Problem Set 8

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# Context

You are trying out four different methods for helping participants with their depression. You decide to give out: medication only, individual therapy, group, and medication and individual therapy. Below are each level’s depression levels at the end of the experiment. You are interested in which therapeutic approach is significantly better at reducing depression levels compared to doing nothing for participants. For the following problem, please do all the following prompts and show your work.

data2 <- data.frame(meds = c(4, 5, 4, 6, 5),  
 ind\_therapy = c(5, 4, 3, 5, 5),  
 group = c(8, 8, 6, 9, 10),  
 med\_ind = c(3, 1, 3, 2, 1),  
 control = c(10, 9, 8, 7, 9))  
  
data2

## meds ind\_therapy group med\_ind control  
## 1 4 5 8 3 10  
## 2 5 4 8 1 9  
## 3 4 3 6 3 8  
## 4 6 5 9 2 7  
## 5 5 5 10 1 9

What is the k?

The number of groups is 5; the medication group, the individual therapy group, the group therapy group, the medication + individual therapy group, and the control group.

What is the number of participants per level?

There are 5 participants per level as we can see that there are 5 scores/values for each level/group.

What is the total number of participants?

To get this value, we must add up all the participants together from all the 5 groups/levels.

5 + 5 + 5 + 5 + 5

## [1] 25

What is the sum of each group?

To get this value, you would add up all the values of each group

meds\_sum = 4 + 5 + 4 + 6 + 5  
ind\_sum = 5 + 4 + 3 + 5 + 5  
group\_sum = 8 + 8 + 6 + 9 + 10  
med\_ind\_sum = 3 + 1 + 3 + 2 + 1  
control\_sum = 10 + 9 + 8 + 7 + 9  
  
meds\_sum

## [1] 24

ind\_sum

## [1] 22

group\_sum

## [1] 41

med\_ind\_sum

## [1] 10

control\_sum

## [1] 43

To get this value, you would add up everything for each group/level

What is the mean of each group?

meds\_mean = meds\_sum/5  
ind\_mean = ind\_sum/5  
group\_mean = group\_sum/5  
med\_ind\_mean = med\_ind\_sum/5  
control\_mean = control\_sum/5  
  
meds\_mean

## [1] 4.8

ind\_mean

## [1] 4.4

group\_mean

## [1] 8.2

med\_ind\_mean

## [1] 2

control\_mean

## [1] 8.6

Use the previous values (the sums) and divide by the number of participants in each group. This is now the average depression score for each group.

What is the sum of squared Xs for reach group?

Use the values for each group and square each value and add them up. This is used for the sum of squares calculations.

meds\_sum2 = 4^2 + 5^2 + 4^2 + 6^2 + 5^2  
ind\_sum2 = 5^2 + 4^2 + 3^2 + 5^2 + 5^2  
group\_sum2 = 8^2 + 8^2 + 6^2 + 9^2 + 10^2  
med\_ind\_sum2 = 3^2 + 1^2 + 3^2 + 2^2 + 1^2  
control\_sum2 = 10^2 + 9^2 + 8^2 + 7^2 + 9^2  
  
meds\_sum2

## [1] 118

ind\_sum2

## [1] 100

group\_sum2

## [1] 345

med\_ind\_sum2

## [1] 24

control\_sum2

## [1] 375

What is the total sum?

This will be the sum of all the group/level sums.

total\_sum = meds\_sum + ind\_sum + group\_sum + med\_ind\_sum + control\_sum   
total\_sum

## [1] 140

What is the total sum of all squared values?

This is the sum of the squared sum values from the squared Xs from each group/level.

total\_sum2 = meds\_sum2 + ind\_sum2 + group\_sum2 + med\_ind\_sum2 + control\_sum2  
total\_sum2

## [1] 962

What is the sum of squares total?

Now we have everything to calculate the sum of squares values. I’ll be using the second formula here. We have the total sum of squared Xs value and the total sum of all the values. We also know the total amount of participants that we have in our study, which was calculated above. So we’ll input those in here.

140^2

## [1] 19600

19600/25

## [1] 784

962 - 784

## [1] 178

What is the sum of squares between/treatment?

Now that we have our sum of squares total, we’ll calculate the sum of squares between/treatment. Once again, I’ll be using the second formula.

24^2

## [1] 576

22^2

## [1] 484

41^2

## [1] 1681

10^2

## [1] 100

43^2

## [1] 1849

140^2

## [1] 19600

576/5

## [1] 115.2

484/5

## [1] 96.8

1681/5

## [1] 336.2

100/5

## [1] 20

1849/5

## [1] 369.8

19600/25

## [1] 784

115.2 + 96.8 + 336.2 + 20 + 369.8

## [1] 938

938 - 784

## [1] 154

What is the sum of squares within/error?

We can easily calculate the sum of squares within/error by using the sum of squares total and the sum of squares between values.

178 - 154

## [1] 24

What are the degrees of freedom between?

To get the degrees of freedom between, we’ll just subtract one from the number of groups

5 - 1

## [1] 4

What are the degrees of freedom within? (N - k)

For the degrees of freedom within, we’ll just subtract the number of groups from the total number of participants

25 - 5

## [1] 20

What are the degrees of freedom total? (N - 1)

To get the total degrees of freedom, we’ll subtract 1 from the total number of participants

25 - 1

## [1] 24

What is the mean squares between value?

To get the mean squares between values, we’ll divide the sum of squres between by the degrees of freedom between

154/4

## [1] 38.5

What is the mean squares within value?

We’ll do the same thing for the mean squares within values

24/20

## [1] 1.2

What is the F-obtained value?

Now we can use the values we just calculated to get the F-obtained value.

38.5/1.2

## [1] 32.08333

Calculate the Tukey HSD

To get the Tukey HSD we need some things. We need our q of studentized value as well as our MS within and the n for each group/level. Remember for our studentized value, we need the df within and the number of groups.

1.2/5

## [1] 0.24

sqrt(.24)

## [1] 0.4898979

4.232\*.49

## [1] 2.07368

So let’s now get the mean comparisons and see if it is greater than the Tukey HSD value.

meds\_mean

## [1] 4.8

ind\_mean

## [1] 4.4

group\_mean

## [1] 8.2

med\_ind\_mean

## [1] 2

control\_mean

## [1] 8.6

# comparisons between medications group and other groups  
4.8 - 4.4

## [1] 0.4

8.2 - 4.8

## [1] 3.4

4.8 - 2

## [1] 2.8

8.6 - 4.8

## [1] 3.8

# comparisons between individual therapy group and other groups  
8.2 - 4.4

## [1] 3.8

4.4 - 2

## [1] 2.4

8.6 - 4.4

## [1] 4.2

# comparisons between group therapy group and other groups  
8.2 - 2

## [1] 6.2

8.6 - 8.2

## [1] 0.4

# comparisons between medication and individual therapy group and other groups  
8.6 - 2

## [1] 6.6

Calculate the Eta Squared

To calculate the effect size, we must get the sum of squares between divided by the sum of squares total. This is what our model(our therapeutic groups) has on depression scores.

154/178

## [1] 0.8651685

Please List the Finding(s).

meds\_mean

## [1] 4.8

ind\_mean

## [1] 4.4

group\_mean

## [1] 8.2

med\_ind\_mean

## [1] 2

control\_mean

## [1] 8.6

sd(data2$meds)

## [1] 0.83666

sd(data2$ind\_therapy)

## [1] 0.8944272

sd(data2$group)

## [1] 1.48324

sd(data2$med\_ind)

## [1] 1

sd(data2$control)

## [1] 1.140175

This study looked at the comparisons between different therapeutic groups on depression scores. There was a statistically significant difference between these groups on depression scores; *F*(4, 20) = 32.08, *p* < .05. Specifically, there were several significant group differences found between these therapeutic groups. The medication group (*M* = 4.8, *SD* = 0.84) was shown to have significantly lower depression scores than the group therapy group (*M* = 8.2, *SD* = 1.48) and the control group (*M* = 8.6, *SD* = 1.14). The medication group did report higher depression scores than the individual therapy and medication group combined (*M* = 2, *SD* = 1). The individual therapy and medication group combined had significantly less depression scores than the individual therapy group alone (*M* = 4.4, *SD* = 0.89). The individual therapy group had significantly lower depression scores compared to the group therapy and control group. The individual therapy and medication group combined group had significantly lower depression scores compared to both the group therapy group and the control group.