show there is a Factor in the data
```

The data consists of two columns, one is a category (the group)

```
names(melon)
```

```
## [1] "Group" "Yield"
```

```
plot(melon)  ## Boxplot
```




```
melon.mod1  <-  lm(Yield ~ Group, data=melon)  ## set up model


####   print coefficients from the model
melon.mod1
```

```
##
## Call:
## lm(formula = Yield ~ Group, data = melon)
##
## Coefficients:
## (Intercept)       GroupB       GroupC       GroupD
##      20.490       16.913       -1.007        9.407
```

```
aov(melon.mod1)
```

```
## Call:
##    aov(formula = melon.mod1)
##
## Terms:
##                     Group Residuals
## Sum of Squares  1292.2103  367.2364
## Deg. of Freedom         3        20
##
## Residual standard error: 4.285069
## Estimated effects may be unbalanced
```

```
summary(melon.mod1)
```

```
##
## Call:
## lm(formula = Yield ~ Group, data = melon)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.0633 -2.5475 -0.5933  3.1633  6.4167
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   20.490      1.749  11.713 2.08e-10 ***
## GroupB        16.913      2.474   6.836 1.21e-06 ***
## GroupC        -1.007      2.474  -0.407  0.68840
## GroupD         9.407      2.474   3.802  0.00112 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.285 on 20 degrees of freedom
## Multiple R-squared:  0.7787, Adjusted R-squared:  0.7455
## F-statistic: 23.46 on 3 and 20 DF,  p-value: 9.316e-07
```

```
replications(Yield ~ Group, data=melon)
```

```
## Group
##     6
```

```
## A test for balance:

!is.list(replications(Yield ~ Group, data=melon))
```

```
## [1] TRUE
```

```
melon.aov  <-  aov(melon.mod1)  ## make a melon anova object
melon.aov
```

```
## Call:
##    aov(formula = melon.mod1)
##
## Terms:
##                     Group Residuals
## Sum of Squares  1292.2103  367.2364
## Deg. of Freedom         3        20
##
## Residual standard error: 4.285069
## Estimated effects may be unbalanced
```

```
summary(melon.aov)
```

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## Group        3 1292.2   430.7   23.46 9.32e-07 ***
## Residuals   20  367.2    18.4
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

We can also get the least significant difference using a function from agricolae

```
## Warning: package 'agricolae' was built under R version 3.2.5
```

```
## $statistics
##       Mean       CV  MSerror
##   26.81833 15.97813 18.36182
##
## $parameters
##   Df ntr  t.value alpha       test name.t
##   20   4 2.085963  0.05 Fisher-LSD  Group
##
## $means
##      Yield      std r      LCL      UCL   Min   Max
## A 20.49000 4.694422 6 16.84087 24.13913 15.92 26.42
## B 37.40333 3.950497 6 33.75421 41.05246 31.98 43.32
## C 19.48333 5.552551 6 15.83421 23.13246 11.42 25.90
## D 29.89667 2.229894 6 26.24754 33.54579 27.58 33.20
##
## $comparison
##       Difference pvalue sig.        LCL        UCL
## A - B -16.913333 0.0000  *** -22.073978 -11.752689
## A - C   1.006667 0.6884       -4.153978   6.167311
## A - D  -9.406667 0.0011   ** -14.567311  -4.246022
## B - C  17.920000 0.0000  ***  12.759356  23.080644
## B - D   7.506667 0.0066   **   2.346022  12.667311
## C - D -10.413333 0.0004  *** -15.573978  -5.252689
##
## $groups
## NULL
```

```
##       Difference pvalue sig.        LCL        UCL
## A - B -16.913333 0.0000  *** -22.073978 -11.752689
## A - C   1.006667 0.6884       -4.153978   6.167311
## A - D  -9.406667 0.0011   ** -14.567311  -4.246022
## B - C  17.920000 0.0000  ***  12.759356  23.080644
## B - D   7.506667 0.0066   **   2.346022  12.667311
## C - D -10.413333 0.0004  *** -15.573978  -5.252689
```

```
## Tables of means
## Grand mean
##
## 26.81833
##
##  Group
## Group
##     A     B     C     D
```

```
## 20.49 37.40 19.48 29.90
##
## Standard errors for differences of means
##         Group
##         2.474
## replic.     6

## Tables of effects
##
##  Group
## Group
##      A      B      C      D
## -6.328 10.585 -7.335  3.078
```

The following from the multicomp library gives the pairwise comparisons using Tukeys

```
library(multcomp)
```

```
## Warning: package 'multcomp' was built under R version 3.2.5
```

```
TestPairsT <- glht(melon.aov, linfct = mcp(Group = "Tukey"))
summary(TestPairsT) # pairwise tests
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: Tukey Contrasts
##
##
## Fit: aov(formula = melon.mod1)
##
## Linear Hypotheses:
##            Estimate Std. Error t value Pr(>|t|)
## B - A == 0   16.913      2.474   6.836  < 0.001 ***
## C - A == 0   -1.007      2.474  -0.407  0.97661
## D - A == 0    9.407      2.474   3.802  0.00579 **
## C - B == 0  -17.920      2.474  -7.243  < 0.001 ***
## D - B == 0   -7.507      2.474  -3.034  0.03067 *
## D - C == 0   10.413      2.474   4.209  0.00221 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```