

STAT 220: Basic Statistics for Quantitative Students

Spring 2006

Assignment due Apr. 21

- 16.1** a. Appropriate. The response variable is quantitative and this is a comparison of independent groups.
b. Not appropriate. The response variable is categorical.
c. Appropriate. The response variable is quantitative and this is a comparison of independent groups.
d. Not appropriate. It's not a comparison of independent groups. There was only one group and all individuals listened to all five songs.
- 16.7** a. The null hypothesis is that the mean ideal number of children is the same for all age groups. There are four age groups so this is written using notation as $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$. The alternative hypothesis is that the mean ideal number of children is not the same for all age groups. This can be written as H_a : not all μ_i are the same. The samples represent the populations of all people in these age groups in the United States.
b. $F = 10.91$ and the p -value is given as 0.000. Because the p -value is so small the null hypothesis can be rejected. So, the conclusion is that the population means are not all the same.
c. The confidence interval for the fourth age group (60+) mean does not overlap with the confidence intervals for the other age group means. That information, combined with the fact that the null hypothesis of equal means was rejected, makes it reasonable to conclude that this age group is significantly different from the others. The first three age groups do not appear to have significantly different means.
d. The sample standard deviations given for the four groups are similar so the assumption seems reasonable. Notice that the smallest standard deviation is 0.7409 (group 2) and the largest is 1.003 (group 4).
- 16.8** a. The mean for the 60+ age group is significantly different from the means for all other age groups. The other group means are not significantly different from each other. Notice that each interval involving the fourth group does not include 0 while all other intervals do include 0.
b. There is 95% confidence that all six intervals capture the corresponding population parameters. And, there is a $100\% - 95\% = 5\%$ chance that at least one of the six intervals does not capture the corresponding population parameter. A parameter here, by the way, is a difference in population means.
- 16.14** a. $SS \text{ Groups} = \sum n_i (\bar{x}_i - \bar{x})^2 =$
 $38(63.9 - 64.8)^2 + 93(64.8 - 64.8)^2 + 22(66.6 - 64.8)^2 = 30.78 + 0 + 71.28 = 102$
b. $(38 - 1)(2.09)^2 + (93 - 1)(2.80)^2 + (22 - 1)(2.76)^2 = 161.62 + 721.28 + 159.97 = 1042.87$
c. $MSE = \frac{SSE}{df} = \frac{1043}{150} = 6.953$; $s_p = \sqrt{MSE} = \sqrt{6.953} = 2.637$.
- 16.16** a. $H_0: \mu_1 = \mu_2 = \mu_3$ versus H_a : not all μ_i are the same, where μ_i is the mean number of finger taps that would be produced by the population of college men, after consuming the amount of caffeine given to group i .
b. There are no outliers, the variation is roughly the same for the three groups, and there is not extreme skewness.
- 16.17** a. The completed table is:

Source	DF	SS	MS	F	P
Caffeine	2	61.40	30.70	6.18	0.006
Error	27	134.10	4.97		
Total	29	195.50			

In the Caffeine row, $df = k-1=3-1=2$ and $MS = SS/df = 61.40/2 = 30.70$

In the Error row, $df = N-k = 30-3 = 27$ and $MS = SS/df = 134.10/27 = 4.97$. Equivalently, the df and the SS can be determined by subtracting the df and SS for Caffeine from the corresponding

values for Total. Finally, $F = \frac{MS_{Caffeine}}{MSE} = \frac{30.70}{4.97} = 6.18$

b. $s_p = \sqrt{MSE} = \sqrt{4.97} = 2.23$. This statistic estimates the population standard deviation of the response variable (for any of the caffeine amounts).

c. The p -value is small so we can conclude that the population mean finger taps are not the same for the three caffeine amounts.

B. Here are some commands that can be used to perform the Mood's median test after the data set is loaded and attached:

```
> median(Studyhrs, na.rm=T)
[1] 2
> temp = (Studyhrs <= 2)
> tab=table(temp, Vote2004)
> tab
      Vote2004
temp  I was too young to be eligible  No Yes
FALSE                34  40 117
TRUE                 33  48 145
> chisq.test(tab)

Pearson's Chi-squared test

data:  tab
X-squared = 0.8026, df = 2, p-value = 0.6695
```

From the chi-square p -value of 0.6695, we see no evidence from Mood's test that there is any difference in the median number of hours studied among the three groups.