**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Math 127 Exam 3 Fall 2014**

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

**Sign Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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. Don’t forget to sign up for Math 128 in Spring 2015.

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

**1a. (2)** ISFJ (The Protector) is the most common personality type making up 14% of the general population. If we take repeated random samples of 200 people, determine the mean and standard deviation of the model for . Show your work and round to three decimal places on everything in this problem.

**1b. (2)** The correct model for  is the Normal model. Presuming we have unbiased samples, the 10% condition is met, and personality type being categorical, what is the final condition that needs to be met for Normality to kick in? Show that it is met.

**1c. (2)** What’s the probability of getting a sample of 200 people with 40 or more ISJFs? Show shaded Normal model.

**2.** Open up the “**ZZZ Retired -** **Fall 2014** **Personality Types**” dataset. Construct a 98% confidence interval for the proportion of Cecil students that are Extraverted.

**2a. (2)** Confidence Interval: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2b. (2)** We would like to test the claim that the majority of Cecil students are Extraverted.

Hypotheses:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2c. (2)** Based on your confidence interval, make a decision and concluding remark in context. Justify your answer with complete sentences in the context of the problem.

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**2d. (2)** What is the margin of error in your interval? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2e. (2)** What two things could we do to reduce the margin of error?

Thing 1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Thing 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3.** Professor Sheppard is an ESFJ (The Provider).ESFJ is the second most common type in the population. ESFJs make up: 12% of the general population, **17% of women**, and 8 % of men. Continue with the “**ZZZ Retired -** **Fall 2014** **Personality Types**” dataset.

Run a hypothesis test to determine if the proportion of **women** at Cecil College that are ESFJ differs from the proportion in the general population of **women**.

**3a. (2)** Hypotheses: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3b. (1)** Summarized data from the sample:

**3c. (2)** Test statistic: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P-value: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3d. (1)** Decision at the 5% significance level: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3e. (2)** Concluding remark in the context of the problem: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Now run a two-sample hypothesis test to determine if the proportion of **women** at Cecil College that are ESFJ is higher than the proportion of **men** at Cecil College that are ESFJ.

**3f. (2)** Hypotheses: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3g. (1)** Summarized data including the difference in sample proportions:

**If the conditions are met, run the test:**

**3h. (2)** Test statistic: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P-value: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3i. (1)** Decision at the 5% significance level: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3j. (2)** Concluding remark in the context of the problem: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**If the conditions are not met, explain why (5):**

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**4.** Continue with the “**ZZZ Retired - Fall 2014** **Personality Types**” dataset. Run a hypothesis test to determine if people who are “***Judging***” are older on average than people who are “***Perceiving***”.

**4a. (2)** Hypotheses: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4b. (1)** Summarized data from the samples including the difference in the sample means:

**4c. (2)** Test statistic: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P-value: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4d. (1)** Decision: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4e. (2)** Concluding remark in the context of the problem: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**4f. (2)** What is the probability you’ve made a Type I error? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4g. (2)** Explain with a sentence in the context of the problem the meaning of the test statistic:

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**5. True or False.** In hypothesis testing…**(1 point each)**

**I.** T F The P-value is the strength of the evidence against the null hypothesis.

**II.** T F The P-value depends on the significance level.

**III.** T F The P-value depends on the data.

**IV.** T F The P-value is P(making a Type I error, if you decided to reject the null hypothesis).

**V**. T F The P-value is P(the null hypothesis is true).

**VI.** T F The P-value is a conditional probability.

**6.** Americans average $861 on Christmas gifts each year with a standard deviation of $212, based on one research institution. Make no assumptions about the shape of the distribution for the amount Americans spend on Christmas gifts.

**6a. (2)** If we were to take repeated random samples of size 10, what condition would we need to confirm in order to model the sample mean with a Normal model?

**6b. (2)** With repeated samples of size 90, determine the mean and standard deviation for the sampling distribution for the sample mean. Show work, round the standard deviation to two decimals.

**6c. (2)** For *n* = 90, what percentage of samples will have a sample mean of at most $850? Draw picture.

**6c. (2)** For *n* = 90, give the two values for *y*-bar that will capture the central 92% of the sampling distribution model. Draw picture.

**6d. (2)** Suppose we take a random sample of size 90 and obtain . Is that unusual? Justify.

**7. (2)** We are going to collect some data in the county – we’d like to know what proportion of households have dogs. There are 42,113 households total, far too many to take a census. A survey done by the ASPCA claims approximately 42% of all households in America have dogs. If we’d like to be 95% confident and require a 3% margin of error, determine the required number of households we will need to survey.

**8. (2)** A doctor wants to determine her own true mean resting heart rate to within one beat with 99% confidence. If her standard deviation is approximately three beats, on how many randomly selected mornings should she take a measurement? Show calculation.

**9.** Based on a random sample of 40 Cecil students, a 98% confidence interval for the average number of credits students are taking is (8.2 credits, ?????? credits) with a margin of error of 2.18 credits.

**9a. (2)** Determine the sample mean.

**9b. (2)** Determine the upper boundary of the interval.

**9c. (2)** Determine the critical *t* value that was used in the confidence interval formula.

**10. (2)** In Professor Sheppard’s class the average score on Exam 2 was a 66.52 and the standard deviation was 14.43. Pretending you are in her class, you have forgotten your score on Exam 2 but recall that your *z*-score is 1.38. Find your score on Exam 2. Show calculation.

**11.** Scientists ran a hypothesis test to determine if the proportion of lab rats that found the cheese in a maze increased if the lab rats were given multiple injections of growth hormones. The team rejected the null at the 1% level of significance. **(1 point each)**

Circle the only correct choice for each row:

What would they do at the 5% level of significance? Reject H0 Fail to Reject H0 Can’t Tell

What would they do at the 10% level of significance? Reject H0 Fail to Reject H0 Can’t Tell

Are the data statistically significant at the 1% level? Yes No Can’t Tell

Are the data statistically significant at the 5% 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

**12. (2)** All classes, use the “**ZZZ Retired -** **Large Survey Math 127**” dataset. What condition is not met if we’d like to test if more than 5% of all Cecil students are Buddhists? The variable is “***Religion***”. Be clear and show it is not met.

**13. (2)** Cecil County ran the following test to determine if the mean income per household has decreased from $70,000. The sample mean from *n* = 191 households was  and the P-value of the test was 0.014.



Interpret the P-value with a sentence in the context of the problem: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**14a.** Use the “**Tuesday Men’s Handicap**” dataset. Each week three games are bowled. Is there evidence that the mean score for **Game 1** exceeds 1000? This would indicate that for Game 1, individual bowlers are averaging over 200, since there are five dudes per team. Show all steps of the hypothesis test. Run the test using . Treat this sample dataset as an unbiased representation of the bowlers in this league. You can assume the conditions are met. **(12 points)**

**14b. (2)**If you made a mistake above, what type? Circle: Type I Type II Type III

**14c. (2)**Explain with a sentence in context what it would mean if you did make this mistake.

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**14d. (2)**The standard error was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Explain what number means with a sentence in context.

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