Math 321 Quiz 5

The following data gave the yield (ounces) of 18 cherry tomatoes plants randomly assigned to 3 types of fertilizers.

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A        19  17  15  14  18 16
B        27  28  30  24  29 23
C        10  11  13   6  10 9
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Summary of data:

$\bar{y}_{1.} = 16.6, \bar{y}_{2.} = 27.6, \bar{y}_{3.} = 10.0, MSE = 3.87.$

1. Construct the Bonferroni confidence intervals for all possible pairwise comparisons of the three mean yields using an experimentwise confidence level of 95%.

We need to get the CIs for $\mu_1 - \mu_2, \mu_1 - \mu_3$ and $\mu_2 - \mu_3$.

The formula is

$\bar{y}_{i.} - \bar{y}_{j.} \pm t\sqrt{MSE}\sqrt{\frac{1}{n_i} + \frac{1}{n_j}}.$

The t critical value is $t = 2.694$.

Here $CL_e = 0.95, \alpha_e = 0.05, m = 3$.

R code: qt(1-(0.05/6),15) or qt(0.05/6,15) and take the positive t value.

Plug in the formula for the CIs, we get the three CIs:

$\mu_1 - \mu_2 : (-14.06, -7.94).$

$\mu_1 - \mu_3 : (3.54, 9.66).$

$\mu_2 - \mu_3 : (14.54, 20.66).$

There is significant difference between each pair of the population means. The confidence intervals show that fertilizer B produces the highest mean yield and C produces the lowest mean yield.

2. What critical value you would use in the Tukey-cramer confidence intervals assuming an 95% exprimentwise confidence level ? You do not need to get the confidence interval, just write down the critical value you would use. Is this critical value bigger or smaller than the critical value of the Bonferroni confidence intervals?

The critical value is $q/\sqrt{2}$ =2.597. The q value can be obtained in R by qtukey(0.95,3,15). It is slightly smaller than the critical value 2.694 in the Bonferroni intervals . That is, the Bonferroni intervals are more conservative.