

In Class 9/21

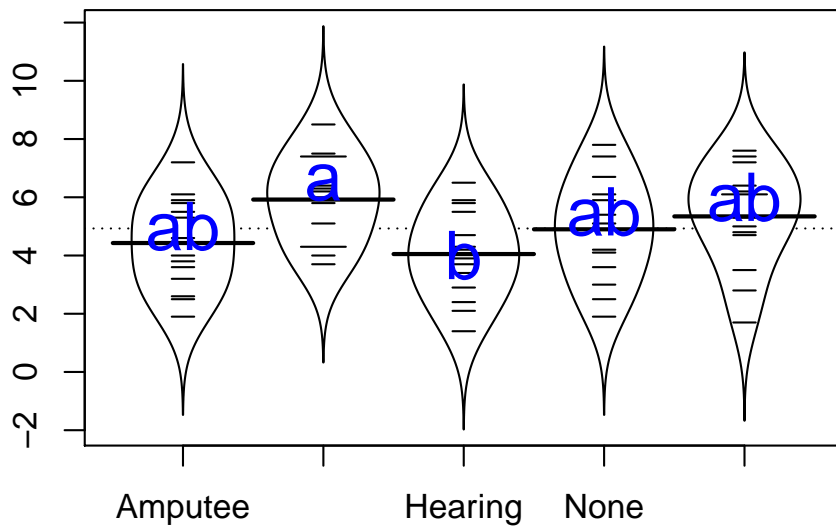
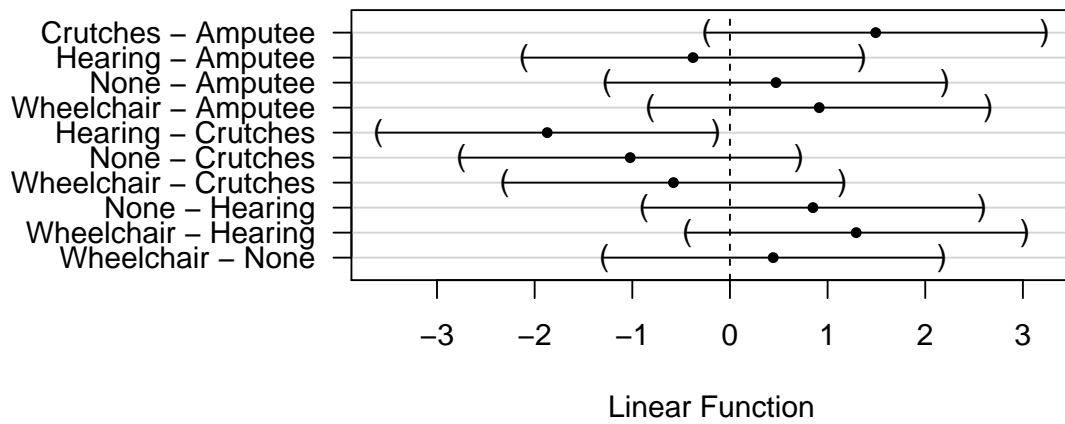
```
lm.hand <- lm(Score~Handicap, data=handicap.data)
anova(lm.hand)
```

```
## Analysis of Variance Table
##
## Response: Score
##           Df Sum Sq Mean Sq F value Pr(>F)
## Handicap   4   30.5    7.63    2.86  0.03
## Residuals 65  173.3    2.67
```

```
require(multcomp)
cis <- glht(lm.hand, linfct=mcp(Handicap = "Tukey"))
confint(cis)

##
## Simultaneous Confidence Intervals
##
## Multiple Comparisons of Means: Tukey Contrasts
##
##
## Fit: lm(formula = Score ~ Handicap, data = handicap.data)
##
## Quantile = 2.81
## 95% family-wise confidence level
##
##
## Linear Hypotheses:
##           Estimate lwr      upr
## Crutches - Amputee == 0    1.493 -0.239  3.225
## Hearing - Amputee == 0    -0.379 -2.110  1.353
## None - Amputee == 0      0.471 -1.260  2.203
## Wheelchair - Amputee == 0  0.914 -0.817  2.646
## Hearing - Crutches == 0   -1.871 -3.603 -0.140
## None - Crutches == 0    -1.021 -2.753  0.710
## Wheelchair - Crutches == 0 -0.579 -2.310  1.153
## None - Hearing == 0       0.850 -0.882  2.582
## Wheelchair - Hearing == 0  1.293 -0.439  3.025
## Wheelchair - None == 0    0.443 -1.289  2.175
```

95% family-wise confidence level



What happens if we do not use a multiple comparison procedure? The true mean for each group is 10. Check to make sure all intervals contain 10.

```
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  9.851036 11.23042
groups2 10.451670 11.83106
groups3  9.696693 11.07608
groups4  9.273430 10.65282
groups5  9.307122 10.68651
groups6  9.958090 11.33748
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  9.547166 11.53429
groups2 10.147800 12.13493
groups3  9.392823 11.37995
groups4  8.969559 10.95669
groups5  9.003252 10.99038
groups6  9.654220 11.64135
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  8.669845 10.07130
groups2  9.436318 10.83777
groups3  9.387577 10.78903
groups4  9.778291 11.17974
groups5  8.923070 10.32452
groups6  9.518390 10.91984
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  8.361115 10.38003
groups2  9.127588 11.14650
groups3  9.078847 11.09776
groups4  9.469561 11.48847
groups5  8.614340 10.63325
groups6  9.209660 11.22857
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  9.568830 11.20051
groups2  8.767659 10.39934
groups3  8.846529 10.47821
groups4  9.374585 11.00626
groups5  8.433931 10.06561
groups6  9.079746 10.71142
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  9.209383 11.55995
groups2  8.408212 10.75878
groups3  8.487081 10.83765
groups4  9.015138 11.36571
groups5  8.074484 10.42505
groups6  8.720298 11.07087
```

```
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  8.489713  9.849643
groups2  9.313334 10.673263
groups3  9.241750 10.601680
groups4  9.530464 10.890394
groups5  9.630912 10.990842
groups6  9.325270 10.685200
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  8.190129 10.14923
groups2  9.013750 10.97285
groups3  8.942167 10.90126
groups4  9.230881 11.18998
groups5  9.331329 11.29043
groups6  9.025687 10.98478
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  9.107038 10.469915
groups2  8.529224  9.892102
groups3  8.944100 10.306978
groups4  9.274045 10.636923
groups5  9.384647 10.747525
groups6  8.740045 10.102923
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  8.806805 10.77015
groups2  8.228991 10.19233
groups3  8.643867 10.60721
groups4  8.973813 10.93716
groups5  9.084414 11.04776
groups6  8.439812 10.40316
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1  9.096457 10.45892
groups2  9.680775 11.04323
groups3  9.280952 10.64341
groups4  9.679842 11.04230
groups5  9.698998 11.06146
groups6  9.134102 10.49656
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1  8.796316 10.75906
groups2  9.380634 11.34337
groups3  8.980811 10.94355
groups4  9.379701 11.34244
groups5  9.398858 11.36160
groups6  8.833961 10.79670
```

```

[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1 9.397737 10.74781
groups2 9.589944 10.94001
groups3 9.042246 10.39231
groups4 9.685154 11.03522
groups5 9.689151 11.03922
groups6 9.111298 10.46137
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1 9.100326 11.04522
groups2 9.292533 11.23742
groups3 8.744835 10.68972
groups4 9.387743 11.33263
groups5 9.391740 11.33663
groups6 8.813887 10.75878
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1 9.498772 10.86402
groups2 9.839157 11.20440
groups3 10.036568 11.40181
groups4 9.598272 10.96352
groups5 9.101405 10.46665
groups6 9.239984 10.60523
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1 9.198018 11.16477
groups2 9.538403 11.50516
groups3 9.735813 11.70257
groups4 9.297517 11.26427
groups5 8.800650 10.76741
groups6 8.939230 10.90598
[1] "INDIVIDUAL-WISE INTERVAL"

```

```

      2.5 %   97.5 %
groups1 9.755545 11.13594
groups2 9.129836 10.51024
groups3 9.792264 11.17266
groups4 9.093313 10.47371
groups5 9.363684 10.74408
groups6 9.715636 11.09604
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1 9.451452 11.44004
groups2 8.825743 10.81433
groups3 9.488171 11.47676
groups4 8.789220 10.77781
groups5 9.059591 11.04818
groups6 9.411543 11.40013
[1] "INDIVIDUAL-WISE INTERVAL"
      2.5 %   97.5 %
groups1 9.907651 11.37240
groups2 9.086596 10.55135
groups3 9.551744 11.01650
groups4 10.184976 11.64973
groups5 9.296932 10.76168
groups6 9.051486 10.51624
[1] "FAMILYWISE INTERVAL"
      0.25 %   99.75 %
groups1 9.584976 11.69508
groups2 8.763921 10.87402
groups3 9.229069 11.33917
groups4 9.862301 11.97240
groups5 8.974257 11.08436
groups6 8.728811 10.83891

```