Math 247: Homework Set 4 **Name:**________________________________

Non-StatCrunch ______________/12 points StatCrunch ________________ / 8 points

Self-Assessment: Determine total number of correctly done problems (they don't have to be done correctly the first time…just make sure you find and fix any errors in your work!) and put that score in the last column.

Instructions for submitting homework:

All StatCrunch problems need to be typed up on a Google Doc (the entire problem, not just the StatCrunch part), with the StatCrunch results cut and pasted into the Google Doc.

You will send the Google Doc to me directly.

	Read this section:	Do these problems:	Completed/ Total (you fill in)
1	**Section 8.4:** Comparing Proportions from Two Samples	8.4 Exercises, page 401: 61, 62, **StatCrunch**: 63, 69 Your work should include all four steps: Step 1: setting up the hypotheses, Step 2: choosing the test and checking the conditions, Step 3 "Compute" by using StatCrunch, Step 4: writing a conclusion (interpret).	/4
2	**Section 7.5:** Comparing Two Population Proportions with Confidence	7.5 Exercises, page 350: 63, 73 **StatCrunch:** 67, 69, 71 For these 3 problems **use StatCrunch to find the Confidence Intervals**. Your work should still include reporting the confidence interval, writing a conclusion (interpret).	/5
3	**Section 9.1:** Sample Means of Random Samples	**9.1 Exercises**, page 460: 1, 2, 6, 8, 9, 10	/6
4	**Section 9.3:** Answering Questions about the Mean of a Population (Confidence Intervals)	**9.3 Exercises**, page 463: • Find t* values: 25, 26 • Confidence Interval interpretation: 19, 20 Find Confidence Intervals • **By hand** (no StatCrunch!): 29 • **Using StatCrunch:** 21, 22, 35 (**Note:** Type these small data sets into StatCrunch directly) • Concept Problems: 31, 33, 51	/11
5	**Section 9.4:** Hypothesis Testing for Means	**9.4 Exercises**, page 465: **Hypothesis Tests:** 41, 42 (The StatCrunch printouts are given for 41 and 42) **StatCrunch for Compute Step:** 37, 39, 44 You do not have to do any of the compute work by hand, but be sure to also do steps 1,2, and 4 of the hypothesis test. (**Note:** Type these small data sets into StatCrunch directly)	/5

6	**Section 9.5:** Comparing Two Population Means	**9.5 Exercises**, page 466: 53, 55, 59, 61, 71 Use **StatCrunch:** 63, 65, 69 - (The Excel files for these problems are on the wrightmath.info website.) As always, to receive credit for the 4 problems above, **include the StatCrunch printout**, showing your work.	/8
7	**Section 11.1:** Multiple Comparisons Read pages 534 – 536 (Stop at "Bonferroni Correction") **Section 11.2:** The Analysis of Variance	**11.2 Exercises**, page 563: 15, 16, 17, 19, 20, 21, 22	/7
8	**Section 11.3:** The ANOVA Test **Section 11.4:** Post Hoc Procedures	**11.3 Exercises**, page 565: 25, 26, 27, 28, 29, **StatCrunch:** 31, 35 (data is located on the website under the Math 247, StatCrunch. **11.4 Exercises,** page 569: 49, 50	/9

Even Answers

8.62: You will get a smaller P-value when you have a larger sample. The test is more sensitive to small differences between two populations when you have a larger sample. Remember that this is where the question of "statistical significance" vs "clinical significance" comes in!

9.2 They are statistics because they come from a sample

9.6 a. Right-skewed. It cannot be Normal, because in a Normal distribution, 68% of the observations are within one standard deviation of the mean. This is not possible here, because phone calls cannot last negative minutes, so the distribution must be right-skewed.

b. Because the sample mean is unbiased, the mean will be about the same as the population mean: 3.25 minutes.

c. The standard deviation of this distribution, also called the standard error, is $4.2/\sqrt{100} = 0.42$ minute.

9.8 the sampling distribution of means

9.10 a. 60,000 is the expected sample mean, assuming an unbiased sample. The sample mean is an unbiased estimator of the population mean.

b. The standard error is $30,000/\sqrt{400} = 1500$.

9.20 a. Only iii. is correct. We are 95% confident that the population mean is between $\$18,546 - \$1398 = \$17,148$ and $\$18,546 + \$1398 = \$19,944$.

b. We cannot reject \$18,000 because it is within the interval.

9.22 *Random Sample*, *Independence*, *Big Population*, and *Large Sample* (*Normal Distribution*) are given.

a. ii. is correct (19.55, 21.00). Both i. and iii. are incorrect.

$$x \pm t^* \frac{s}{\sqrt{n}} = 20.275 \pm 3.182\left(\frac{0.457}{\sqrt{4}}\right) = 10.325 \pm 0.727$$

Inverse Cumulative Distribution Function

```
Student's t distribution with 3 DF
P( X <= x )        x
      0.975  3.18245
```

One-Sample T: Carrot Weight

```
Variable        N    Mean   StDev   SE Mean       95% CI
Carrot Weight   4  20.275   0.457     0.229   (19.547, 21.003)
```

b. No, we cannot reject the claim of 20 pounds, because 20 is within the interval.

9.44 a. *Step 1*: H_0: $\mu = 128$, H_a: $\mu < 128$, where μ is the population mean weight of 20-year-old women.

Step 2: One-sample *t*-test: *Random Sample*, *Independence*, and *Big Population* are met. *Large Sample* (*Normal Distribution*): $n = 40 > 25$, $\alpha = 0.05$.

Step 3: $t = -2.53$, p-value = 0.008.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{122 - 128}{15/\sqrt{40}} = -2.53$$

One-Sample T

```
Test of mu = 128 vs < 128
                                   95% Upper
 N    Mean  StDev  SE Mean       Bound      T      P
40  122.00  15.00     2.37      126.00  -2.53  0.008
```

Step 4: Reject H_0. The mean for vegetarian women is significantly less than 128.

b. *Step 3*: $t = -4.00$, p-value < 0.001.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{122 - 128}{15/\sqrt{100}} = -4.00$$

One-Sample T

```
Test of mu = 128 vs < 128
                                    95% Upper
  N    Mean  StDev  SE Mean       Bound      T      P
100  122.00  15.00     1.50      124.49  -4.00  0.000
```

Step 4: Reject H_0. The mean for vegetarian women is significantly less than 128.

c. Larger *n*, smaller standard error (narrower and taller sampling distribution) with less area in the tails, as shown by the smaller p-value.

9.26 a. Use $t^* = 2.797$.

b. It is larger because the sample size is smaller (so the distribution is wider) and also because the level of confidence is greater.

c. The 95% interval is wider because a greater level of confidence requires a larger t^*.

9.40 a. You should not be able to reject 5 pounds, because the confidence interval (4.9 to 5.3) did capture 5 pounds.

b. *Step 1*: H_0: $\mu = 5$, H_a: $\mu \neq 5$

Step 2: One-sample *t*-test: *Random Sample*, *Independence*, and *Big Population* are met. *Large Sample* (*Normal Distribution*) is given, $\alpha = 0.05$

Step 3: $t = 1.99$, p-value = 0.141.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{5.125 - 5}{0.126/\sqrt{4}} = 1.99$$

One-Sample T: Tomato Weight

```
Test of mu = 5 vs not = 5
Variable       N    Mean   StDev  SE Mean          95% CI           T      P
Tomato Weight  4  5.1250  0.1258   0.0629  (4.9248, 5.3252)  1.99  0.141
```

Step 4: Do not reject H_0. The mean is not significantly different from 5 pounds.

11.16 Group A,B,C would have F = 9.38 and Group G,H,K would have F = 25. How can we tell? Note that the difference in means (the center of the symmetric boxplots) is the same for each grouping. What is different is the amount of variation in each group. Since there is more variation WITHIN the groups in A,B,C, the F-statistic for A,B,C will be smaller

11.20 a. SS class = 3273.8 – 3247.2 = 26.6

b. 26.6/3 = 8.87, which rounded is 8.9.

c. 8.9/30.6 = 0.291, which rounded is 0.29.

d. If MS factor (MS class) is less than MS Error, the *F*-value will be less than 1.

11.22 a. The highest sample mean was for the sophomores, and the lowest mean was for the freshmen.

b. μ is the population mean number of TV hours per week. H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$,

H_a: At least population one mean is different from another or class has an effect on TV hours.

c. $F = 0.29$

d. No. There was no random assignment. There could be confounding factors, such as age, hours of work for money, or living situation.

11.26 p-value = 0.833. Do not reject H_0. We do not have enough evidence to conclude that class affects the number of TV hours.

11.27 The pulse rates are not in three independent groups, so the condition of independent groups fails.

11.28 The boxplots show that the data are too skewed for us to use ANOVA with sample sizes under 25. Also, the standard deviations are too different, because the ratio of the largest to the smallest is $10.793/1.165$, or about 9.3, which is larger than 2; thus the same-variance condition fails.