

Math 316

Review of Chapter 11 ANOVA

One-way ANOVA. **Table 11.1.1.**

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$. H_A : at least one μ_i is different from the others.

P is the likelihood of getting samples this different (or even more different) from each other, if H_0 were true.

Case 1: Original case.

Source	df	SS	MS	F	P
Between	4	52.31	13.08	1.65	.10 < P < .20
Within	55	436.94	7.94		
Total	59	489.25			

Notes:

Between $df = 5 - 1 = 4$

Total $df = 60 - 1 = 59$

So Within $df = 59 - 4 = 55$

Case 2: Change Treatment Group 5 value 9.5 to 15. (How does **Figure 11.1.1** change?)

Source	df	SS	MS	F	P
Between	4	68.63	17.16	2.17	.05 < P < .10
Within	55	433.96	7.89		
Total	59	502.58			

Case 3: Change all values in Group 5 to its mean of 12.29167. (How does **Figure 11.1.1** change?)

Source	df	SS	MS	F	P
Between	4	52.31	13.08	2.08	.05 < P < .10
Within	55	346.21	6.29		
Total	59	398.52			

One-way ANOVA with Blocking. **Table 11.6.3 and Table 11.6.4.**

$H_0: \mu_1 = \mu_2 = \mu_3$. H_A and P are same as for One-way ANOVA.

Case 1: Original case.

Source	df	SS	MS	F	P
Between Treatments	2	1.986	0.993	5.47	$.02 < P < .05$
Between Blocks	4	2.441	0.610		
Within	8	1.452	0.182		
Total	14	5.879			

Notes:

Between Treatments $df = 3 - 1 = 2$

Between Blocks $df = 5 - 1 = 4$

Total $df = 15 - 1 = 14$

So Within $df = 14 - 2 - 4 = 8$

If we had ignored the blocking. (Recall **diagram** on page 473 and **Figure 11.6.5**.)

Source	df	SS	MS	F	P
Between Treatments	2	1.986	0.993	3.06	$.05 < P < .10$
Within	12	3.893	0.324		
Total	14	5.879			

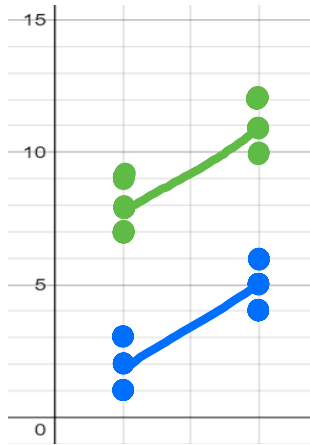
With this larger P value we are less likely to reject H_0 and accept H_A . That is, we are *less* likely to conclude that at least one Treatment has an effect different from the others, when in fact that may be the case, which means that there has been a loss of Power. See the end of Section 7.3 for **definition of Power**.

Case 2: Change Block 3, Control value 1.46 to 2. (How does **Figure 11.6.5** change?)

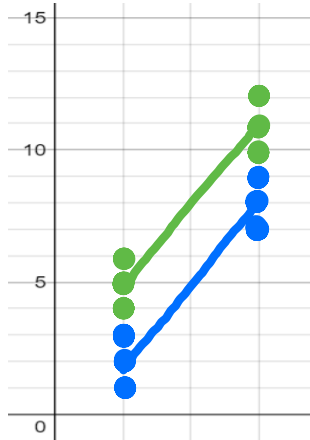
Source	df	SS	MS	F	P
Between Treatments	2	2.563	1.282	6.91	$.01 < P < .02$
Between Blocks	4	2.311	0.578		
Within	8	1.433	0.185		
Total	14	6.357			

Two-way ANOVA. Some made-up examples, kind of a simpler version of **Example 11.7.2**.

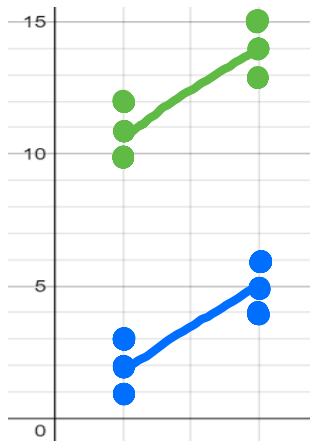
Row 2
Row 1



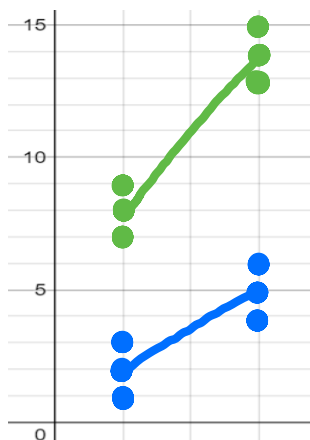
Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	108	108	108	< .0001
Columns	1	27	27	27	.0008
Interaction	1	0	0	0	1
Within	8	8	1		
Total	11	143			



Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	27	27	27	.0008
Columns	1	108	108	108	< .0001
Interaction	1	0	0	0	1
Within	8	8	1		
Total	11	143			



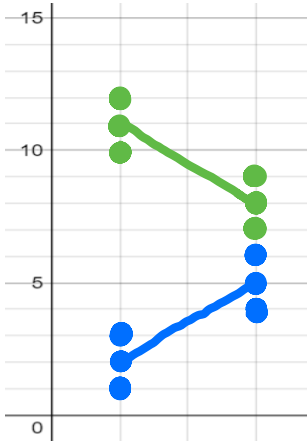
Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	243	243	243	< .0001
Columns	1	27	27	27	.0008
Interaction	1	0	0	0	1
Within	8	8	1		
Total	11	278			



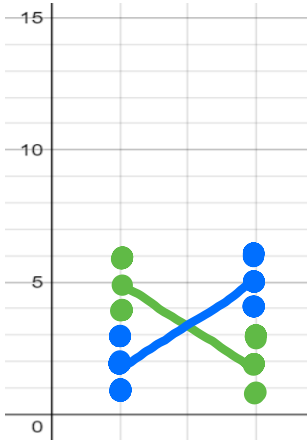
Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	168.75	168.75	168.75	< .0001
Columns	1	60.75	60.75	60.75	.0001
Interaction	1	6.75	6.75	6.75	.0317
Within	8	8	1		
Total	11	244.25			

Row 2

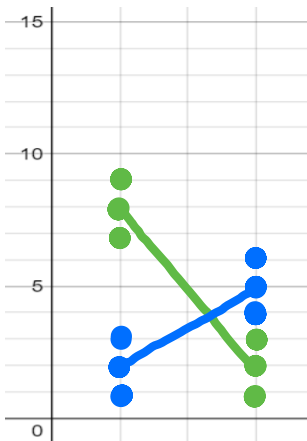
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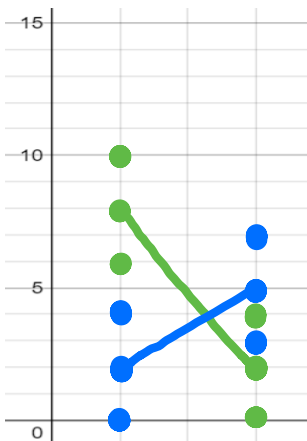
Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	108	108	108	< .0001
Columns	1	0	0	0	1
Interaction	1	27	27	27	.0008
Within	8	8	1		
Total	11	143			



Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	0	0	0	1
Columns	1	0	0	0	1
Interaction	1	27	27	27	.0008
Within	8	8	1		
Total	11	35			



Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	6.75	6.75	6.75	.0317
Columns	1	6.75	6.75	6.75	.0317
Interaction	1	60.75	60.75	60.75	.0001
Within	8	8	1		
Total	11	82.25			



Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Rows	1	6.75	6.75	1.69	.2298
Columns	1	6.75	6.75	1.69	.2298
Interaction	1	60.75	60.75	15.19	.0046
Within	8	32	4		
Total	11	106.25			