## Feedback — Quiz 4[Help](https://class.coursera.org/statinference-005/help/quizzes?url=https%3A%2F%2Fclass.coursera.org%2Fstatinference-005%2Fquiz%2Ffeedback%3Fsubmission_id%3D59865)

You submitted this quiz on **Tue 7 Oct 2014 8:02 PM PDT**. You got a score of **11.00** out of **11.00**. However, you will not get credit for it, since it was submitted past the deadline.

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### Question 1

A pharmaceutical company is interested in testing a potential blood pressure lowering medication. Their first examination considers only subjects that received the medication at baseline then two weeks later. The data are as follows (SBP in mmHg)

| **Subject** | **Baseline** | **Week 2** |
| --- | --- | --- |
| 1 | 140 | 132 |
| 2 | 138 | 135 |
| 3 | 150 | 151 |
| 4 | 148 | 146 |
| 5 | 135 | 130 |

Consider testing the hypothesis that there was a mean reduction in blood pressure? Give the P-value for the associated two sided test.

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.05 |  |  |  |
| 0.10 |  |  |  |
| 0.043 |  |  |  |
| 0.087 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

*H*0:*μd*=0 versus *H*0:*μd*≠0 where *μd* is the mean difference between followup and baseline.

bl <- c(140, 138, 150, 148, 135)

fu <- c(132, 135, 151, 146, 130)

t.test(fu, bl, alternative = "two.sided", paired = TRUE)

Paired t-test

data: fu and bl

t = -2.262, df = 4, p-value = 0.08652

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-7.5739 0.7739

sample estimates:

mean of the differences

-3.4

Note the equivalence with this

t.test(fu - bl, alternative = "two.sided")

One Sample t-test

data: fu - bl

t = -2.262, df = 4, p-value = 0.08652

alternative hypothesis: true mean is not equal to 0

95 percent confidence interval:

-7.5739 0.7739

sample estimates:

mean of x

-3.4

Note the difference if the test were one sided

t.test(fu, bl, alternative = "less", paired = TRUE)

Paired t-test

data: fu and bl

t = -2.262, df = 4, p-value = 0.04326

alternative hypothesis: true difference in means is less than 0

95 percent confidence interval:

-Inf -0.1951

sample estimates:

mean of the differences

-3.4

### Question 2

A sample of 9 men yielded a sample average brain volume of 1,100cc and a standard deviation of 30cc. What is the complete set of values of *μ*0 that a test of *H*0:*μ*=*μ*0 would fail to reject the null hypothesis in a two sided 5% Students t-test?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 1080 to 1120 |  |  |  |
| 1031 to 1169 |  |  |  |
| 1081 to 1119 |  |  |  |
| 1077 to 1123 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

This is the 95% student's T confidence interval.

1100 + c(-1, 1) \* qt(0.975, 8) \* 30/sqrt(9)

[1] 1077 1123

Potential incorrect answers

1100 + c(-1, 1) \* qnorm(0.975) \* 30/sqrt(9)

[1] 1080 1120

1100 + c(-1, 1) \* qt(0.95, 8) \* 30/sqrt(9)

[1] 1081 1119

1100 + c(-1, 1) \* qt(0.975, 8) \* 30

[1] 1031 1169

### Question 3

Researchers conducted a blind taste test of Coke versus Pepsi. Each of four people was asked which of two blinded drinks given in random order that they preferred. The data was such that 3 of the 4 people chose Coke. Assuming that this sample is representative, report a P-value for a test of the hypothesis that Coke is preferred to Pepsi using a one sided exact test.

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.005 |  |  |  |
| 0.10 |  |  |  |
| 0.31 | Correct | 1.00 |  |
| 0.62 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

Let *p* be the proportion of people who prefer Coke. Then, we want to test *H*0:*p*=.5 versus *Ha*:*p*>.5. Let *X* be the number out of 4 that prefer Coke; assume *X*∼*Binomial*(*p*,.5). *Pvalue*=*P*(*X*≥3)=choose(4,3)0.530.51+choose(4,4)0.540.50

pbinom(2, size = 4, prob = 0.5, lower.tail = FALSE)

[1] 0.3125

choose(4, 3) \* 0.5^4 + choose(4, 4) \* 0.5^4

[1] 0.3125

### Question 4

Infection rates at a hospital above 1 infection per 100 person days at risk are believed to be too high and are used as a benchmark. A hospital that had previously been above the benchmark recently had 10 infections over the last 1,787 person days at risk. About what is the one sided P-value for the relevant test of whether the hospital is \*below\* the standard?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.52 |  |  |  |
| 0.11 |  |  |  |
| 0.22 |  |  |  |
| 0.03 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

*H*0:*λ*=0.01 versus *Ha*:*λ*<0.01. *X*=11, *t*=1,787 and assume *X*∼*H*0*Poisson*(0.01×*t*)

ppois(10, lambda = 0.01 \* 1787)

## [1] 0.03237

### Question 5

Suppose that 18 obese subjects were randomized, 9 each, to a new diet pill and a placebo. Subjects’ body mass indices (BMIs) were measured at a baseline and again after having received the treatment or placebo for four weeks. The average difference from follow-up to the baseline (followup - baseline) was −3 kg/m2 for the treated group and 1 kg/m2 for the placebo group. The corresponding standard deviations of the differences was 1.5 kg/m2 for the treatment group and 1.8 kg/m2 for the placebo group. Does the change in BMI over the two year period appear to differ between the treated and placebo groups? Assuming normality of the underlying data and a common population variance, give a pvalue for a two sided t test.

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| Less than 0.01 | Correct | 1.00 |  |
| Larger than 0.10 |  |  |  |
| Less than 0.05, but larger than 0.01 |  |  |  |
| Less than 0.10 but larger than 0.05 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

*H*0:*μdifference*,*treated*=*μdifference*,*placebo*

n1 <- n2 <- 9

x1 <- -3 ##treated

x2 <- 1 ##placebo

s1 <- 1.5 ##treated

s2 <- 1.8 ##placebo

s <- sqrt(((n1 - 1) \* s1^2 + (n2 - 1) \* s2^2)/(n1 + n2 - 2))

ts <- (x1 - x2)/(s \* sqrt(1/n1 + 1/n2))

2 \* pt(ts, n1 + n2 - 2)

[1] 0.0001025

### Question 6

Brain volumes for 9 men yielded a 90% confidence interval of 1,077 cc to 1,123 cc. Would you reject in a two sided 5% hypothesis test of *H*0:*μ*=1,078?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| No you wouldn't reject. | Correct | 1.00 |  |
| Yes you would reject. |  |  |  |
| It's impossible to tell. |  |  |  |
| Where does Brian come up with these questions? |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

No, you would fail to reject. The 95% interval would be wider than the 90% interval. Since 1,078 is in the narrower 90% interval, it would also be in the wider 95% interval. Thus, in either case it's in the interval and so you would fail to reject.

### Question 7

Researchers would like to conduct a study of 100 healthy adults to detect a four year mean brain volume loss of.01 *mm*3. Assume that the standard deviation of four year volume loss in this population is .04 *mm*3. About what would be the power of the study for a 5% one sided test versus a null hypothesis of no volume loss?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.60 |  |  |  |
| 0.80 | Correct | 1.00 |  |
| 0.70 |  |  |  |
| 0.50 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

The hypothesis is *H*0:*μ*Δ=0 versus *Ha*:*μ*Δ>0 where *μ*Δ is volume loss (change defined as Baseline - Four Weeks). The test statistics is 10*X*¯Δ.04 which is rejected if it is larger than *Z*.95=1.645.  
We want to calculate

*P*(*X*¯Δ*σ*Δ/10>1.645 | *μ*Δ=.01)=*P*(*X*¯Δ−.01.004>1.645−.01.004 | *μ*Δ=.01)=*P*(*Z*>−.855)=.80

Or note that *X*¯Δ is *N*(.01,.004) under the alternative and we want the *P*(*X*¯Δ>1.645∗.004) under *Ha*.

pnorm(1.645 \* 0.004, mean = 0.01, sd = 0.004, lower.tail = FALSE)

[1] 0.8037

### Question 8

Researchers would like to conduct a study of *n* healthy adults to detect a four year mean brain volume loss of.01 *mm*3. Assume that the standard deviation of four year volume loss in this population is .04 *mm*3. About what would be the value of *n* needded for 90% power of type one error rate of 5% one sided test versus a null hypothesis of no volume loss?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 120 |  |  |  |
| 160 |  |  |  |
| 180 |  |  |  |
| 140 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

The hypothesis is *H*0:*μ*Δ=0 versus *Ha*:*μ*Δ>0 where *μ*Δ is volume loss (change defined as Baseline - Four Weeks). The test statistics is *X*¯Δ.04/*n*√ which is rejected if it is larger than *Z*.95=1.645.  
We want to calculate

*P*(*X*¯Δ*σ*Δ/*n*−−√>1.645 | *μ*Δ=.01)=*P*(*X*¯Δ−.01.04/*n*−−√>1.645−.01.04/*n*−−√ | *μ*Δ=.01)=*P*(*Z*>1.645−*n*−−√/4)=.90

So we need 1.645−*n*−−√/4=*Z*.10=−1.282 and thus *n*=(4∗(1.645+1.282))2.

ceiling((4 \* (qnorm(0.95) - qnorm(0.1)))^2)

[1] 138

### Question 9

As you increase the type one error rate, *α*, what happens to power?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| You will get larger power. | Correct | 1.00 |  |
| No, for real, where does Brian come up with these problems? |  |  |  |
| It's impossible to tell given the information in the problem. |  |  |  |
| You will get smaller power. |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

As you require less evidence to reject, i.e. your *α* rate goes up, you will have larger power.

### Question 10

The Daily Planet ran a recent story about Kryptonite poisoning in the water supply after a recent event in Metropolis. Their usual field reporter, Clark Kent, called in sick and so Lois Lane reported the story. Researchers sampled 288 individuals and found mean blood Kryptonite levels of 44, both measured in Lex Luthors per milliliter (LL/ml). They compared this to 288 sampled individuals from Gotham city who had an average level of 42.04. About what is the Pvalue for a two sided Z test of the relevant hypothesis? Assume that the standard deviation is 12 for both groups.

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.01 |  |  |  |
| 0.05 | Correct | 1.00 |  |
| 0.10 |  |  |  |
| 0.20 |  |  |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**

*H*0:*μMetropolis*=*μGotham* versus *Ha*:*μMetropolis*≠*μGotham*.

xM <- 44

xG <- 42.04

sM <- sG <- 12

nM <- nG <- 288

ts = (xM - xG)/sqrt(sM^2/nM + sG^2/nG)

2 \* pnorm(-abs(ts))

[1] 0.05

### Question 11

Suppose that a researcher performs 10 hypothesis tests and wants a familywise error rate of no more than 5%. What alpha level should she compare her p values to in order to ensure the desired error rate?

|  |  |  |  |
| --- | --- | --- | --- |
| **Your Answer** |  | **Score** | **Explanation** |
| 0.0005 |  |  |  |
| 0.05 |  |  |  |
| 0.1 |  |  |  |
| 0.005 | Correct | 1.00 |  |
| Total |  | 1.00 / 1.00 |  |

**Question Explanation**Using the Bonferroni correction we use $\alpha / 10 = 0.005$.

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