Name: Key Math 127 – Exam 3A – Summer 2016

Oath: ***"I will not discuss the exam contents with anyone until the key is posted to Blackboard".***

Sign Name: Key

The penalty for cheating on this exam is a grade of 0% for Math 127 Exam 3 and the severe, lifelong disappointment of your instructor.

Student Instructions

1. **One sheet of handwritten or typed notes is OK. Staple to the test when submitting.**

   Students may not use the "pink sheet" or any copied or scanned answer keys or Math 127 department documents.

2. **Any calculator is OK. No cell phone calculators.**

3. **www.statcrunch.com is required. All other webpages are prohibited.**

4. **Test must be completed in one sitting, but it is untimed. Very short bathroom breaks are permitted.**

5. **This test is graded out of 100 points and counts for 1/7 of your Math 127 grade.**

6. **Show work when necessary or points will be deducted. If you only report an answer and it is wrong, you will receive no credit. You may use the StatCrunch calculators for any probability calculations when appropriate.**

7. **Points are in parentheses for each question.**

8. **Good luck. Do your best. Glad to be part of your Cecil College experience.**

1. Short Answer

1a. (3) Which hypothesis is presumed true before you collect your data? Null, H_0

1b. (3) True True or False – The whole reason we rely on hypothesis tests and confidence intervals is because we typically only have access to a sample of data.

1c. (3) False True or False – Increasing the sample size will make your confidence intervals wider, all other things held constant.

1d. (3) True True or False – Increasing the sample size will make your P-values smaller, all other things held constant.

1e. (3) ± 3.8906 Give the z value that you'd need for $\hat{p} \pm z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ for a 99.99% CI.

1f. (3) ± 2.3646 Give the t value that you'd need for $\bar{y} \pm t\left(\frac{s}{\sqrt{n}}\right)$ for a 95% CI with $n = 8$.

1g. (3) Explain the meaning of statistically significant data / statistically significant results with regards to hypothesis testing.

Data too unusual to attribute to chance. Data that led to the rejection of the null.

2. (3) We are going to calculate the required sample size for an upcoming study. We are going to estimate the percentage of Cecil College students who have heard of Uncle Web Knows Best. We'd like to be within 3% of the true percentage. We need to be 95% confident. Since hardly anyone knows about this game, let's use $\hat{p} = 5\%$ have heard of it (though that might be pushing it). Show calculation.

$$n = \frac{1.96^2(0.05)(0.95)}{(0.03)^2} = 202.75$$

So $n = 203$

3. (3) You'd like to estimate your resting diastolic blood pressure to within 4 units. You'll do this by taking a measurement on n randomly selected mornings when you first wake up. You'll need to be 99% confident and you estimate the standard deviation of your resting diastolic blood pressure to be 5 units. Show the work to determine how many mornings you must take your blood pressure.

$$n = \left[\frac{2.576(5)}{(4)}\right]^2 = 10.37$$

So $n = 11$

5. On August 3, 2016, NBC News has Trump at 43%. For this problem, assume that is the correct proportion for the entire country. Suppose we were to take an unbiased sample of 380 voters. Answer the following questions under that scenario. For this problem, let a vote for Trump be classified as a "Success".

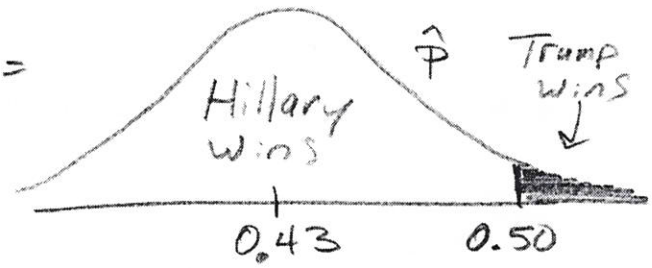
5a. (3) It is easy to show that the mean and standard deviation of the sampling distribution model for the sample proportion are 0.43 and 0.025 respectively. Verify the calculation for the standard deviation:

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.43(0.57)}{380}} \approx 0.025$$

5b. (3) Using your model for the sample proportion, and presuming only two candidates and a majority needed to win (and for that matter, the Electoral College does not exist and we just go by a straight vote count), what is the chance that a random sample of 380 voters has Trump winning? Show your shaded model for full credit.

$P(\hat{p} \text{ exceeds } 0.50) =$

Answer: 0.0026



5c. (3) Suppose we take a sample of 380 people. Only 150 say they'd vote for Trump. Is that unusually low? Determine that with a z-score. Show calculation.

$$\hat{p} = \frac{150}{380} = 0.3947 \qquad z = \frac{0.3947 - 0.43}{0.025}$$

No, z within ±2 ↔ $z = -1.412$

Retired –

6. (5) Open up the "**Calendar Year 2016 Large Survey**" dataset. Give a 95% confidence interval for the true proportion of all Cecil College students who have the final goal of "***Master's***" "***Degree***".

$\hat{p}$ = ~~81/220~~ 145/424 CI: ~~(30.44%, 43.19%)~~ (29.68%, 38.71%)

7. (5) Open up the "**Calendar Year 2016 Large Survey**" dataset. Give a 95% confidence interval for the true proportion of all Cecil College students that "***Ideally***" want 2 or more "***Children***".

$\hat{p}$ = ~~177/219~~ 346/424 CI: ~~(75.61%, 86.04%)~~ (77.92%, 85.29%)

8. (5) Open up the "**Calendar Year 2016 Large Survey**" dataset. Give a 95% confidence interval for the true mean "***Work Time***" for all Cecil College students.

$\bar{y}$ = ~~24.94~~ 24.72 CI: ~~(22.78 hours, 27.09 hours)~~ (23.146, 26.287)

9. The internet says that the average per capita income for Cecil County residents is \$29,025. Let's presume that's true, let's presume the standard deviation is \$20,000, and let's conclude that the distribution of incomes would be extremely skewed to the right.

9a. (2) For the Normality $\bar{y}$ to kick in, what needs to happen? $n \geq 30$

9b. (3) If we took repeated samples of size 64, the mean of $\bar{y}$ will be \$29,025 and the standard deviation of $\bar{y}$ will be \$2,500. Show where the \$2,500 came from.

$$\sigma_{\bar{y}} = \frac{20{,}000}{\sqrt{64}} = \$2{,}500$$

9c. (3) For $n = 64$, what percentage of samples will have a sample mean per capita income of at most \$25,000?

$$P(\bar{y} \leq 25{,}000) = 0.0537 = 5.37\%$$

9d. (3) For $n = 64$, what percentage of samples will have a sample mean per capita income of at least \$30,000?

$$P(\bar{y} \geq 30{,}000) = 0.3483 = 34.83\%$$

Retired over

10. (12) Use our "**Calendar Year 2016 Library Data**" to determine if the mean number of "***Pages***" for all the books in our library is ~~under~~ 350 pages. Show all steps, but you can use StatCrunch for computing the test statistic and P-value. Conditions are met, so you don't have to check them.

$H_0: \mu = 350$ vs. $H_A: \mu \neq 350$

Summarized ~~Data~~: $n = 193$ (363), $\bar{y} = 347.22$ (374.91), $s = 189.995$ (272.77)

Test Stat: $t = -0.203$ (1.74)

P-Value: 0.4195 (0.0414)

Decision: ~~Fail to~~ Reject H_0

Conclusion: There is evidence ~~at all~~ that the mean pages is ~~under~~ over 350.

Retired

11. Use the "**Calendar Year 2016 Large Survey**" dataset to answer this question.

Test if more than ½ of our **Republicans** at Cecil College think that "***Marijuana***" should be legal.

For this problem, "***Moderate Republican***" and "***Strong Republican***" are Republican. ("***Party Affiliation***")

Big Hint: The denominator of your fraction should be ~~63~~. 129

11a. (14) Run the test, show all steps, and on this one, dutifully check the conditions and write them down. You can use StatCrunch and do not need to show calculations.

Hypotheses: $H_0: p = 0.50$ vs. $H_A: p > 0.50$

Conditions: Unbiased Sample — yes ✓

Weed: Yes/No Categorical ✓

~~65~~ ~~62~~ Success / ~~64~~ ~~67~~ Fails ✓✓ (Exceed 10)

Summarized Data: $\hat{p} = \frac{65}{129} = 0.5039$ Test Statistic: $Z = 0.088$

P-value: ~~0.4499~~ 0.4649 Decision: Fail to Reject H_0

Concluding Remark in Context: No evidence at all to say @ Cecil, more than ½ of our Republicans say yes to legalize Marijuana

11b. (3) With a sentence in context, explain the meaning of the **test statistic**: Our $\hat{p}$ = ~~50.8%~~ 50.39% was only ~~0.126~~ 0.088 Standard Errors above the hypothesized p = 50%.

11c. (3) With a sentence in context, explain the meaning of the **standard error**: With repeated samples, we'd expect $\hat{p}$ to vary by about ~~6.3%~~ 4.4%

11d. (3) With a sentence in context, explain the meaning of the **P-value**: If ½ of our Repub. wanted weed legal, we'd get $\hat{p}$ = ~~50.8%~~ 50.39% or one even bigger, ~~44.9%~~ 46.49% of the time.

11e. (3) With a sentence in context, explain what it'd mean if we made an **error**: Type II. In reality @ Cecil, more than ½ our Republicans do want weed legal.