STASTICS BOOT CAMP

Independent Samples t Test

- A small study was conducted to see if people in Kansas and New York spend the same amount of money per month going to the movies. Participants randomly sampled. Data represented in dollars are below. Complete an Independent Samples t Test. Alpha = .05

  - Kansans: 12, 18
  - New Yorkers: 14, 19

Group Statistics

	State	N	Mean	Std. Deviation	Std. Error Mean
Dollars Spent per month	Kansas	2	15.0000	4.24264	3.00000
	New York	2	16.5000	3.53553	2.50000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Dollars Spent per month	Equal variances assumed	.	.	-.384	2	.738	-1.50000	3.90512	-18.30240	15.30240
	Equal variances not assumed			-.384	1.937	.739	-1.50000	3.90512	-18.83701	15.83701

Independent Samples t Test

- A small study was conducted to see if 7th graders miss the same number of class days (per school year) as 8th graders at John Barrett middle school. Students randomly sampled from two grades. Data are represented below. Complete an Independent Samples t Test. Alpha = .05

  - 7th graders: 8, 10
  - 8th graders: 18, 17

Group Statistics

	Grade	N	Mean	Std. Deviation	Std. Error Mean
Number of days missed during school year	7th graders	2	9.0000	1.41421	1.00000
	8th graders	2	17.5000	.70711	.50000

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of days missed during school year	Equal variances assumed	.	.	-7.603	2	.017	-8.50000	1.11803	-13.31051	-3.68949
	Equal variances not assumed			-7.603	1.471	.037	-8.50000	1.11803	-15.41852	-1.58148

Dependent Samples t Test

- A small study was conducted to see if Xanax has no effect on mood. Higher numbers indicate better mood. Participants completed survey before and one hour after taking a dose of Xanax. Likert-scale data are represented below. Complete a dependent samples t Test. Alpha = .05

Mood before	Mood after
7	7
2	7
4	8

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	mood_before	4.33	3	2.517	1.453
	mood_after	7.33	3	.577	.333

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	mood_before & mood_after	3	-.115	.927

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	mood_before - mood_after	-3.000	2.646	1.528	-9.572	3.572	-1.964	2	.188

Dependent Samples t Test

- A small study was conducted to see if male and female pet owners have the same amount of empathy. Individuals were matched for type of pet owned. Likert-scale data are represented below. Higher scores indicate more empathy. Complete a dependent samples t Test. Alpha = .05

Pet	Male	Female
Dog	3	10
Cat	5	8
Buffalo	2	11

Paired Samples Statistics

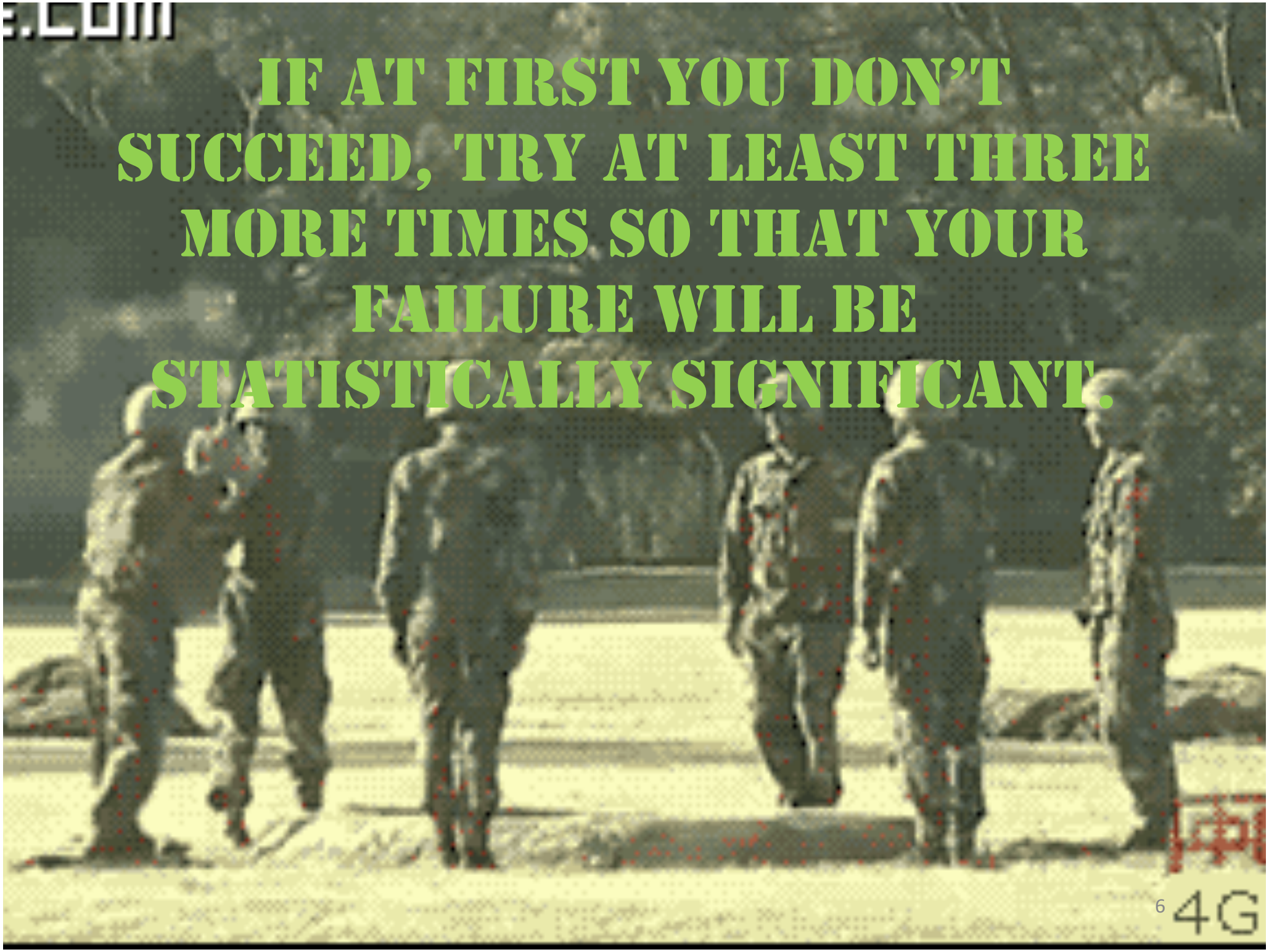
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Male	3.3333	3	1.52753	.88192
	Female	9.6667	3	1.52753	.88192

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Male & Female	3	-1.000	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Male - Female	-6.33333	3.05505	1.76383	-13.92250	1.25583	-3.591	2	.070


IF AT FIRST YOU DON'T SUCCEED, TRY AT LEAST THREE MORE TIMES SO THAT YOUR FAILURE WILL BE STATISTICALLY SIGNIFICANT.

One-Way, Independent ANOVA

- 20 young pigs are assigned at random among 4 experimental groups. Each group is fed a different diet (soylant green, Pop Tarts, Nike running shoes, buffalo). After 10 months on the diet, pigs are weighed (in Kg) to see whether weights are the same for all diets. Fill in the summary ANOVA table, and draw your conclusion quickly. Accept or reject? Difference or no difference? APA probability statement. Use $\alpha = 5\%$

Source	DF	SS	MS	F	P
Between	3		1567.73		
Within	16	121.34			
Total					

ANOVA

weight of pigs in kg at end of 10 months

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4703.188	3	1567.729	206.722	.000
Within Groups	121.340	16	7.584		
Total	4824.528	19			

Descriptives

weight of pigs in kg at end of 10 months

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Soylant Green	5	60.6800	3.02771	1.35403	56.9206	64.4394	57.10	65.00
Pop Tarts	5	69.2400	2.95770	1.32272	65.5675	72.9125	66.30	74.00
Nike Running Shoes	5	100.3400	2.16402	.96778	97.6530	103.0270	97.50	102.60
Buffalo	5	86.3800	2.78155	1.24395	82.9263	89.8337	83.20	90.30
Total	20	79.1600	15.93495	3.56316	71.7022	86.6178	57.10	102.60

Soylant Green	Pop Tarts	Nike Running Shoes	Buffalo
60.8	68.3	102.6	87.9
57.1	67.7	102.2	84.7
65.0	74.0	100.5	83.2
58.7	66.3	97.5	85.8
61.8	69.9	98.9	90.3

Pigs and LSD!

- Interpret the LSD table.

Post Hoc Tests

Multiple Comparisons

Dependent Variable: weight of pigs in kg at end of 10 months

LSD

(I) type of feed pigs eat	(J) type of feed pigs eat	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Soylant Green	Pop Tarts	-8.56000*	1.74169	.000	-12.2522	-4.8678
	Nike Running Shoes	-39.66000*	1.74169	.000	-43.3522	-35.9678
	Buffalo	-25.70000*	1.74169	.000	-29.3922	-22.0078
Pop Tarts	Soylant Green	8.56000*	1.74169	.000	4.8678	12.2522
	Nike Running Shoes	-31.10000*	1.74169	.000	-34.7922	-27.4078
	Buffalo	-17.14000*	1.74169	.000	-20.8322	-13.4478
Nike Running Shoes	Soylant Green	39.66000*	1.74169	.000	35.9678	43.3522
	Pop Tarts	31.10000*	1.74169	.000	27.4078	34.7922
	Buffalo	13.96000*	1.74169	.000	10.2678	17.6522
Buffalo	Soylant Green	25.70000*	1.74169	.000	22.0078	29.3922
	Pop Tarts	17.14000*	1.74169	.000	13.4478	20.8322
	Nike Running Shoes	-13.96000*	1.74169	.000	-17.6522	-10.2678

*. The mean difference is significant at the 0.05 level.

One-Way, Independent ANOVA

- Suppose the National Transportation Safety Board (NTSB) wants to examine the safety of compact cars, midsize cars, and full-size cars. It collects a sample of three for each of the treatments (cars types). Complete the summary ANOVA table. Conclude whether the mean head pressure during crash is equal across all cars. Accept or reject? Difference or no difference? APA probability statement. Use $\alpha = 5\%$

Source	DF	SS	MS	F	P
Between		86049.56			
Within					
Total		96303.56			

ANOVA

Pressure

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	86049.556	2	43024.778	25.175	.001
Within Groups	10254.000	6	1709.000		
Total	96303.556	8			

Descriptives

Pressure

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Compact	3	666.6667	31.18226	18.00309	589.2056	744.1277	643.00	702.00
Midsize	3	473.6667	49.16638	28.38623	351.5306	595.8027	427.00	525.00
Full-size	3	447.3333	41.68133	24.06473	343.7912	550.8755	402.00	484.00
Total	9	529.2222	109.71757	36.57252	444.8858	613.5586	402.00	702.00

Compact	Mid Size	Full Size
643	469	484
655	427	456
702	525	402

Cars and LSD!

- Interpret the LSD table.

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Pressure

LSD

(I) Car_Type	(J) Car_Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Compact	Midsize	193.00000*	33.75401	.001	110.4069	275.5931
	Full-size	219.33333*	33.75401	.001	136.7402	301.9264
Midsize	Compact	-193.00000*	33.75401	.001	-275.5931	-110.4069
	Full-size	26.33333	33.75401	.465	-56.2598	108.9264
Full-size	Compact	-219.33333*	33.75401	.001	-301.9264	-136.7402
	Midsize	-26.33333	33.75401	.465	-108.9264	56.2598

*. The mean difference is significant at the 0.05 level.

$S_{\bar{X}_1 - \bar{X}_2}$	*estimated standard error of the mean differences*
S_D	*standard deviation of the differences*
$\frac{\bar{X}_D \sqrt{N}}{s_D}$	*Dependent t test formula*

MS_b	*mean square between groups*
MS_w	*Mean square within groups*
k	*number of groups in research design*

How do you calculate F_{comp} from ANOVA summary table?	*Divide mean square between by mean square within*
What information does the LSD table provide?	*Pairwise differences between group averages and significance levels*
True or False: It is always necessary to conduct post hoc tests after ANOVA	*FALSE: post hoc testing needed only if initial computed F is significant*

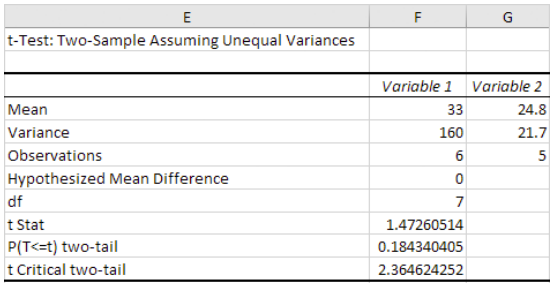
True or False: When the Pearson coefficient is closer to 0, rejection is more likely	*FALSE: the Pearson coefficient is the computed r which is stronger when it is farther from 0*
True or False: When the absolute computed r is greater than the critical r, we conclude a significant difference exists between our group averages	*FALSE: correlation analyses are about relationships among pairs of scores, not differences between averages*
True or False: the coefficient of determination tells us percent of variance two variables share	*TRUE: the coefficient is r squared and indicates % shared variance*

$\overline{X}_D$	*mean of the differences*
True or False: degrees of freedom within is always larger than degrees of freedom between	*TRUE: df-b relates to number of groups and df-w relates to number of scores; always have more scores than groups*
True or false: "Between groups" refers to random sample variance	*FALSE: "Between groups" refers to the effect of the treatment or independent variable*

Define "homogeneity of variance"	*variance is approx. the same for different score distributions*
What are the degrees of freedom for an indpendent, one way ANOVA?	*df-b: number of groups minus one* *df-w: number of scores minus number of groups*
Define "independent variable"	*the grouping variable, what is being manipulated, should be the only difference between groups*

α	*alpha level, the level at which we test $H_{0,}$ equals Type 1 error, possibility of mistake when rejecting null*
Does a critical t value represent a specific location or an area?	*critical statistical values represent cut-off points at specific locations of distributions*
Does an alpha level represent a specific location or an area?	*alpha level represents the deviant area in which comparison statistics are unlikely due to chance alone*

$$\frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{(N_1-1)s_1^2 + (N_2-1)s_2^2}{N_1+N_2-2}\right)\left(\frac{1}{N_1}+\frac{1}{N_2}\right)}}$$	*independent t test formula*
$$\frac{MS_b}{MS_w} =$$	*computed F*
Reject or accept? $p < .05$	*REJECT*

Reject or accept? no difference	*ACCEPT*
Type 1 or Type 2 error? Sig = .003	*Type 1*
Difference or no difference? 	*No difference*

E	F	G
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	*Variable 2*
Mean	33	24.8
Variance	160	21.7
Observations	6	5
Hypothesized Mean Difference	0	
df	7	
t Stat	1.47260514	
P(T<=t) two-tail	0.184340405	
t Critical two-tail	2.364624252	

Significant relationship or no?

r(8) = -.84, p > .001

No significant relationship, any time we have "p >" then we infer no significance--no matter what value the probability exceeds

True or False? Based on the table below, those with 2 years of computer experience performed about as well as those with 3 or more years experience. Assume alpha = .05

Multiple Comparisons

Dependent Variable: Total for Comp Survey

LSD

(I) Yrs of Comp Experience	(J) Yrs of Comp Experience	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Up to 1 yr	2 years	3.6095	4.293	.406	-5.0893	12.3083
	3 or more	-2.6242	4.586	.571	-11.9164	6.6679
2 years	Up to 1 yr	-3.6095	4.293	.406	-12.3083	5.0893
	3 or more	-6.2338	4.655	.189	-15.6653	3.1977
3 or more	Up to 1 yr	2.6242	4.586	.571	-6.6679	11.9164
	2 years	6.2338	4.655	.189	-3.1977	15.6653

TRUE: The sig value for the pairwise comparison of the 2-year and 3-year+ groups has a sig value above .05

A directional hypothesis about two group means would be referred to as a one or two-tailed hypothesis?	*one-tailed, "directional" means a prediction that one mean will be higher or lower than the other (i.e., will be in a specific tail of the distribution)*
In your own words, identify and explain each part of the APA probability statement below: **F(3,76) = 6.43, p < .01**	***F**: type of test* ***(3,76)** : df-between and df-within* ***6.43**: computed F stat* ***p**: probability of chance in rejection* ***p<.01**: probability of chance accounting for difference among group averages*
When between groups variability goes down, what will happen to the F value?	*computed F gets closer to 0*

Difference or no difference?

Paired Samples Test

Paired Differences				t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference				
viation	Std. Error Mean	Lower	Upper			
38667	.62838	-.69414	1.78414	.867	199	.387

No difference

$$\frac{SS_B}{df_B} =$$

MS_B

$N - k$

degrees of freedom within