Name: Key **Math 127 Exam 3 Spring 2015**

Version A

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

Sign Name: Key

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: Key

- Show all work when appropriate.
- Points are in parentheses or noted for each problem.
- This test is graded out of 100 points and counts for 20% of your Math 127 grade.
- The graded exams are kept on file for at least one year and students are welcome to come see them whenever I am available in my office.
- An answer key will be posted on Blackboard shortly after the testing is completed.
- Exam grades will be posted to Blackboard by lunch time on Friday, May 8.
- Final grade announcements will be posted to Blackboard by Friday, May 8. Your numerical "Course Grade" on Blackboard is your final grade in Math 127 and you will know your letter grade based on my announcement.
- Letter grades will be posted to MyCecil, but students may see WIP for a few days.
- Good luck on this exam. Good luck in the future. It's been my pleasure to work with you this semester.

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No work needs to be shown on this page. Answers only for full credit. One point each this page.

1. Clearly circle T = true or F = false.

T	F	The P-value is the strength of the evidence against the null hypothesis.
T	F	If the P-value is less than significance level we reject H_0.
T	F	The P-value depends on the hypothesized value.
T	F	If you reject the null, the P-value is the probability of making a Type I error.
T	F	The P-value is P(the null hypothesis is false).
T	F	Margin of error must always be positive.
T	F	The best measure of spread for skewed data is the median.
T	F	Random samples and unbiased samples are the same thing.
T	F	The standard deviation must always be a nonnegative number in all cases.
T	F	Smaller sample sizes will lead to skinnier confidence intervals.

2. \$64214 We have a confidence interval for the population mean salary of all community college math professors, (\$59,604 to ?????????). Margin of error was \$4610. Determine the sample mean salary.

3. 2.4405 We have an interval for the difference in the mean IQs of females vs. males, based on data from 54 females and 59 males: (–2.487 to +2.394). Give margin of error. Do not round.

4. We have a test for a population proportion, P-value = 0.0044, hypothesized value of 65%. If we're testing for "not equals to", the sample proportion was:

   Greater Than 65% Less Than 65% Cannot Tell

5. Scientists ran a hypothesis test to determine if the mean weight of lab rats increased when fed a high fat diet. The team failed to reject the null hypothesis at the 5% level of significance. Circle the only correct choice.

What would they do at the 1% level of significance?	Reject H_0	Fail to Reject H_0	Can't Tell
What would they do at the 10% level of significance?	Reject H_0	Fail to Reject H_0	Can't Tell
Are the data statistically significant at the 1% level?	Yes	No	Can't Tell
Are the data statistically significant at the 10% level?	Yes	No	Can't Tell
What kind of error could they have made at the 1% level?		Type I	Type II

6. $t =$ 2.145 Give the t value for $\bar{y} \pm t\left(\frac{s}{\sqrt{n}}\right)$ if $n = 15$ data points, 95% confidence.

   $z =$ 1.751 Give the z value for $\hat{p} \pm z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ for 92% confidence.

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7a. (3) Only one-fourth of Americans speak a second language other than English. If we take repeated random samples of 117 people, determine the mean and standard deviation of the model for $\hat{p}$. Show your work and round to two decimal places on this problem.

$p = 0.25,\ n = 117$

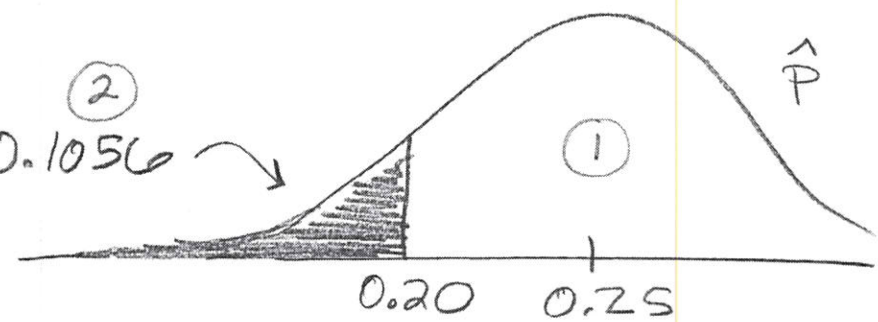
$\mu_{\hat{p}} = 0.25$ (1) $\quad \sigma_{\hat{p}} = \sqrt{\frac{0.25(0.75)}{117}} \approx 0.04$ (2)

7b. (3) What is the probability that in a sample of 117 people, one-fifth or less of respondents speak a second language. Illustrate this with a shaded diagram of the model. Give answer with 4 decimals.

$\frac{1}{5} = 0.2$

(2)

$P(\hat{p} \le 0.2) = 0.1056$



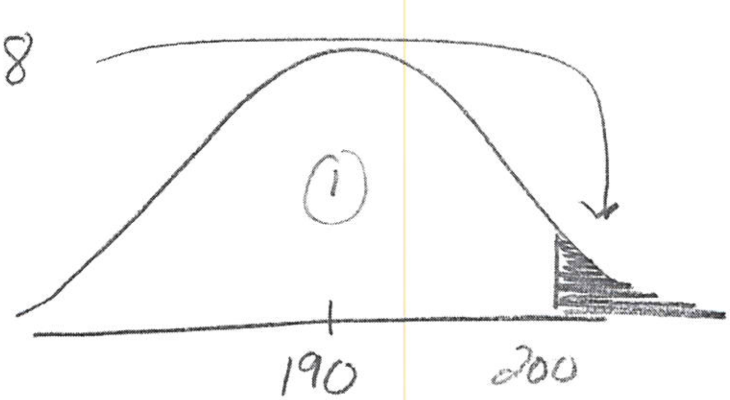
8a. (3) The mean weight of adult American men is 190 pounds with a standard deviation of 40 pounds and a skewed right distribution. If we were to take repeated samples of size $n = 64$, determine the mean and the standard deviation of the model for $\bar{y}$. Show work.

$\mu_{\bar{y}} = 190$ lbs. (1) $\quad \sigma_{\bar{y}} = \frac{\sigma_y}{\sqrt{n}} = \frac{40}{\sqrt{64}} = 5$ lbs. (2)

8b. (3) What is the probability that in a random sample of 64 men, the mean weight is at least 200 pounds? Illustrate this with a shaded diagram of the model. Give Answer with 4 decimals.

$P(\bar{y} \ge 200) = 0.0228$

(2)



ZZZ Retired

9. Open up the "**Calendar Year 2015 Large Survey**" dataset (piano). We would like to test if the mean ideal "***Marriage Age***" is higher for males than it is for females.

9a. (2) Give the appropriate summary stats needed to run this test.

Males: $n = \cancel{39}$ 97, $\bar{Y} = \cancel{26.795}$ 26.67 (1/2), $S = \cancel{2.536}$ 2.639 (1/2) 2.741

Females: $n = \cancel{73}$ 217, $\bar{Y} = \cancel{25.671}$ 25.57 ~~(1/2)~~, $S = 2.\cancel{824}$ ~~(1/2)~~

9b. (2) We believe the samples are unbiased, the 10% condition is met and that the variables are quantitative. What is the fourth condition and explain how it is met.

Sample Size: both exceed 30 ✓✓ (2)
(Normality Debatable)

9c. (2) Hypotheses: $H_0: \mu_m = \mu_F$ vs. $H_A: \mu_M > \mu_F$ (2)

9d. (4) Give the test statistic and the P-value. Technology is OK. Big hint #1: Uncheck "pool variances". Big hint #2: Degrees of freedom for this test will be ~~85.272737~~. 191.8569

Test Stat: $t = \cancel{2.146}$ (2) 3.377

P-Value $= \cancel{0.0174}$ (2) 0.0004

9e. (1) At the 1% significance level, what is the decision? ~~Fail to~~ Reject Ho (1)

9f. (2) Write a conclusion in context if the test is run at the 1% significance level:

We have ~~No~~ evidence at the 1% level to say the mean ideal marriage age is higher for males than it is for females. (2)

9g. (1) At the 5% significance level, what is the decision? Reject Ho (1)

9h. (2) Write a conclusion in context if the test is run at the 5% significance level:

There is evidence to say that the mean ideal marriage age for males is higher than it is for females. (2)

Not on Exam 3 any longer

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10. A linear regression equation was fit to a sample of hip surgery patients. The explanatory variable was x = "*Age*" of the patient. The response variable was y = "***Recovery Time in Days***". The data can be found in "**Hip Surgery Outcomes**", but is not needed to answer this question. All conditions are met for linear regression. The StatCrunch output is supplied below:

> **Simple linear regression results:**
> Dependent Variable: Recovery (in days)
> Independent Variable: Age
> Recovery (in days) = –15.92 + 0.613 Age
> Sample size: 209
> R (correlation coefficient) = 0.412
> R-sq = 0.1694
> Estimate of error standard deviation: 5.34

10a. (3) Interpret the slope with a sentence in context: For each year older a patient gets, we expect recovery time to increase by 0.613 days.

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10b. (3) Interpret R^2 with a sentence in context: 16.94% of the variation in Recovery time can be explained by knowing AGE. (83.06% is explained by other variables).

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10c. (3) Interpret S_e with a sentence in context: On average, our predictions for Recovery time are off by 5.34 days.

3

10d. (3) Interpret the y-intercept with a sentence in context: You can't. It makes no sense whatsoever for a 0 year-old patient to have a negative 15.92 day recovery.

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10e. (3) Professor Kupe is 37 years old. Predict his recovery time: 6.761 days.

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ZZZ Retired -

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11. Open up the "**Calendar Year 2015 Large Survey**" dataset (piano). We would like to test if less than 25% of all Cecil College "***Females***" use "***Pinterest***" "***All the time***".

11a. (2) Hypotheses: H_0: $p = 0.25$ (1) H_A: $p < 0.25$ (1)

48/228 = 0.2105

11b. (2) Give the value of the sample proportion, fraction and percentage: $\hat{p} = \frac{\cancel{19}}{\cancel{82}} = \cancel{0.2317}$ (2)

11c. (2) We will use a 95% confidence interval to run this test. Give the 95% confidence interval:

~~(0.1404, 0.3230)~~ or ~~(14.04%, 32.3%)~~

(0.1576, 0.2634) (2) (15.76%, 26.34%)

0.0529

11d. (2) What is the margin of error of your interval? ~~0.0913~~ (2) (Answer only)

11e. (2) Decision: Reject H_0 Fail to Reject H_0 (2)

11f. (2) Write a conclusion in context. There is no evidence that less than 25% of all Cecil College females use pinterest all the time (2)

12. (3) Today 17% of Americans are blue-eyed. This is down from a century ago when nearly half of all Americans were blue-eyed. We are going to collect some data to determine the proportion of blue-eyed people in Cecil County. There are approximately 102,000 resents in Cecil County, far too many to take a census, so we will answer this question with a confidence interval. If we would like to be 99% confident and require a 4% margin of error, determine the required number of residents we will need to survey. Give formula, calculation and answer below.

$$n = \frac{z^2 \hat{p}(1-\hat{p})}{(ME)^2} = \frac{(2.576)^2(0.17)(1-0.17)}{(0.04)^2} = 585.2$$

So $n = 586$

$\boxed{(-1) \text{ For } n = 1037}$ (3)

13. (3) A nurse wanted to determine his own true mean resting heart rate to within two beats with 95% confidence. If his standard deviation is approximately six beats, on how many randomly selected mornings should he take a measurement? Give formula, calculation and answer below.

$$n = \left(\frac{z\,(\text{SD Estimate})}{ME}\right)^2 = \left(\frac{1.96(6)}{2}\right)^2 = 34.57$$

(3)

So $n = 35$

14. Use the "**Flight Delays**" dataset. We'd like to test if the mean "***Delay***" in minutes is greater than 0 for all flights leaving the Bradley International Airport (Airport = BDL). A positive-valued "***Delay***" means the flight departed late. A negative-valued "***Delay***" means the flight left early. The dataset is a random sample of all flights leaving from the two airports.

14a. (2) Hypotheses: H_0: $\mu = 0$ mins (1) H_A: $\mu > 0$ mins (1)

14b. (1) Summarized Data: $\bar{Y}_{BDL} = 0.656$ (1/2), $S_{BDL} = 8.194$ (1/2)

14c. (1) What condition must be met since the shape of the distribution of "***Delay***" for BDL is skewed right? Is it met? n must exceed 30. n=32 ✓ (1)

14d. (2) Test Statistic: $t = 0.453$ (1) P-value: 0.3268 (1)

14e. (2) Decision using a 5% significance level: Fail to Reject H_0 (2)

14f. (2) Concluding remark using a 5% significance level: No evidence to say that flights leaving BDL are, on average, late. (2)

Double Check: Did you run the test for all airports or just the Bradley International Airport as required?

14g. (3) Interpret your test statistic with a sentence in the context of the problem: Our $\bar{Y} = 0.656$ mins late was 0.453 standard errors above the hypothesized 0. (3)

14h. (3) Interpret your P-value with a sentence in the context of the problem: If flights leave BDL on time on average, we'd get a $\bar{Y} = 0.656$ or one even higher, 32.68% of the time. (3)

14i. (3) If you made an error, what type? What would that mean in the context of the problem? Type II. It means that in reality, BDL flights leave, on average, late. (3)