

Name: \_\_\_\_\_

MyID: \_\_\_\_\_

### Assignment 6 Part I

§ Read the following scenario and interpret the output to answer questions 1-5 below:

**You are considered an expert research scientist in your field. Therefore, you have been asked by a prominent journal to review a study for inclusion in their next edition. The author has provided you with his findings as well as his original data to assist you in the decision making process.**

#### Study Abstract:

This study examined the impact of three conditions designed to decrease the number of weekly vocal outbursts among patients diagnosed with Tourette's Syndrome. The first group of patients received psycho-behavioral training, group 2 received psycho-behavioral training **plus** a low dose of drug A, and group 3 received a high dosage of Drug A only. The subjects were assigned to treatment conditions, by their psychiatrist, based on the severity of their disorder. Due to subject loss the final 'n size' for each group was 10, 20, and 25 for groups 1, 2, and 3, respectively.

The results of this study confirm that psycho-behavioral training issued in conjunction with a low dose of medication is most effective in treating the vocal manifestations of Tourette's Syndrome.

#### Author's Output:

##### 1) Descriptive Information

group	N	Mean	Variance	Std. Deviation	Median	Skewness	Kurtosis
1	10	12.600	44.711	6.687	12.500	-0.301	0.219
2	20	8.950	13.734	3.706	9.000	0.085	0.140
3	25	10.280	1.127	1.061	10.000	0.293	-1.076
Total	55	10.218	14.433	3.799	10.000	0.496	2.931

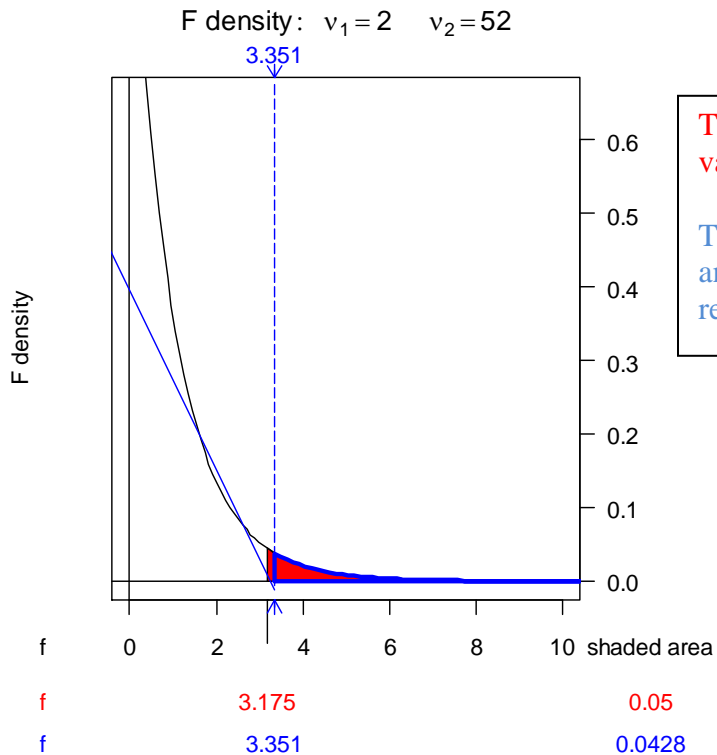
##### 2) ANOVA Table

#### ANOVA

score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	88.992	2	44.496	3.351	.043
Within Groups	690.390	52	13.277		
Total	779.382	54			

### 3) Graph of F Curve



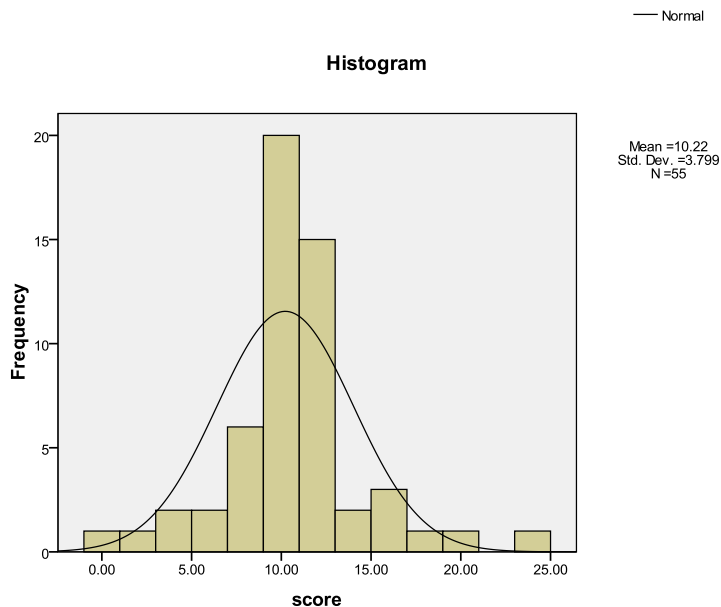
The red text and area denote the critical value and the rejection region, respectively.

The blue text value denotes the observed  $f$  and its probability superimposed on the rejection region, respectively.

### YOUR SUPPORTING DOCUMENTATION:

Being the expert researcher that you are, you analyzed the author's data and reviewed the results of an applicable simulation study.

### 1) Distribution of Number of Vocalizations Over One Week



## MONTE CARLO ANALYSES

Number of Simulated Samples Taken: 100,000

## POPULATION VALUES:

Group	Pop Mean	Pop SD	N
1	10.000	5.000	10
2	10.000	3.000	20
3	10.000	1.000	25

## NUMBER OF REJECTIONS OF HYPOTHESIS TESTS

Because the Population Means are EQUAL, the Null Hypothesis is TRUE

Therefore, any rejections of the Null Hypothesis are Type I errors

2-tailed tests were performed at ALPHA= 0.050

Hypothesis Tested	# of Rejections	Proportion Rejected
Overall ANOVA F:	16147	<b>0.1615</b>

## QUESTIONS:

- 1) What is the author's **most serious** design flaw?
  - a) He violated the assumption of homogeneity of variance
  - b) His sample data was not normally distributed and therefore  $E_{ij}$  is not normally distributed
  - c) He did not employ random sampling
  - d) He has unequal sample sizes across groups
- 2) Briefly define the type of design presented above (refer to the number of patients per group). Is the data missing at random? Why or Why Not?  
 The subject loss created an unbalanced design that is missing NOT at random. It occurred as a result of patients being grouped by severity of disorder—those that were more severe, dropped out of the experiment. Therefore, the data that was lost is related to the dependent variable (or number of vocalizations).
- 3) Review the Monte Carlo Simulation Results and supply **brief** answers to i-iii:
  - i. In a very brief statement, explain why the simulation study was conducted (what was being examined)?  
 To examine what happens to alpha when the assumption of homogeneity of variance is violated under an unbalanced design with the smaller sample size having the greatest variability
  - ii. List the nominal significance level and describe why it was set to this level.  
 .05—it was set to this level because it coincides with the alpha the author utilized to test his null hypothesis

- iii. Briefly describe what the value under the ‘Proportion Rejected’ means and the impact it would have on the Null Hypothesis F Curve.  
 It means that that 16.15% of the 100,000 simulated samples were rejected when the null hypothesis was true (there was no mean difference between groups). Therefore, the F curve the author presented is incorrect, the shaded rejection region should be much higher under these conditions—we no longer have sufficient evidence to reject the null.
- 4) Again using the Monte Carlo results, select the statement that describes the results:
- The F test is robust to this violation and we can trust the author’s results
  - The F test is not robust to this violation, we have observed that it is conservative with regard to Type I error
  - The F test is not robust to this violation, we have observed that it is liberal with regard to Type I error
- 5) After your review of the author’s study, you decide to provide some guidance for his future endeavors. First, you review the assumptions of the linear model and the most serious design flaw you noted above. Next, you list the points below. Elaborate on each point by providing the information requested
- Levene’s Test yielded ( $F=12.23$ ,  $p=.00$ ). Provide the Null Hypothesis and interpret the p value.  
 $H_0: \sigma^2_1 = \sigma^2_2 = \sigma^2_3$  The p value suggests we reject the null that the variance is equal among the groups
  - Data Transformation may reduce heterogeneity. Transform these scores using the square root method. Also, briefly describe why you chose this method over the other available options.  
 $13.00 = 3.67$   
 $15.00 = 3.93$   
 $8.00 = 2.91$   
 This method was selected because the dependent variable is counts (Vocalizations that occur in a specific time frame).
  - Finally, you recommend that the author research other strategies that “deal with the heterogeneity of variance”. You present him with the output below.

While you are showing alternatives to the ANOVA, what do the significance values mean, ultimately, for this study?

That we must fail to reject the null-the difference that are observed between the means are likely due to error.

**Robust Tests of Equality of Means**

score				
	Statistic <sup>a</sup>	df1	df2	Sig.
Welch	1.779	2	17.132	.199

Brown-Forsythe	1.937	2	13.816	.181
----------------	-------	---	--------	------

a. Asymptotically F distributed.

## Part II SPSS

§ Import the dataset tracking.sav into SPSS, answer the following questions:

a. Null Hypothesis: There is not a statistically significant difference in the length of time between practice trials and the length of time the individual is able to keep on target.  $H_0$ :

$$\mu_1 = \mu_2 = \mu_3 = \mu_4$$

b.

### Test of Homogeneity of Variances

Seconds

Levene Statistic	df1	df2	Sig.
.523	3	16	.673

Levene's Test p-value = 0.673. The homogeneity assumption has not been violated. Therefore, the omnibus F-test through One-Way ANOVA is fine to use.

For practice purposes, the Brown Forsythe Test has a p-value of 0.000.

### Robust Tests of Equality of Means

Seconds

	Statistic <sup>a</sup>	df1	df2	Sig.
Brown-Forsythe	11.074	3	14.477	.000

a. Asymptotically F distributed.

c. There is statistically significant evidence that there are differences in the groups and the ability to keep on target ( $F=11.074$ ,  $df=3, 14.477$ ,  $p\text{-value} = 0.00$ ). {or  $F=11.074$ ,  $df=2, 16$ ,  $p\text{-value} = 0.000$  if used One-Way ANOVA data)

ANOVA

Seconds

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	373.750	3	124.583	11.074	.000
Within Groups	180.000	16	11.250		
Total	553.750	19			