A17

Extra credit module 17

ANOVA (analysis of variance)

Stat 251

Instructions:
Only upload in BbLearn. Follow directions on Assignments link on class website for BbLearn submissions.

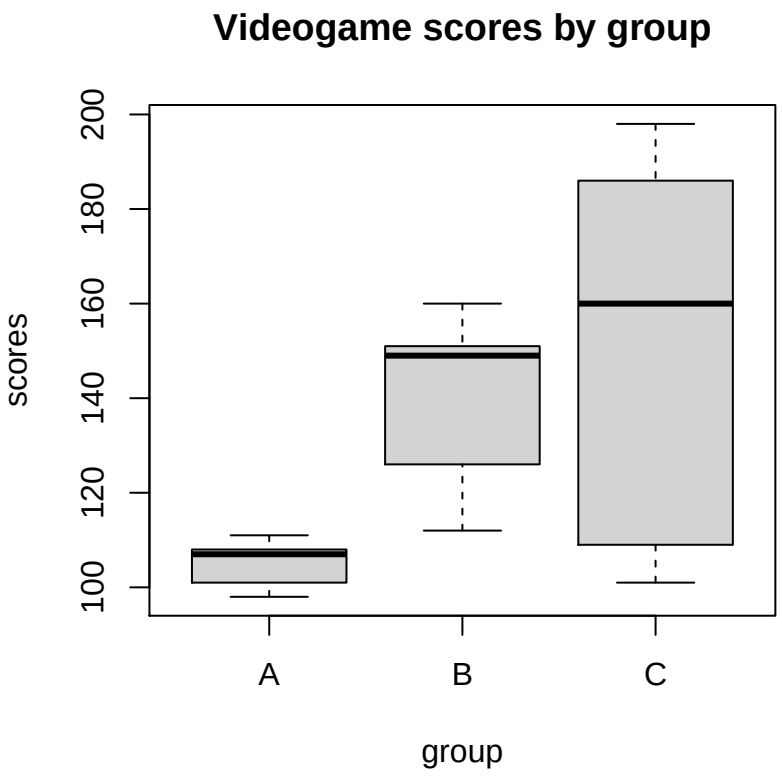
This assignment is worth up to 3.5 points **if and only if you complete ALL problems**

(1) State the assumptions of ANOVA as from the lecture notes

(2) A video game developer is testing a new game on three different groups. Each group represents a different target market for the game. The developer collects scores from a random sample from each group.

   (a) Complete an ANOVA table using the values given below, including the group means, group standard deviations, group samples sizes, and grand mean
   (b) State the hypotheses for this dataset

```
boxplot(scores~group,data=videogame,main='Videogame scores by group')
```



```
gaming
```

```
  means   vars       sds ns
A 105.0   28.5  5.338539  5
B 139.6  395.3 19.882153  5
C 150.8 1944.7 44.098753  5
```

```
grandmean
```

```
[1] 131.8
```

(3) An experiment was conducted to see how differing levels of tension on yarn during weaving affects the number of breaks. The dataset gives the number of warp breaks per loom, where a loom corresponds to a fixed length of yarn. Lengths of yarn were randomly assigned to one of three tension levels: H (high), M (medium), and L (low), with each tension level having eighteen lengths of yarn. Is there sufficient evidence the breaks differ by tension levels?

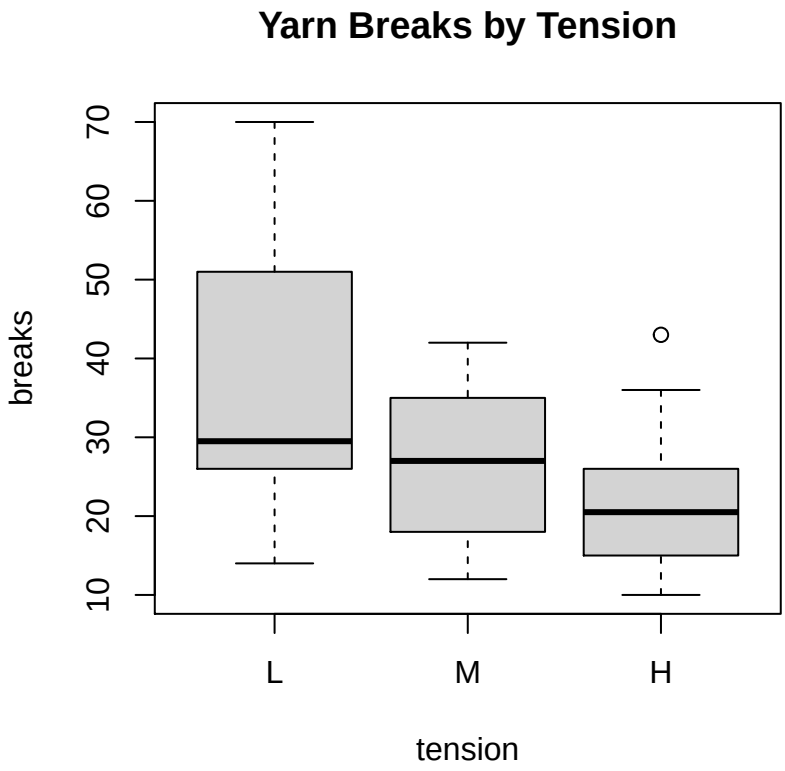
(a) State hypotheses of ANOVA for the breaks by tension level

(b) State F statistic, *pvalue*, results of the test, and conclusion in context

(c) Based on your ANOVA test, is it appropriate to conduct a multiple comparison test, specifically Tukey's test? Breifly explain why.

(d) If appropriate, conduct Tukey's HSD test with the provided output. State which levels are or are not different. Is there a tension level that is the lowest?

```
boxplot(breaks~tension,data=yarn,main='Yarn Breaks by Tension')
```




```
anova(fit)
```

```
Analysis of Variance Table

Response: breaks
```

```
          Df Sum Sq Mean Sq F value   Pr(>F)
tension    2 2034.3 1017.13  7.2061 0.001753 **
Residuals 51 7198.6  141.15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
HSD.test(fit2,'tension',group=T,console=T)
```

```
Study: fit2 ~ "tension"

HSD Test for breaks

Mean Square Error:  141.1481

tension,  means

    breaks       std  r Min Max
H 21.66667  8.352527 18  10  43
L 36.38889 16.446487 18  14  70
M 26.38889  9.121009 18  12  42

Alpha: 0.05 ; DF Error: 51
Critical Value of Studentized Range: 3.413883

Minimun Significant Difference: 9.559824

Treatments with the same letter are not significantly different.

    breaks groups
L 36.38889      a
M 26.38889      b
H 21.66667      b
```