**EXERCISE SET 4 (DUE 23:00 UTC SUNDAY JUNE 29)**

This exercise set is worth 15 points. The normal curve applet can be found here:

<http://www.stat.berkeley.edu/~stark/Java/Html/NormHiLite.htm>

The *t* curve applet can be found in Fig 30-1 of Chapter 30:

<http://www.stat.berkeley.edu/~stark/SticiGui/Text/zTest.htm>

If a problem asks for an approximation, please use the methods described in the video lecture segments. Unless the problem says otherwise, please give answers correct to one decimal place according to those methods.

Some of the problems below are about simple random samples. If the population size is not given, you can assume that the correction factor for standard errors is close enough to 1 that it does not need to be computed.

**Please use the 5% cutoff for *P*-values unless otherwise instructed in the problem.**

In a study of the effect of a medical treatment, a simple random sample of 300 of the 500 participating patients was assigned to the treatment group; the remaining patients formed the control group.   
  
When the patients were assessed at the end of the study, favorable outcomes were observed in 162 patients in the treatment group and 97 patients in the control group.   
  
Did the treatment have an effect, or is this just chance variation? Perform a statistical test, following the steps in Problems 1A-1D.

PROBLEM 1A

(1/1 point)

The null hypothesis is (pick the best among the options):

Top of Form

The treatment has an effect which could be good or bad.The treatment has a good effect.The treatment has no effect. The treatment has no effect. - correctThe treatment has a bad effect.

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**EXPLANATION**

“Null” = nothing is going on other than chance variation

**Hide Answer**Reveal Answer

*You have used 1 of 1 submissions*

PROBLEM 1B

(2/2 points)

Under the null hypothesis, the SE of the difference between the percents of favorable outcomes in the two groups is about \_\_\_\_\_\_\_%.



4.6- correct

4.6

https://d3me1lu76xxzkb.cloudfront.net/static/images/spinner.bc34f953403f.gif

4.55

**EXPLANATION**

162/300 = 0.54; sqrt(.54\*.46/300) = 0.0288 = 2.88%

97/200 = 0.485; sqrt(.485\*.515/200) = 0.0353 = 3.53%

SE of the difference = sqrt(2.88^2 + 3.53^2) = 4.55

**Hide Answer**Reveal Answer

*You have used 1 of 2 submissions*

PROBLEM 1C

(2/2 points)

The z statistic is closest to

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0.81.01.2 1.2 - correct1.41.61.82.0

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**EXPLANATION**

Observed difference is 54% - 48.5% = 5.5%

z = (5.5 - 0)/4.55 = 1.209

**Hide Answer**Reveal Answer

*You have used 1 of 2 submissions*

PROBLEM 1D

(1/1 point)

The conclusion of the test is (pick the better of the two options)

Top of Form

The observed difference is due to chance. The observed difference is due to chance. - correctThe treatment has an effect.

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**EXPLANATION**

The two-sided P is over 22%; the one-sided P is 11% which is pretty substantial too.

**Hide Answer**Reveal Answer

*You have used 1 of 1 submissions*

In a simple random sample of 250 father-son pairs taken from a large population of such pairs, the mean height of the fathers is 68.5 inches and the SD is 2.5 inches; the mean height of the sons is 69 inches and the SD is 3 inches; the correlation between the heights of the fathers and sons is 0.5.

In the population, are the sons taller than their fathers, on average? Or is this just chance variation? Follow the steps in Problems 2A-2B.

PROBLEM 2A

(2/2 points)

The SE of the mean difference between heights of fathers and sons in the sample is closest to

Top of Form

3.905 inches2.784 inches0.247 inches0.176 inches 0.176 inches - correct

Bottom of Form

**EXPLANATION**

SD of 250 differences between heights of father-son pairs is approximately:

sqrt(2.5^2 + 3^2 - 2\*0.5\*2.5\*3) = 2.784 inches

SE of the mean difference in the sample is approximately 2.784/sqrt(250) = 0.176 inches

**Hide Answer**Reveal Answer

*You have used 2 of 2 submissions*

PROBLEM 2B

(2/2 points)

Which of the following most closely represents the result of the test?

Top of Form

The result is not statistically significant, so we conclude that it is due to chance variation.The result is not statistically significant, so we conclude that the sons are taller than their fathers, on average.The result is highly statistically significant, so we conclude that the sons are taller than their fathers, on average. The result is highly statistically significant, so we conclude that the sons are taller than their fathers, on average. - correctThe result is highly statistically significant, so we conclude that it is due to chance variation.

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**EXPLANATION**

Observed difference between means = 0.5 inches;

z = (0.5 - 0)/0.176 = 2.841

One-sided P is approximately 0.225% which is less than 1%, so the result is highly statistically significant.

The conclusion is that we’re seeing a real effect; if chance error were the only reason for the result, then something extremely unlikely has happened.

**Hide Answer**Reveal Answer

*You have used 1 of 1 submissions*

A group of scientists is studying whether a new medical treatment has an adverse (bad) effect on lung function. Here are data on a simple random sample of 10 patients taken from a large population of patients in the study. Both variables are measurements, in liters, of the amount of air that the patient can blow out (this is a very rough description of a well-defined measure). The bigger a measurement is, the better the lung function. The “baseline” measurement was taken before the treatment, and the “final” measurement was taken after the treatment.

**Baseline**           **Final**

4.19                     4.17

4.52                     4.20

4.50                     4.53

3.90                     3.95

4.33                     4.15

4.30                     4.19

3.94                     3.96

4.35                     4.26

4.21                     4.07

4.17                     3.93

In case you need summary statistics, here are some that are commonly used; the SDs have *n-1* = 9 in the denominator.

Baseline: mean 4.241, SD 0.2065

Final: mean 4.141, SD 0.1798

Correlation between baseline and final: 0.8055

Perform a one-sided test at the 5% level, following the steps in Problems 3A-3C.

PROBLEM 3A

(2 points possible)

Based on the information given, which test should you perform?

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binomial test for the fairness of a coin one-sample z test for a population mean (quantitative varibale; not proportions of zeros and ones)one-sample t test for a population meantwo-sample z test for the difference between population means, based on independent samplestwo-sample z test for the effect of a treatment, applied to the results of a randomized controlled experiment two-sample z test for the effect of a treatment, applied to the results of a randomized controlled experiment - incorrect

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**EXPLANATION**

The data are paired, so this will be a one-sample test; this rules out the fourth and fifth options. There are only 10 observations, so the probabilities for sample means need not be normal; this rules out the second option. You can’t use the t since there’s no assumption about the underlying normality of the variables; this rules out the third option. The only thing left is to compare the results to tosses of a coin. Define a “head” to be a patient whose score goes down after treatment; then you’re testing whether the number of heads is like the result of tossing a coin 10 times, or whether there are too many heads for “coin tossing” to be a reasonable conclusion.

**Hide Answer**Reveal Answer

*You have used 2 of 2 submissions*

PROBLEM 3B

(2/2 points)

The P-value of the test is

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less than 1%between 1% and 5%between 5% and 10%between 10% and 15%between 15% and 20% between 15% and 20% - correct

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**EXPLANATION**

In 7 of the 10 pairs, the patient’s score went down. So you want the chance of 7 or more heads in 10 tosses of a coin. That’s 17.19%.

**Hide Answer**Reveal Answer

*You have used 2 of 2 submissions*

PROBLEM 3C

(1/1 point)

The conclusion of the test is:

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The treatment had a bad effect.The results are due to chance variation. The results are due to chance variation. - correct

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**EXPLANATION**

Large P

**Hide Answer**Reveal Answer

*You have used 1 of 1 submissions*