Name: Key

Math 127 Exam 3 Summer 2017

Version The Netherlands

Oath: *"I will not discuss the exam contents with anyone on Earth until the answer key is posted to BB."*

Sign Name: _____

Permitted Materials: One-sheet of handwritten or typed notes. No copies of published materials.
The datasets are found on www.statcrunch.com. No other webpages.
Any calculator is permitted or use the calculator found on the computers.
No cell phones on the desk. No cell phone calculators.
You must staple your sheet of notes to the exam.

Sign Name: _____

- Show all work when appropriate. StatCrunch can be used for everything unless you are explicitly asked to show a calculation.
- Points are in parentheses for each problem.
- This test is graded out of 100 points and counts for 25% of your Math 127 grade.
- The graded exams are kept on file for at least one year and students are welcome to come collect them whenever I am available in my office.
- An answer key will be posted on Blackboard on Tuesday, August 1st after the testing is completed.
- Final letter grade cutoffs will be posted to Blackboard on Tuesday, August 1st around 8 PM. Your numerical "Course Grade" on Blackboard is your final grade in Math 127 and you will know your letter grade based on my announcement. 89.5% is a guaranteed A. 79.5% for a B. 69.5% for a C. 59.5% for a D.
- Letter grades will be posted to MyCecil, but students may see WIP for a few days.
- Good luck on this exam. It has been my pleasure to work with you this semester.

1. It is estimated that 75% of Mount Hood climbers are "***Male***". We will model the sample proportion of "***Male***" climbers with a Normal model for a few scenarios.

1a. (2) For a random sample of $n = 200$ climbers, give the mean and standard deviation for the $\hat{p}$ model.

$\mu_{\hat{p}} = p = 0.75$, $\sigma_{\hat{p}} = \sqrt{\frac{0.75(0.25)}{200}} = 0.0306$

1b. (2) For a sample of $n = 200$ climbers, determine P(sample has at least 80% "***Male***") = 0.0511

1c. (2) For a sample of $n = 200$ climbers, give the 12th percentile for the sampling distribution model: 0.714

1d. (2) An unbiased sample of $n = 200$ climbers from July 2017 had 66% "***Male***". Are you surprised? Are you convinced "***Female***" climbership is on the rise? Use your model to justify your conclusion. You do **not** need to run a hypothesis test start to finish for full credit.

I use z-scores.

$z = \frac{0.66 - 0.75}{0.0306} = -2.94$ → yes, this would be evidence the % of male climbers is ↓

OR $P(\hat{p} \leq 0.66) = 0.001$, very rare

2. (3) Professor Kupe wants to estimate the mean "***Age***" of the people who live in his building. He wants to be within 2 years and is a 95%-confidence-kind-of-guy. Looking around the lobby and the elevators and by the pool, he estimates the standard deviation of "***Age***" to be about 12 years.

Solve for the required sample size to run this study. Show calculation.

$n = \left[\frac{1.96(12)}{2}\right]^2 = 138.3$

so $n = 139$ people

3. (3) Ol' Kupe wants to estimate the proportion of people in his building who are currently "***Divorced***". A margin of error of 5% will suffice, and one estimate is that about 12% of all adults are currently divorced.

Solve for the required sample size to run this study. Show calculation.

$n = \left[\frac{(1.96)^2(0.12)(0.88)}{(0.05)^2}\right] = 162.3$

so $n = 163$

ZZZ Retired

4. Use the "**Calendar Year 2017 Cell Phone Addiction**" dataset to test if under 10% of all people on their smart phones are currently playing "***Games***".

Use the variable "**App Category**" for this one.

4a. (2) Hypotheses: $H_0: p = 0.10$ vs. $H_A: p < 0.10$

4b. (3) Condition 1: App is categorical ✓

Condition 2: Presume Sample is Unbiased ✓

Condition 3: $n = 515$ is less than 10% of all local smart phone users, yes √

Condition 4: 45 success, 470 fail, both exceed 10 ✓✓

4c. (2) Summarized data: $\hat{p} = \frac{45}{515} = 0.0874$

4d. (2) Test Stat: $Z = -0.955$ P-value: 0.1699

4e. (2) Decision: Fail to Reject H_0

4f. (2) Conclusion: We do not have evidence that less than 10% of people on phones are currently playing games.

4g. (2) Interpret your test statistic with a sentence in context: Our $\hat{p} = 8.74\%$ was 0.955 standard errors below the hypothesized $p = 10\%$

4h. (2) Interpret your P-value with a sentence in context: If truly 10% of cell phone users are playing games, we'd get a $\hat{p} = 8.74\%$ or smaller about 16.99% of the time.

4i. (2) If you made an error, which kind? Type II Explain the reality of the situation, if in fact you did make an error: In reality, it is less than 10% playing games.

5. Make a bunch of confidence intervals for Cecil College students. They are all of the 95% variety.

Use the "**ZZZ Retired - Calendar Year 2017 Large Survey**" dataset.

5a. (2) CI for the true mean "***Self Confidence***" rating for our whole school: (68.24, 72.51)

5b. (2) CI for the true difference in means for "***TV Time***", "***Democrats***" vs. "***Republicans***": (-0.247 hrs, +4.950 hrs.)[1]

5c. (2) CI for the true proportion who think the "***Worst Problem***" is "***Global Warming***": (12.31%, 18.67%)

5d. (2) CI for the true difference in proportions, "***Smokers***" vs. "***Nonsmokers***" for playing the "***Lottery***": (8.73%, 32.10%)

6. Here's an interval for the proportion senior citizens who have an active Facebook account:

(49.5%, 62.1%)

6a. (2) Sample proportion: 55.8%

6b. (2) Margin of error: 6.3%

7. Here's an interval for the average number of "***Sleep Hours***" for corporate CEOs:

(5.18 hours, 6.05 hours)

7a. (2) Sample mean: 5.615 hrs.

7b. (2) Margin of error: 0.435 hrs.

8. (1) True or False: P-values depend on the sample size. True

9. (1) True or False: The width of a confidence interval depends on the sample size. True

10. (1) True or False: P(Making a Type I or Type II Error) depends on the sample size. True

[1] Don't forget to uncheck "Pool Variances"!!!

11a. (12) Run a complete test and show all the steps to determine if the typical non-perishable food has more than 400 milligrams of "***Sodium***" per serving (on average).

Use the "**ZZZ Retired - Calendar Year 2017 Food Bank**" dataset. Use ~~$n = 181$~~ data points. Reject if your P-value is less than 0.05 (in other words, use a 5% level of significance). Show hypotheses, summarized data, test statistic, P-value, decision, and conclusion in context. Conditions are met.

$H_0: \mu = 400$ vs $H_A: \mu > 400$ mg.

$n = 645$, $\bar{y} = 390.28$, $s = 286.39$

Test Stat: $t = -0.862$

P-Value $= 0.8055$

Dec: Fail to Reject H_0

Concl: No evidence whatsoever to say the mean Sodium exceeds 400 mg.

11b. (4) Professor Kupe doesn't trust the product in row 23.
Remove it, and rerun your test, still using $\alpha = 0.05$.

Revised P-value: _____

Revised decision: _____

Revised concluding remark: _____

_____

_____

Lessons learned.
Always check a graph.
Always make your conclusions with a healthy dose of skepticism.
Don't treat fixed significance level tests as holy.

Never Mind
Data Changed.

12. (12) Use the "**ZZZ Retired - Calendar Year 2017 Large Survey**" dataset to test if a higher proportion of my students think "***Marijuana***" should be "***Legal***" when compared to "***Sheppard's***" students.

Group by "***Instructor***". I am "***Kupresanin***" by the way. Conditions are met!

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

$H_0: p_{KUPE} = p_{SHEP}$ vs. $H_A: p_{KUPE} > p_{SHEP}$

$\hat{p}_K = \frac{127}{169} = 0.7515$ $\hat{p}_S = \frac{113}{180} = 0.6278$

Diff = 0.1237

Test Stat = $z = 2.492$ Dec.: Reject H_0

P-value = 0.0064

Concl: We do have evidence a higher % of Kupe students want pot legalized

13. (12) Same dataset. Now test if we exercise more than they do. "***Sheppard's***" students, that is. On average. Variable is "***Exercise Hours***" and grouping by "***Instructor***" again. Conditions are met!

Points earned for hypotheses, summarized data, test statistic[2], P-value, decision, and conclusion.

$H_0: \mu_K = \mu_S$ vs. $H_A: \mu_K > \mu_S$

	n	$\bar{y}$	s
Kupe	167	5.14	4.20
Slap	184	4.54	4.49

Diff: 0.60 hours

Test Stat: $t = 1.28$

P-Value = 0.1006

Dec: Fail to Reject H_0

Concl: We do not have evidence that on avg. Kupe's students exercise more than Sheppard's.

[2] ~~Hey. Did you uncheck "Pool Variances"? I would.~~

14. Let's cook up the sampling distribution model for the sample mean. Let's presume with certainty that the true mean "***Work Hours***" for all Cecil College students is $\mu = 21.49$ hours with a standard deviation of $\sigma = 17.59$ hours.

"***Work Hours***" is multimodal / skewed right, so we will take samples of size $n = 40$.

14a. (2) Determine the mean and standard deviation for the $\bar{y}$ model, using $n = 40$.

$\mu_{\bar{y}} = 21.49 \quad \sigma_{\bar{y}} = 2.781$

14b. (2)P(Sample of 40 students have a mean "***Work Time***" over 25 hours) = 0.1034

14c. (2) Value of the sample mean that separates the bottom 1/3 from the top 2/3 of $\bar{y}$ values: 20.29

14d. (2) Students are working less, or at least that is what is believed. Pretend you are investigating "***Work Time***" trends at Cecil. How low would your one sample mean have to be to convince you that on average, students are working less than they used to? Justify.

$21.49 - 2(2.781) =$

15.928

Extra Credit (3 points)

I have a 95% confidence interval for the mean "***IQ***" of all Cecil College students: (93.25, 111.98).

If this was based on a sample size of $n = 15$ students, solve for the sample standard deviation, s:

Must show work. No trial and error using StatCrunch shortcuts.

16.91