Name: Key

Math 127 – Exam 3A – Spring 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.

Student Instructions

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

   Students may <u>not</u> 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. **<u>www.statcrunch.com</u> 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 25% 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.**

Version B — pages jumbled. Same exact test.

1. Do faculty and students have similar perceptions of what types of behavior are inappropriate in the classroom? Each individual in a random sample of 173 students in general education classes at a large public university was asked to judge various behaviors on a scale of 1 (totally inappropriate) to 5 (totally appropriate). In a separate sample, 98 faculty members also rated the same behaviors. The sample standard deviations were not given in the report, but for this problem, you can assume they were all equal to 1. Presume all conditions for inference are met.

Student Behavior	Student Mean Rating	Faculty Mean Rating
Wearing Hats	2.80	3.63
Addressing Instructor by First Name	2.90	2.11
Talking on Phone	1.11	1.04
Texting	1.94	1.10

1a. (4) Create a 99% confidence interval for the difference in means for "***Talking on Phone***". You can use StatCrunch for your interval. Treat "***Students***" as sample 1. Can we conclude that students and faculty differ when it comes to texting? Why?

99% interval: No Pool (−0.259, 0.399) Yes Pool (−0.258, 0.398)

Conclusion: No evidence that the mean cell phone rating differs for faculty and students.

1b. (10) Run a complete hypothesis test to determine if "***Students***" have a higher mean score for "***Texting***" than "***Faculty***" do. Show hypotheses, test statistic, P-value, decision, and conclusion. The data are already summarized for you, and you can use StatCrunch to do the test.

$H_0: \mu_S = \mu_F$

$H_A: \mu_S > \mu_F$

No Pool: Test Stat: $t = 6.64$

No Pool: P-Value = < 0.0001

Pooled: Same

Pooled: Same

Decision: Reject H_0

Conclusion: There is evidence that the mean Student texting rating exceeds the mean Faculty texting rating.

2. A report from www.dailydot.com states that 48% of all adult Americans have no savings. Let's believe that to be true here in Cecil County, but we will be taking a sample of size $n = 141$ residents to investigate this claim.

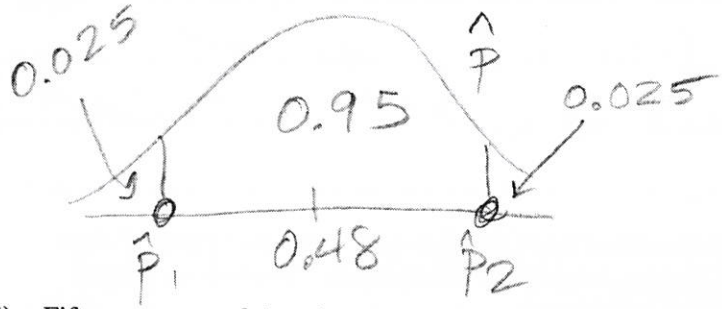
2a. (2) Determine the mean and the standard deviation for the sampling model for the sample proportion. Show calculation.

$\mu_{\hat{p}} = p = 0.48$ $\quad \sigma_{\hat{p}} = \sqrt{\frac{0.48(0.52)}{141}} \approx 0.042$

2b. (2) Using your model, what percentage (with no savings) would you need to see in your sample to make the conclusion that in Cecil County, really it's more than 48% of adults who have no savings? Justify your answer.

$\mu_{\hat{p}} + 2\sigma_{\hat{p}} = 0.48 + 2(0.042)$
$= 0.564$ (other answers OK)

2c. (2) If this claim is true in Cecil County, give the two sample proportion values that would capture the central 95% of the sampling model. Draw it and label it.



$\hat{p}_1 = 0.3977$

$\hat{p}_2 = 0.5623$

3. (3) Fifteen percent of Americans don't use the internet. At least that's what www.wired.com said. In Cecil County, we'd like to estimate the proportion of all residents who don't use the internet. What is the required sample size to ensure 99% confidence and a margin of error of 4%. Show calculation.

$n = \frac{(2.576)^2(0.15)(0.85)}{(0.04)^2} = 528.79$

so $\boxed{n = 529}$

4. (3) www.financialfreedomadvantage.com says that the mean retirement savings for people aged 35-44 is \$80,100. It was noted that this number is probably skewed high because of the few household that have large amounts of savings.

We'd like to estimate the mean retirement savings for people aged 35-44 in Cecil County. What is the required sample size to be within \$5000 with 97% confidence. Your professor estimates the standard deviation to be about \$30,000.

$n = \left[\frac{2.170(30{,}000)}{5000}\right]^2 = 169.54$

so $\boxed{n = 170}$

5. Americans average \$8,713 spent yearly on health care, according to www.pgpf.org. Let's presume the standard deviation is $\sigma = \$10{,}000$ and let's presume the shape of the distribution of "***Health Care Spending***" is very skewed to the right.

5a. (1) For the Normality of the sample mean to kick in, what needs to happen?

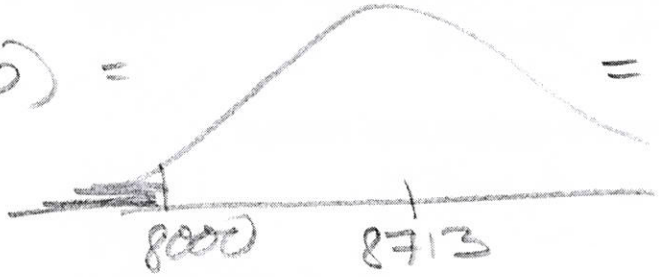
n at least 30

5b. (2) Give the mean and standard deviation of the sampling distribution model for the sample mean if we were to take repeated samples of size $n = 625$.

$\mu_{\bar{y}} = \mu_y = 8713$ $\quad \sigma_{\bar{y}} = \frac{10000}{\sqrt{625}} = 400$

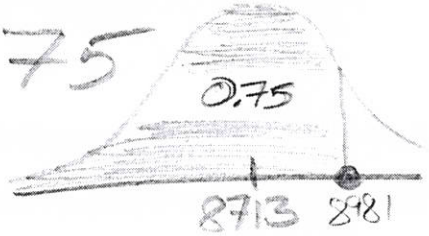
5c. (2) For $n = 625$, what percentage of samples will have a sample mean of at most \$8,000? Draw a shaded model. Label.

$P(\bar{y} \leq 8000) =$ $= 0.0373$



5d. (2) For $n = 625$, determine the 75th percentile of the sampling distribution model. Draw a shaded model. Label.

$P(\bar{y} \leq 8982.80) = 0.75$



5e. (2) Suppose we take a random sample of size 625 and obtain $\bar{y} = \$9{,}150.78$. Is that unusual? Justify.

$P(\bar{y} > 9150.78) = 0.1369$ So not really

$z = \frac{9150.78 - 8713}{400} = 1.09$ So not really

6. (5) True or False.

T (F) Larger samples lead to wider confidence intervals.
(T) F Small P-values indicate the data was statistically significant.
T (F) Gossett discovered the Student's t model while working for General Motors.
(T) F Type I errors only can occur if you reject the null hypothesis.
(T) F Those lucky enough to have population data do not have to run tests or compute intervals.

7. (6) Professor Kupe ran a hypothesis test to determine if his Facebook advertising for Uncle Web Knows Best if more effective geared towards women compared to men. He failed to reject the null hypothesis at the 5% significance level.

P-Value over 0.05

7a. What would Kupe do at the 1% level of significance?

Reject H_0 **Fail to Reject H_0** **Can't Tell**

7b. What would Kupe do at the 10% level of significance?

Reject H_0 **Fail to Reject H_0** **Can't Tell**

7c. Are the data statistically significant at the 1% level?

Yes **No** **Can't Tell**

7d. Are the data statistically significant at the 5% level?

Yes **No** **Can't Tell**

7e. Are the data statistically significant at the 10% level?

Yes **No** **Can't Tell**

7f. What kind of error could Kupe have made at the 5% level?

Type I **Type II**

Retired

8. (8) Go on StatCrunch and generate the following confidence intervals. "**2016 Calendar Year Large Survey**".

8a. Proportion of "***Females***" who have a "***Credit Card***". 95% CI: $\hat{p} = \frac{67}{110}$ ~~(51.79%, 70.03%)~~ $\hat{p} = 144/257$ (49.96%, 62.10%)

8b. Mean "***Commute***" for all Cecil College students. 96% CI: ~~(15.94 min, 19.21 min)~~ (17.42 min, 20.01 min.)

8c. Difference in the proportion of those on whose "***Living Situation***" is "***Renting***", "***Males***" vs. "***Females***".

97% CI: ~~$\hat{p}_M = \frac{19}{78}$, $\hat{p}_F = \frac{17}{110}$ (−4.03%, +21.83%)~~ $\hat{p}_M = \frac{36}{165}$, $\hat{p}_F = \frac{38}{259}$ (−1.31%, +15.6%)

8d. Mean of the difference in "***Ideal Children***" versus "***Number of Children***" by student.
You need to create a new column of differences, and let's all do "***Ideal Children***" – "***Number of Children***".

98% CI: ~~(1.68 kids, 2.16 kids)~~ (1.73 kids, 2.07 kids)

Retired –

9. Use the **"Calendar Year 2016 Personality Type"** dataset to answer this question.

Test if more than 50% of our entire college scores on the "***F***" = "***Feeling***" scale.

9a. (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.

$H_0: p = 0.50$

$H_A: p > 0.50$

Summarized Data: $\hat{p} = \frac{226}{359} = 0.6295$

Test Stat: $z = 4.91$

P-Value = < 0.0001

Reject H_0

Conditions:

VARIABLE F/T is categorical ✓

$n = 359 < 10\%$ of Cecil College? ✓

226 Successes, 133 Fails ✓ ✓

Sample Unbiased ✓

There is evidence at Cecil College, more than 1/2 of all students are "Feeling".

62.95%

9b. (2) With a sentence in context, explain the meaning of the **test statistic**: 4.91

Our $\hat{p} = 62.95\%$ is 4.91 Standard Errors above the hypothesized $p = 50\%$

9c. (2) With a sentence in context, explain the meaning of the **standard error**:

With repeated samples, we'd expect $\hat{p}$ to vary by about 2.64%.

9d. (2) With a sentence in context, explain the meaning of the **P-value**:

If at Cecil truly 50% of students were Feeling, We'd get a $\hat{p} = 62.95\%$ or one even bigger, less than 0.01% of the time.

9e. (2) With a sentence in context, explain what it'd mean if we made an **error**:

In reality, at Cecil College, 50% (or less than 50%) are Feeling.

Retired –

10. (12) Use our "**Calendar Year 2016 Library Data**" to test if the average number of "***Pages***" for the books in our entire library is ~~below~~ over 350 pages.

n = 362

It was discovered that the "***Encyclopedia of Bioethics***" was recorded in error – that book should not have been mixed in with the stacks. Remove it before proceeding. The mean should really be ~~344.51955~~ 372.558.

Run the test, show all steps. Conditions are met.

$H_0: \mu = 350$ pages

$H_A: \mu > 350$ pages

Test Stat: $t = 1.593$

P-Value = 0.056

Fail to Reject H_0

Summarized Data

$n = 362$

$\bar{y} = 372.558$

$s = 269.43$

There is no evidence to say the mean pages of all books in our library is over 350.

11. (12) Use the "***Parents***" dataset. Test if a higher proportion of "***Males***" (compared to the "***Females***")think that the best way to raise a child is to have a "***One Full, One Home***" arrangement – i.e. one parent works full time, one parent stays at home with the child.

Run the test, show all steps. Conditions are met.

$H_0: P_M = P_F$

$H_A: P_M > P_F$

Test Stat: $z = 1.73$

P-Value = 0.042

$\hat{P}_M = \frac{189}{700} = 0.27$

$\hat{P}_F = \frac{161}{700} = 0.23$

Difference = 0.04

Decision: P-Value < 0.05 so Reject H_0

Conclusion: There is evidence to say a higher % of males vote for One Full / One at Home arrangement