EDUC 6050 – Spring 2018 Name: ______________________________

Single Sample Z-Tests and T-Tests

HW #2

Directions: *Please complete all of the sections. You get half of your points for finishing/turning it in on time and the other half for correctness. For the Jamovi section, please print the output from Jamovi and staple the two documents together. Have fun!*

Section I: Single Sample Z-Tests

1. What are the assumptions of the Single Sample Z-test?
   Independence of data points
   Variable is continuous
   Distribution is normal
   Variances are approximately equal
2. If $\mu = 100, \sigma = 10$, write the null and research hypotheses (two-tailed).
$$H_0: \mu_{sample} = 100$$
$$H_A: \mu_{sample} \neq 100$$
3. What is the critical z value if $\alpha = .05$?
$$z_{critical} = 1.96$$
4. Calculate the z if the mean of our sample is 90. Is this significant? (n = 100)
$$z = \frac{X - \mu}{\sigma/\sqrt{N}} = \frac{90 - 100}{10/10} = \frac{-10}{1} = -10$$
   This is significant.
5. Calculate the effect size (d) for this situation. Is this effect small, moderate, or large?
$$d = \frac{M - \mu}{\sigma} = \frac{90 - 100}{10} = \frac{-10}{10} = -1 = 1$$
   Large effect.
6. Using page 157 as a guide, write the interpretation of the results.
   There was a significant difference between our sample's population and the standard (comparison) population [z(100) = -10, p < .05], therefore we reject the null. The standard population was 10 units higher than the sample mean. The effect was large (d = 1).

Section II: Single Sample T-Tests

7. What are the assumptions of the Single Sample T-Test?
   Independence of data points
   Variable is continuous
   Distribution is normal
   Variances are approximately equal
8. If $\mu = 5$, write the null and research hypotheses (two-tailed).
$$H_0: \mu_{sample} = 5$$
$$H_A: \mu_{sample} \neq 5$$

9. What is the critical t value if $\alpha = .05$ and we have a sample size of 20?
$$t_{critical}(19) = 2.09$$

10. Calculate the observed t if the mean of our sample is 7.5. Is this significant?
   (SE = 1.5, SD = 5)
   If you used the n = 20 then $SE = \frac{5}{\sqrt{20}} = 1.12$

$$t(19) = \frac{M - \mu}{SE} = \frac{7.5 - 5}{1.5} = \frac{2.5}{1.5} = 1.67$$
$$t(19) = \frac{M - \mu}{SE} = \frac{7.5 - 5}{1.12} = \frac{2.5}{1.12} = 2.23$$

   Either value works for this problem. For t = 1.67, it is not significant. For t = 2.23, the effect is significant.
11. Calculate the effect size (d) for this situation. Is this effect small, moderate, or large?
$$d = \frac{M - \mu}{SD} = \frac{7.5 - 5}{5} = \frac{2.5}{5} = .5$$
   This is a moderate effect.

12. Using page 216 as a guide, write the interpretation of the results.
   For t = 1.67: Our sample was not statistically significantly different than the comparison population [t(19) = 1.67, p > .05]. However, the effect size was moderate (d = .5), possibly suggesting we need to use a larger sample to obtain a significant result.

   For t = 2.23: Our sample was statistically significantly different than the comparison population [t(19) = 2.23, p < .05]. In addition, the effect size was moderate (d = .5). Ultimately, it appears that the population from which we drew the sample is different than the comparison population.

Section III: Jamovi

Download the data set "HW2_Data.csv" from Canvas. In it, there are three variables: 1) Group, 2) Pretest, and 3) Posttest. The Group is a randomly assigned condition (1 = treatment, 2 = control), the Pretest is the self-reported confidence before the intervention, and Posttest is the self-reported confidence after the intervention. We want to see if the pretest scores are different across the two groups. With this information and the data set, do the following:

1. Import the data into Jamovi.
2. Tell Jamovi that Group is a nominal variable and label the levels. ✓
3. Make sure both Pretest and Posttest are scale variables. ✓
4. Check assumptions of the type of test that you want to use to test whether our groups are the same or not ($H_0: \mu_1 = \mu_2$).
   See output of the Shapiro-Wilk and Levene's tests. Normality holds (p = .195) but homogeneity doesn't (p = .045).

5. After checking the assumptions, define the critical region for this test.
   Since we will get a p-value we can define it using just the alpha.
   $$\alpha = .05$$

6. Compute the test statistic, the effect size, and confidence intervals. ✓
7. Interpret the results in the context of the study.
   The groups (treatment and control) were not statistically significantly different at pretest, t(18) = .569, p = .576. The effect size was small (d = .255). We are 95% confident that the true mean difference between the groups at pretest is between -1.08 and 1.88. However, a limitation of these results is that the assumption of homogeneity may not hold (p = .045).

8. Paste or print out the Jamovi output from this study and write the interpretation of the results below.

Output:

Independent Samples T-Test

								95% Confidence Interval	
		statistic	df	p	Mean difference	SE difference	Cohen's d	Lower	Upper
Pretest	Student's t	0.569 [a]	18.0	0.576	0.400	0.702	0.255	-1.08	1.88

[a] Levene's test is significant (p < .05), suggesting a violation of the assumption of equal variances

Test of Normality (Shapiro-Wilk)

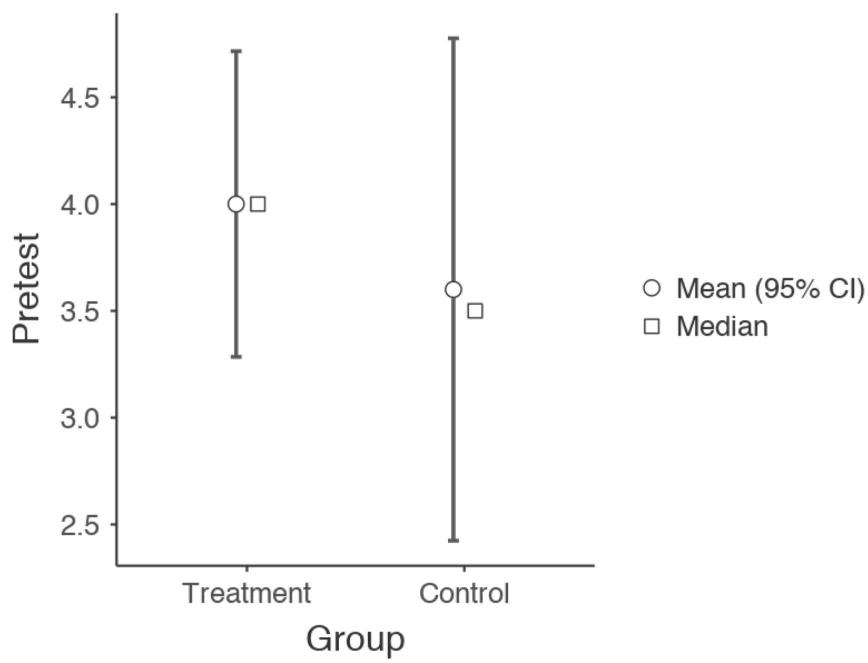
	W	p
Pretest	0.935	0.195

Note. A low p-value suggests a violation of the assumption of normality

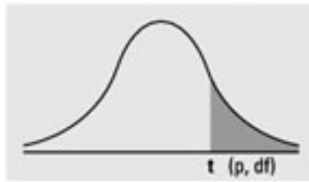
Test of Equality of Variances (Levene's)

	F	df	p
Pretest	4.65	1	0.045

Note. A low p-value suggests a violation of the assumption of equal variances



Numbers in each row of the table are values on a *t*-distribution with (*df*) degrees of freedom for selected right-tail (greater-than) probabilities (*p*).



df/p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	43178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
z	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905
CI	———	———	80%	90%	95%	98%	99%	99.9%