Problem Set #9: Solution

1. Below are the results of a one-way ANOVA with three treatments. In each treatment there were 8 participants (n = 8).
	1. Fill in the missing values below (HINT: start by computing the degrees of freedom):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source  | SS | df | MS | F |
| Between Treatment Within Treatment (Error) Total | 40 |  | 4 |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Source  | SS | df | MS | F |
| Between Treatment Within Treatment (Error) Total | 40 84 124 | 2 21 23 | 20 4 | 5 |

Df: if there are 3 treatments the dfbt = 3-2= 2. If there are 8 participants per group then df total = (8\*3) - 1 = 24 – 1 = 23. This also means that df error will be 24 – 3 = 21.

SS: I can now find SS within because I know what MS within is and what df within is.

 MS within = SS within/ df within

4 = SS/21 = 4\*21 = SS = 84 = SS within

 If SS total is 40 and SS within is 84, then SS total = 40+84 = 124

MS: I can now find MS treatment because I know SStotal and df total

 MS bt = SS bt/df bt

 MS bt = 40/2 = 20

Now I can find F:

 F = MS bt/ MS within

 F = 20/4 = 5

1. The four sources of variability in a repeated measures ANOVA design are described below. Match each definition with the correct source: total variability; between treatments variability; within treatments variability; between subjects variability.
	1. The scores in the data set as a whole are relatively spread apart or relatively bunched together. Total Variability
	2. The scores in treatment are relatively close to one another or relatively spread apart. Within Treatments Variability
	3. The means are relatively similar to the Grand Mean or are relatively dissimilar from the Grand Mean. Between Treatments Variability
	4. The scores of the participants are relatively similar to one another or are relatively different from one another. Between Subjects Variability
2. If the between participants variability is relatively high, will that increase or decrease the likelihood of rejecting the null hypothesis? Explain your answer.

If the between participants variability is relatively high, the chance/error variation will be relatively low. Because the chance/error variation is in the denominator of the formula for the observed value of F, the observed value of the test statistic will increase. When the observed value of F is relatively large, it is more likely to exceed the critical value. Therefore, we will be more likely to reject the null.

1. A researcher wants to examine a new social skills treatment to improve friendships in children. She recruits 6 children to participate in the treatment. The number of friends each child has is assessed before treatment begins, 3 months into treatment and 6 months into treatment. She wants to examine if time in treatment influences number of friendships. The data are presented in the table below. Conduct a repeated measures ANOVA by hand to determine if there is a significant effect of duration of treatment on unruly behavior (set alpha = .05). You do not have to run post-hoc tests.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Before  | 3 month | 6 months | P |
| Billy | 0 | 4 | 2 | 6 |
| Bobby  | 1 | 5 | 6 | 12 |
| Bubby | 3 | 3 | 3 | 9 |
| Benny | 0 | 1 | 5 | 6 |
| Barry | 0 | 2 | 4 | 6 |
| Buster | 2 | 3 | 4 | 9 |
| Mean | 1 | 3 | 4 |  |
| T | 6  | 18 | 24 | G =48 |
| ∑ (X2) | 14 | 64 | 106 |  |

SStotal = = 184-128 = 56

SSbetween =  =  = [6 + 54 +96] – 128 = 28

SSwithin = =8+10-10 = 28

SSbetween subjects = = = [12 + 48 + 27 +12 +12+27] – 128 = 10

SSerror = SSWI - SSBS = 28 – 10 = 18

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SS | df | MS | F |
| Between treatments | 28 | 2 | 14 | 7.78 |
| Within treatments | 28 | 15 |  |  |
|  Between subjects | 10 | 5 |  |  |
|  Error | 18 | 10 | 1.8 |  |
| Total | 56 | 17 |  |  |

$$η^{2}= \frac{MS\_{BT}}{MS\_{total}-MS\_{BS}}=\frac{28}{56-10}=\frac{28}{46}=0.61$$

Critical value: 4.10; decision: reject the null
There is a significant effect of time in treatment on the number of friends children have F(2,10) = 7.78, p < .05, η2 = .61. The number of friends children have increases from before treatment (M = 1) to 3 months later (M = 3) and increase again 6 months later (M = 4).