Feedback — Quiz 4 **Please Note: No Grace Period**

Help Center

Thank you. Your submission for this quiz was received.

You submitted this quiz on **Sun 29 Nov 2015 6:36 PM EST**. You got a score of **7.00** out of **9.00**. You can attempt again, if you'd like.

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 T test.

(Hint, consider that the observations are paired.)

Your Answer		Score	Explanation
◉ 0.087	✔	1.00	
○ 0.05			
○ 0.043			
○ 0.10			
Total		1.00 / 1.00	

Question Explanation

$H_0 : \mu_d = 0$ versus $H_0 : \mu_d \neq 0$ where μ_d 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 $H_0 : \mu = \mu_0$would fail to reject the null hypothesis in a two sided 5% Students t-test?

Your Answer		Score	Explanation
◉ 1077 to 1123	✔	1.00	
○ 1080 to 1120			

○ 1081 to 1119		
○ 1031 to 1169		
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
○ 0.10			
○ 0.31			
○ 0.005			
◉ 0.62	✖	0.00	
Total		0.00 / 1.00	

Question Explanation

Let p be the proportion of people who prefer Coke. Then, we want to test $H_0 : p = .5$ versus $H_a : p > .5$. Let X be the number out of 4 that prefer Coke; assume $X \sim Binomial(p, .5)$.
$Pvalue = P(X \geq 3) = \text{choose}(4,3)0.5^3 0.5^1 + \text{choose}(4,4)0.5^4 0.5^0$

```
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	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

$H_0 : \lambda = 0.01$ versus $H_a : \lambda < 0.01$. $X = 11$, $t = 1,787$ and assume $X \sim_{H_0} Poisson(0.01 \times t)$

```
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 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
◉ Larger than 0.10	✖	0.00	
○ Less than 0.01			
○ Less than 0.05, but larger than 0.01			
○ Less than 0.10 but larger than 0.05			
Total		0.00 / 1.00	

Question Explanation

$$H_0 : \mu_{difference,treated} = \mu_{difference,placebo}$$

```
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 $H_0 : \mu = 1,078$?

Your Answer		Score	Explanation
○ It's impossible to tell.			
○ Where does Brian come up with these questions?			
○ Yes you would reject.			
◉ No you wouldn't reject.	✔	1.00	
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	✔	1.00	
○ 0.50			
○ 0.70			
Total		1.00 / 1.00	

Question Explanation

The hypothesis is $H_0 : \mu_\Delta = 0$ versus $H_a : \mu_\Delta > 0$ where μ_Δ is volume loss (change defined as Baseline - Four Weeks). The test statistics is $10\ \frac{\bar X_\Delta}{.04}$ which is rejected if it is larger than $Z_{.95} = 1.645$.
We want to calculate

$$P\left(\frac{\bar X_\Delta}{\sigma_\Delta/10} > 1.645 \mid \mu_\Delta = .01\right) = P\left(\frac{\bar X_\Delta - .01}{.004} > 1.645 - \frac{.01}{.004} \mid \mu_\Delta = .01\right) = P(Z > -.855) = .80$$

Or note that $\bar X_\Delta$ is $N(.01, .004)$ under the alternative and we want the $P(\bar X_\Delta > 1.645 * .004)$ under H_a.

```
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
○ 180			
○ 160			
◉ 140	✔	1.00	
○ 120			

Total	1.00 / 1.00

Question Explanation

The hypothesis is $H_0 : \mu_\Delta = 0$ versus $H_a : \mu_\Delta > 0$ where μ_Δ is volume loss (change defined as Baseline - Four Weeks). The test statistics is $\frac{\bar X_\Delta}{.04/\sqrt{n}}$ which is rejected if it is larger than $Z_{.95} = 1.645$.
We want to calculate

$$P\left(\frac{\bar X_\Delta}{\sigma_\Delta/\sqrt{n}} > 1.645 \mid \mu_\Delta = .01\right) = P\left(\frac{\bar X_\Delta - .01}{.04/\sqrt{n}} > 1.645 - \frac{.01}{.04/\sqrt{n}} \mid \mu_\Delta = .01\right) = P(Z > 1.645 - \sqrt{n}/4) = .90$$

So we need $1.645 - \sqrt{n}/4 = Z_{.10} = -1.282$ 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.	✔	1.00	
○ It's impossible to tell given the information in the problem.			
○ You will get smaller power.			
○ No, for real, where does Brian come up with these problems?			
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.