Name: Key **Math 127 Exam 3 Summer 2014**

Oath: ***"I will not discuss the exam contents with anyone until it is returned to me by my instructor"***

Sign Name: Key

Show all work when appropriate. Points are in parentheses. This test is graded out of 100 points and counts for 20% of your Math 127 grade.

Thanks for a nice semester. Best wishes.

The graded exams are kept on file for at least one year in my office and students are welcome to come see them whenever I'm available in my office.

An answer key will be posted to Blackboard shortly after the testing is completed.

A

1. Suppose Kupe averages \$61.11 spent when shopping at Aldi and the standard deviation is \$19.25. You can presume these figures to represent the population of all of his purchases at Aldi during the past 7 years. The amount he spends each trip to his favorite store are well-modeled with a Normal distribution.

1a. If we were to take repeated random samples of size 10, determine the mean and standard deviation for the sampling distribution model for the sample mean. (4)

$\mu_{\bar{y}} = \mu_y = 61.11$ $\qquad$ $\sigma_{\bar{y}} = \frac{\sigma_y}{\sqrt{n}} = \frac{19.25}{\sqrt{10}} \approx 6.087$

1b. What percentage of samples will have a sample mean of at most \$60? (2) 0.4277

1c. What percentage of samples will have sample means of at least \$50? (2) 0.9660

1d. Suppose we take a random sample of his receipts and obtain $\bar{y} = \$65.92$. Is that unusual? Justify. (2)

$P(\bar{y} \geq 65.92) = 0.2147$ so no.

OR $z = \frac{65.92 - 61.11}{6.087} = 0.7902$ st. dev. above 61.11, so no.

2a. We'd like to estimate the proportion of vehicles on Route 40 that are pickup trucks. We want to be 99% confident and we want a margin of error of 2.5%. Determine the sample size needed presuming that in rural areas, about 27% of vehicles on the road are pickup trucks. Show calculation. (4)

$$n = \frac{2.576^2(0.27)(0.73)}{(0.025)^2} \approx 2092.6$$

So 2093 vehicles!

2b. Reducing the confidence level to 90% would reduce the required sample size to? (2)

$$n = \frac{1.645^2(0.27)(0.73)}{(0.025)^2} \approx 853.4$$

so 854 vehicles!

777 Retired - Calendar Year 2014
Large Survey

3. This problem involves opinions on whether or not creationism should be taught in the schools. In the ~~"**Large Survey Math 127**"~~ dataset, let's test if a higher proportion of "***Christians***" think that students "***Should Hear Both Sides***" when compared to the "***Nones***".

Make a contingency table for Row = Creationism and Column = Religion to summarize your data and pull what numbers you might need to run this test. Presume conditions are met.

3a. Hypotheses: (2) $H_0: p_C = p_N$ vs. $H_A: p_C > p_N$

3b. Summarized data including the difference in sample proportions: (2)

$\hat{p}_C = \frac{\cancel{35}\ 88}{\cancel{49}\ 114} = \cancel{0.7143}\ 0.7719$ $\hat{p}_N = \frac{\cancel{19}\ 47}{\cancel{32}\ 79} = \cancel{0.5938}\ 0.5949$

$\hat{p}_C - \hat{p}_N = \cancel{0.1205}\ 0.177$

3c. Test statistic: (1) $Z = \cancel{1.125}\ 2.637$ P-value: (1) ~~0.1303~~ 0.0042

3d. Decision at the 5% significance level: (2) ~~Fail to~~ Reject Ho

3e. Concluding remark in the context of the problem: (2) ~~Not enough~~ there is evidence to say a higher proportion of Christians think students should hear both sides.

3f. If an error was made, what type, and what would that mean is true in reality? (2) ~~Type II~~ Type I

In reality, ~~a higher~~ the proportion of Christians do think students should hear both sides. is the same as for the "Nones"

4. A hypothesis test was run. the decision was "Fail to reject H_0" at the 10% significance level. (4)

4a. What would you do at the 5% significance level? Fail to Reject Ho

4b. What would you do at the 1% significance level? Fail to Reject Ho

4c. Are these data statistically significant? No

4d. Say we're testing H_0: $p = 0.74$. Would any reasonable (90% / 95% / 99%) confidence interval contain the value 0.74?

Yes No Can't Tell

5. 62% of McDonald's morning customers order coffee. We will presume today is just like any other day and we expect 600 morning customers each and every morning.

5a. Determine the mean and the standard deviation of the model for $\hat{p}$. Show work. Round to **four** decimals on everything in this problem, so that ol' Professor Kupe can have one answer key. (4)

$\mu_{\hat{p}} = p = 0.62$ $\sigma_{\hat{p}} = \sqrt{\frac{0.62(0.38)}{600}} \approx 0.0198$

5b. Determine $P\left(\hat{p} > \frac{2}{3}\right) =$ 0.0092. No picture needed. (2)

5c. Explain in words what $P\left(\hat{p} > \frac{2}{3}\right)$ means. (2) Probability that our sample of 600 people had more than 2/3 order coffee.

"Probability that p-hat is greater than two-thirds" does not count for any credit.

6. A doctor wants to determine her own true mean resting heart rate to within two beats with 95% confidence. If her standard deviation is approximately three beats, on how many randomly selected mornings should she take a measurement? Show calculation. (4)

ME = 2
z = 1.96
St. Dev. ≈ 3

$n = \left[\frac{1.96 \times 3}{2}\right]^2 \approx 8.6$

so n = 9 mornings

7. 510 Americans were polled on whether or not they have skipped work dishonestly. A certain unknown number said "Yes". A confidence interval was created to estimate a range of plausible values for all Americans who would say "Yes": (29.242%, 37.425%).

How many in the sample said "Yes"? (3)

$\hat{p} = 33.333\%$
$\times 510 \approx$ ~~170~~ 170

ZZZ Retired - Calender Year 2014 Large Survey

8. Are we convinced that the average height of all Cecil College males is under 6 feet tall (72 inches)? Use the "~~**Large Survey Math 127**~~" dataset and presume all conditions are met.

8a. Hypotheses: (2) $H_0: \mu = 72$ inches vs. $H_A: \mu < 72$ inches

8b. Appropriate summary statistics: (2) 71.038" 3.358"

$n = \cancel{47}$ 106, $\bar{y} = \cancel{70.894}$", $s = \cancel{3.031}$"

-2.95

8c. Test Statistic: (1) $T = \cancel{-2.503}$ P-value: (1) ~~0.008~~ 0.002

8d. Decision and concluding remark in context: (2) Reject Ho.

There is evidence the mean height for males at CC is under 6' tall.

8e. Interpret the value of your test statistic from above with a sentence in context: (2)

71.038" 2.95

Our $\bar{y} = \cancel{70.894}$" is ~~2.503~~ standard errors below the hypothesized 72".

8f. The standard error of the test statistic is ~~0.442~~ 0.326. Explain what this value means in the context of the problem. (2)

With repeated samples, we expect $\bar{y}$ to vary by about ~~0.442~~" 0.326".

8g. Give a range of plausible values for the true mean height of all Cecil College males. Use 95% confidence. (2)

(~~70.004"~~, ~~71.783"~~)

(70.391", 71.684")

9a. Use the "**Bachelor's Degree Institutions**" dataset.

Show all steps (assume conditions met) to test if a majority of all colleges in this country are "***4-yer, Private not-for-profit***". Make sure you get the right group, many of the "***Types***" look similar. (12 points)

(2) $H_0: p = 0.5$

$H_A: p > 0.5$

(2) $\hat{p} = \frac{243}{468} = 0.5192$

(2) Test Stat: $z = 0.8321$

(2) P-Value : 0.2027

(2) Decision : Fail to Reject Ho.

(2) Conclusion : No evidence ~~that~~ a majority of all colleges in US are 4-year, "Private, Not for Profit".

9b. Interpret your P-value with a sentence in the context of the problem. (3)

IF 50% of colleges are 4-year -----, we'd get $\hat{p} = 51.92\%$ or even higher, 20.27% of the time. (Not very unusual).

10. Use the "**Smoking Mothers**" dataset. Assume the conditions are met for inference. These are two groups of women who had babies and then later, it was determined whether or not the mother smoked cigarettes during the pregnancy.

Run a complete hypothesis test to determine if non-smokers have babies with a higher mean weight compared to smokers. Show all steps. (12 points)

(2) $H_0: \mu_{NON} = \mu_{SMOKERS}$

$H_A: \mu_{NON} > \mu_{SMOKERS}$

Diff: $\bar{Y}_{NON} - \bar{Y}_{SMOKE} =$ 725 g.

Summary Stats:

(2) $\bar{Y}_{NON} = 3588$, $S = 597.42$, $n = 35$

$\bar{Y}_{SMOKERS} = 2863$, $S = 956.62$, $n = 22$

(2) Test Stat: $t = 3.186$

(2) P-Value: 0.0016

(2) Decision: Reject Ho.

(2) Concl: There is statistical evidence that non-smoking mothers have heavier babies, on average, than smokers do.

11. Open up the "**MLB Salaries 2010 and 2011**" dataset. Each team (use all 30) has two measurements, "***2010 Team Salary***" and "***2011 Team Salary***" in millions of dollars.

Run a complete hypothesis test to determine if the mean difference in salary is positive, taking 2011 Salary – 2010 Salary as our variable. This would indicate that, on average, teams were significantly increasing their pay going into year 2011.

You will need to take a column of differences to run this test. Show all steps. Assume all conditions are met. (12 points)

Variable is: 2011 − 2010 Salary

$H_0: \mu_{DIFF} = 0$

$H_A: \mu_{DIFF} > 0$

Summary Stats: $\bar{Y} = 1.973$

$S = 17.74$

$n = 30$

Test Stat: $T = 0.6092$

P-Value $= 0.2736$

Decision: Fail to Reject H_0.

Conclusion: No evidence to say that teams paid more in 2011 compared to 2010, on average.