Name: KEY

Math 127 – Exam 3 – Fall 2016

Oath: ***"I will not discuss the exam contents with anyone on planet Earth until the answer 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.

VERSION KARDASHIAN

Testing Center Staff Instructions

1. **One sheet of handwritten or typed notes is OK.**

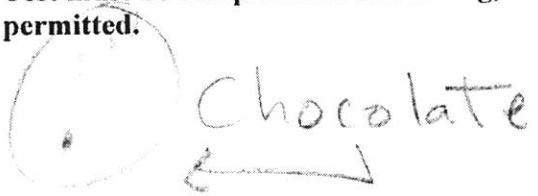
   Students may <u>not</u> use the "pink sheet" or any copied or scanned answer keys or Math 127 department documents.

2. **Collect the sheet of notes and staple it to the test when submitted.**

3. **Any calculator is OK. No cell phones.**

4. **<u>www.statcrunch.com</u> is required. All other webpages are prohibited.**

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



Student Instructions

1. **This test is graded out of 100 points and counts for 25% of your Math 127 grade.**

2. **Show work when necessary or points will be deducted. If you only report an answer and it is wrong, you will receive no credit.**

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

4. **Good luck, do your best, it was a pleasure working with you this semester.**

Retired –

1. Short Answer Hypothesis Test / Confidence Interval Problems. Use the "**Calendar Year 2016 Large Survey**" dataset for this question. We learned five types of hypothesis tests, and for **1a – 1e** below, there is one example of each.

1a. (2) Test if the mean "***Age***" of all Cecil College students is more than 22. Test statistic: $t = 1.16$

1b. (2) Test if, on average, "***Female***" "***Ideal Children***" exceeds "***Male***" "***Ideal Children***". P-value: 0.1735 (0.188 OK)

$\hat{P}_{CH} = \frac{83}{181}$ $\hat{P}_{CATH} = \frac{25}{62}$

1c. (2) Test if a higher proportion of "***Christian***" students are most motivated by "***Love***" when compared to the "***Catholic***" students. Test statistic: $z = 0.757$

1d. (2) Test if a majority of our students have a "***Credit Card***". P-value: 0.0951

$\hat{p} = \frac{226}{425}$

1e. (2) Test if the typical student at Cecil has, on average, more "***Student Loan Debt***" than "***Credit Card Debt***" by creating a new variable "***Student Loan Debt***" – "***Credit Card Debt***" and testing if the mean of the differences is positive. Test Statistic: $t = 6.31$

2. A test was run by medical researchers to determine if the proportion of patients experiencing sleeplessness using "***Tirosint***" was larger than the proportion using "***Levoxyl***". The test was run at $\alpha = 0.01$ and the researchers failed to reject the null hypothesis. PValue exceeds 0.01

2a. (2) If the test was run at the $\alpha = 0.05$ level, what would the researchers do? CAN'T TELL!

2b. (2) What kind of error could the researchers have made using $\alpha = 0.01$? Type II

2c. (2) If the researchers used the data to make either 99% or 95% intervals for the true difference in proportions, would that interval include the value 0%? YES

3. A 95% interval for the proportion of Cecil students who have taken English 101 at a different school was (19.8%, 23.2%).

3a. (2) Calculate margin of error: 1.7%

3b. (2) Calculate the sample proportion: 21.5%

Space to Calculate:

$ME = \frac{23.2 - 19.8}{2} = 1.7\%$ $\hat{p} = \frac{19.8\% + 23.2\%}{2} = 21.5\%$

3c. (2) A 94% interval would be: (Skinnier) Wider Of Equal Length Can't Tell

4. (2) A 99% interval for the true mean "***Household Size***" of Cecil College students was (??????, 4.12) and the margin of error was 0.89. Calculate the lower bound.

$$LB = UB - 2(ME) = 4.12 - (2)(0.89)$$
$$LB = 2.34$$

5. (2) We run a hypothesis test for a proportion and the test statistic ends up being 0. Then certainly, the value of $\hat{p}$ would be equal to p_0 or the hypothesized proportion.

6. (2) About half of adults are single in the USA, according to Forbes back in 2014. We will conduct a study here in the county, and need to compute the required sample size. We require 98% confidence and a margin of error of 3%. Show calculation.

$$n = \left(\frac{2.3263(0.5)}{0.03}\right)^2 = 1503.2$$

So $n = 1504$

7. (2) The average age people get married has jumped to 28 nationwide. Is it younger here in Cecil County? We will collect a sample to investigate, and we will use 95% confidence. Our estimate can be within one year of the true value, and we will use an estimated standard deviation of two years for our calculation. Show work.

$$n = \left[\frac{1.96(2)}{1}\right]^2 = 15.37$$

So $n = 16$ people

8. (1)	Statistically significant data means:	We reject H_0	We fail to reject H_0
9. (1)	Type II errors can occur when:	We reject H_0	We fail to reject H_0
10. (1)	Big test statistics go with when:	We reject H_0	We fail to reject H_0
11. (1)	Big P-values go with when:	We reject H_0	We fail to reject H_0
12. (1)	P-value = 0.0404, $\alpha = 0.01$, and:	We reject H_0	We fail to reject H_0
13. (1)	H_A: $p > 0.44$, and 95% CI (0.4392, 0.4818), and:	We reject H_0	We fail to reject H_0

14. Let us presume the proportion of all Cecil students who place importance in "***Astrological Sign***" is 28% for the whole school. We will cook up the sampling distribution model for the sample proportion for samples of size $n = 275$. No dataset for this problem.

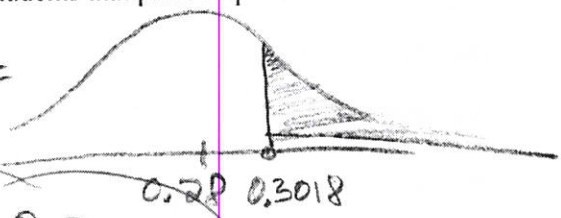
14a. (2) Determine the mean and standard deviation for the model. Round your standard deviation to three places. Show calculation.

$\mu_{\hat{p}} = p = 0.28$ $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.28(0.72)}{275}}$

$= 0.027$

14b. (2) What is the probability that a sample of 275 students has 83 or more students that place importance in "***Astrological Sign***"? Draw a shaded model to support.

$\hat{p} = \frac{83}{275} = 0.3018$ $P(\hat{p} > 0.3018) =$



$= 0.2097$

14c. (2) The 95th percentile of the distribution is 0.3244 = 32.44%. Clearly interpret this value with a sentence in the context of the problem:

With repeated samples, we'd get a $\hat{p}$ under 32.44% 95% of the time.

OR 95% of our samples have a $\hat{p}$ at most 32.44%

15. IQ scores of Cecil College students follow a Normal(101, 15) model. We will cook up the sampling distribution for the sample mean for samples of size $n = 9$.

15a. (2) Mean and standard deviation of the $\bar{y}$ model: $\mu_{\bar{y}} = 101$, $\sigma_{\bar{y}} = \frac{15}{\sqrt{9}} = 5$

15b. (2) Why is the $\bar{y}$ model Normal? Since IQ is Normal

15c. (2) P(Sample of 9 students have a mean IQ over 105) = 0.2119

15d. (2) P(Sample of 9 students have a mean IQ under 100) = 0.4207

15e. (2) 93rd Percentile of the sampling distribution: 108.38

15f. (2) Two cutpoint IQ values of $\bar{y}$ that, if the sample mean exceeded those values, would lead you to believe that at Cecil College, N(101, 15) is **not** the correct IQ model.

Cutpoint #1: 91 Cutpoint #2: 111

$\mu_{\bar{y}} \pm 2\sigma_{\bar{y}}$ is great here.

16. Test if the mean "***Copyright***" for books written by "***Females***" is newer than the mean "***Copyright***" for books written by "***Males***". Use "***Females***" as sample #1. "**Calendar Year 2016 Library Data**".

Retired -

Ignore the "***Cannot Determines***".

Uncheck the "***Pool Variances***" box.

16a. (2) Hypotheses: $H_0: \mu_F = \mu_M$ vs. $H_a: \mu_F > \mu_M$

16b. (2) Appropriate summary statistics:

	n	Mean	SD
Female:	64	1987.59	17.82
Male:	271	1983.12	21.51

Diff: 4.47 YEARS

16c. (0) Test Statistic: $t = 1.73$

16d. (2) P-value: 0.0431

16e. (2) Decision: Reject H_0 (Just use an $\alpha = 0.05$ so we all decide the same thing)

16f. (2) Conclusion, in context: There is evidence that @ Cecil's library, on average, Books written by Females are newer than Books written by Males.

16g. (2) Interpret the test statistic of $t = 1.73$ with a sentence in context: Our difference of 4.47 years was 1.73 SE above the hypothesized difference of 0 years.

16h. (2) Interpret the P-value with a sentence in context: If at Cecil there was no difference in the mean Copyrights, we'd get a sample diff. of 4.47, or one even bigger, 4.31% of the time.

16i. (2) If a Type I error were made, explain in context what that would mean: In reality, there is no difference in the mean CopyRights in our library.

16j. (2) Interpret the standard error of the difference in sample means, SE = 2.58 years: With repeated samples, we'd expect our difference to vary by about 2.58 years.

Retired

17. Test if more than 10% of the "***Males***" think "***Contraception Is Wrong***" with a one-sample test. Use the "**Calendar Year 2016 Large Survey**". Points awarded for hypotheses, summarized data, test statistic, P-value, decision, conclusion.

17a. (2) Check conditions first. Thoroughly. Sample Unbiased ✓
Contraception Categorical ✓
20 Success, 139 Fail, both exceed 10 ✓ ✓

17b. (12) Now finish off the test:

$H_0: p = 0.10$ vs. $H_A: p > 0.10$
Summarized data: $\hat{p} = \frac{20}{159} = 0.1258$
Test Stat: $Z = 1.08$
P-Value = 0.1392
Fail To Reject H_0. There is no conclusive evidence that more than 10% of our Male students think Contraception is Wrong.

Retired

18. Use a 99% confidence interval to determine if the mean "***Number of Tattoos***" for only the "***Females***" exceeds 1, "**Calendar Year 2016 Large Survey**" dataset.

18a. (2) Hypotheses: $H_0: \mu = 1$ vs. $H_A: \mu > 1$ ~~tattoo~~

18b. (2) 99% CI: (0.866 ~~tattoos~~, 1.497 ~~tattoos~~)

18c. (2) Decision: Fail to Reject H_0

18d. (2) Conclusion in context: We are not convinced that on average, Cecil Females have more than one tattoo.

19. (6) Do we have statistical evidence that at Cecil College, a higher proportion of "***Females***" "***Own***" their home, compared to the "***Males***"? Variable = "***Living Situation***" and use the "**Calendar Year 2016 Large Survey**".

Run the test. All we need is the concluding remark with a P-value included in your write up.

We are convinced that a higher % of females own, since P-value of 0.0293 is relatively small.

$\hat{p}_F = \frac{36}{259}$, $\hat{p}_F = \frac{13}{165}$

Retired

Extra Credit (10 points)

Do products typically have more "***Sugar Grams***" compared to "***Fat Grams***"?

Use the "**Calendar Year 2016 Food Bank**" dataset.

We will presume this is an unbiased sample of all grocery store products.

Run the appropriate hypothesis test to determine if we have evidence for or against the above question.

Points awarded for correct hypotheses, summarized data, test statistic, P-value, decision, and conclusion.

Dependent Samples | Sugar - Fat |

Cook Up New Variable First.

$H_0: \mu_d = 0$ vs. $H_A: \mu_d > 0$

Summarized data: $n = 142$

$\bar{y}_d = 1.768$

$s_d = 9.857$

One-Sample T test

Test Stat: $t = 2.137$

P-Value = 0.0172

Reject H_0, conclude the typical product has more Sugar than Fat, on average.

If two-sample T TEST incorrectly used, $t = 1.99$, P-Value = 0.0239

MAX 5 Points.