Hw #7 problem 4!

A private and a public university are located in the same city. For the private university, 1046 alumni were surveyed and 653 said that they attended at least one class reunion. For the public university, 791 out of 1327 sampled alumni claimed they have attended at least one class reunion. Find and interpret the 85% confidence interval for the difference between the population proportions.

$x_1 = 653 \quad n_1 = 1046 \quad \hat{p}_1 = \frac{653}{1046} \approx 0.6243$

$x_2 = 791 \quad n_2 = 1327 \quad \hat{p}_2 \approx \frac{791}{1327} = 0.5961$

$C = .85 \quad z^* = \text{qnorm}(1.85/2)$

$$(0.6243 - 0.5961) \pm \text{qnorm}(1.85/2) * \sqrt{\frac{0.6243 * 0.3757}{1046} + \frac{0.5961 * 0.4039}{1327}}$$

```
> (0.6243-0.5961)+c(-1,1)*qnorm(1.85/2)*sqrt(0.6243*0.3757/1046+0.5961*0.4039/1327)
[1] -0.0007939694
[2]  0.0571939694

> prop.test(x=c(653,791),n=c(1046,1327),conf.level = 0.85,correct=F)

   85 percent confidence interval:
    -0.000792614  0.057195806
```

Question 9

An automobile manufacturer claims his best product has an average lifespan of exactly 20 years. A skeptical product evaluator asks for evidence (data) that might be used to evaluate this claim. The product evaluator was provided data collected from a random sample of 45 people who used the product. Using the data, an average product lifespan of 21 years and a standard deviation of 8 years was calculated. Select the 99%, confidence interval for the true mean lifespan of this product.

a) [17.422, 24.578]

b) [16.923, 23.077]

c) [-3.0769, 3.0769]

d) [20.541, 21.459]

e) [17.923, 24.077]

f) None of the above

$n = 45$ $\bar{x} = 21$ $s = 8$ sample SD use t

$c = .99$

$\bar{x} \pm t^* \frac{s}{\sqrt{n}}$

21 ± qt(1.99/2, 44) * 8/sqrt(45)

Question 10

An important problem in industry is shipment damage. A electronics distribution company ships its product by truck and determines that it cannot meet its profit expectations if, on average, the number of damaged items per truckload is greater than 12. A random sample of 12 departing truckloads is selected at the delivery point and the average number of damaged items per truckload is calculated to be 11.3 with a calculated sample of variance of 0.49. Select a 99% confidence interval for the true mean of damaged items.

a) [48.26, -30.02]

b) [10.67, 11.93]

c) [-0.6285, 0.6285]

d) [10.69, 11.91]

e) [11.37, 12.63]

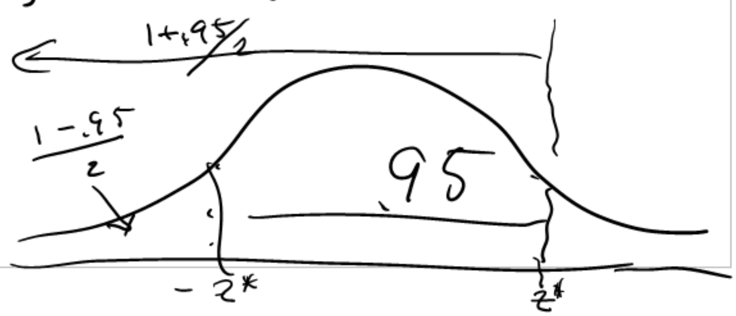
f) None of the above

$n = 12$ $\bar{x} = 11.3$ $s^2 = 0.49$

$s = \sqrt{0.49} = 0.7$ Sample SD use t^*

$c = .99$

11.3 ± qt(1.99/2, 11) * 0.7/sqrt(12)



HW #7 problem 3:

You want to design a study to estimate the proportion of students on your campus who agree with the statement, "The student government is an effective organization for expressing the needs of students to the administration." You will use a 95% confidence interval and you would like the margin of error of the interval to be .05 or less. Find the minimum sample size required.

$c = .95$ $z^* = $ qnorm(1.95/2) $= 1.96$ $m \le 0.05$

$n > p^*(1-p^*)\left(\frac{z^*}{m}\right)^2 = 0.5(1-0.5)\left(\frac{1.96}{0.05}\right)^2$

If p-value ≤ α reject H_0 (RH_0)
If p-value > α Fail to reject H_0 (FRH_0)

PRINTABLE VERSION

Quiz 12

Question 1

$\alpha = 1 - C = 0.05$

In a hypothesis test, if the computed P-value is greater than a specified level of significance, then we

a) reject the null hypothesis.

b) fail to reject the null hypothesis.

c) retest with a different sample.

Example Mean Body Temperature of healthy adults

$H_0: \mu = 98.6 \quad H_A: \mu < 98.6$

Assume population sd $\sigma = 0.62$

From sample of $n = 100$ healthy adults we got a mean body temp of $\bar{x} = 98.2$

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{98.2 - 98.6}{\left(\frac{0.62}{\sqrt{100}}\right)}$$

$z = -6.45 \leftarrow$ Test stat

Question 2

A one-sided significance test gives a P-value of .03. From this we can

a) ~~Say~~ that the probability that the null hypothesis is false is .03.

b) Reject the null hypothesis with 96% confidence. $\alpha = 1 - .96 = 0.04$

Agree p-value < 0.04 RH_0

$P(\bar{x} \leq 98.2) = P(z \leq -6.45)$

H_A

c) ~~Say~~ that the probability that the null hypothesis is true is .03.

d) Reject the null hypothesis with 97% confidence.

> pnorm(-6.45)
[1] 5.592508e-11

P-value ≤ 0.03 = 1 - .97

= 0.0000000000559 = P-value

Reject H_0

Question 3

It is believed that the average amount of money spent per U.S. household per week on food is about \$98, with standard deviation \$10. A random sample of 100 households in a certain affluent community yields a mean weekly food budget of \$100. We want to test the hypothesis that the mean weekly food budget for all households in this community is higher than the national average. State the null and alternative hypotheses for this test.

$H_0: \mu = 98 \quad \boxed{H_A: \mu > 98}$ ($<$, $\neq$)

a) H_0: μ = 98, H_a: μ < 98

b) ~~H_0: μ = 100, H_a: μ > 100~~

c) ~~H_0: μ = 100, H_a: μ < 100~~

d) H_0: μ = 98, H_a: μ ≠ 98

e) H_0: μ = 98, H_a: μ > 98

Question 4

It is believed that the average amount of money spent per U.S. household per week on food is about \$98, with standard deviation \$10. A random sample of 100 households in a certain affluent community yields a mean weekly food budget of \$100. We want to test the hypothesis that the mean weekly food budget for all households in this community is higher than the national average. Are the results significant at the 5% level?

$H_0: \mu = 98$ $H_A: \mu > 98$ Right tail $\sigma = 10$ pop SD use z
$n = 100$ $\bar{X} = 100$ $\alpha = 0.05$

a) Yes, we should reject H_o.

b) No, we should fail to reject H_o.

Test statistic: $z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} = \frac{100-98}{10/\sqrt{100}} = 2$

P-value: $P(z > 2) = 1 - \text{pnorm}(2) = 0.0228 < 0.05$

Question 5

Based on information from a large insurance company, 68% of all damage liability claims are made by single people under the age of 25. A random sample of 53 claims showed that 41 were made by single people under the age of 25. Does this indicate that the insurance claims of single people under the age of 25 is higher than the national percent reported by the large insurance company? State the null and alternate hypothesis.

$H_0: p = 0.68$ $H_A: p > 0.68$

a) H_o: $p = .68$, H_a: $p < .68$

b) H_o: $p = .77$, H_a: $p > .77$

c) H_o: $p = .68$, H_a: $p > .68$

d) H_o: $p = .77$, H_a: $p < .77$

e) H_o: $p = .68$, H_a: $p \neq .68$

Question 6

Based on information from a large insurance company, 67% of all damage liability claims are made by single people under the age of 25. A random sample of 51 claims showed that 44 were made by single people under the age of 25. Does this indicate that the insurance claims of single people under the age of 25 is higher than the national percent reported by the large insurance company? Give the test statistic and your conclusion.

1 $H_0: p = 0.67$ $H_A: p > 0.67$

$n = 51$ $x = 44$ $\hat{p} = \frac{44}{51} = 0.8627$

2 Test statistic:

$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{(0.8627 - 0.67)}{\sqrt{\frac{0.67(1-0.67)}{51}}}$

$z = 2.927$

a) z = 2.927; fail to reject H_o at the 5% significance level

b) ~~z = -2.427; fail~~ to reject H_o at the 5% significance level

c) ~~z = 2.427; reject H_o~~ at the 5% significance level

d) ~~z = -2.927; reject H_o~~ at the 5% significance level

e) z = 2.927; reject H_o at the 5% significance level

3 P-value $= P(z > 2.927) = 1 - \text{pnorm}(2.927) = 0.0017 < 0.05$ R H_0

Question 7

Let x represent the hemoglobin count (HC) in grams per 100 milliliters of whole blood. The distribution for HC is approximately normal with $\mu = 14$ for healthy adult women. Suppose that a female patient has taken 12 laboratory blood samples in the last year. The HC data sent to her doctor is listed below. We would like to know if the data indicates this patient has significantly high HC compared to the population.

(19, 14, 23, 20, 15, 19, 21, 16, 18, 18, 16, 21)

State the null and alternate hypothesis.

~~a) H_0: μ = 18.3, H_a: μ < 18.3~~

~~b) H_0: μ = 18.3,~~ H_a: μ > 18.3

c) H_0: μ = 14, H_a: μ < 14

d) H_0: μ = 14, H_a: μ > 14

e) H_0: μ = 14, H_a: μ ≠ 14

$H_0: \mu = 14 \quad H_A: \mu > 14$

T-test for means

```
> t.test(hc,mu=14,alternative = "greater")
```
← input

```
 One Sample t-test
data:  hc
t = 5.5432, df = 11,p-value = 8.726e-05
alternative hypothesis: true mean is greater than 14
95 percent confidence interval:
 16.92943      Inf
sample estimates:
mean of x
 18.33333
```

Test statistic

$t = 5.5432$

p-value $= 0.000087$

≈ 0.0001

Question 8

Let x represent the hemoglobin count (HC) in grams per 100 milliliters of whole blood. The distribution for HC is approximately normal with μ = 14 for healthy adult women. Suppose that a female patient has taken 12 laboratory blood samples in the last year. The HC data sent to her doctor is listed below. We would like to know if the data indicates this patient has significantly high HC compared to the population.

(19, 14, 23, 20, 15, 19, 21, 16, 18, 18, 16, 21)

Give the p-value and interpret the results.

a) p = .0762; Based on 5% significance level, I will fail to reject the null hypothesis and conclude this patient does not have a high HC level.

b) p = .1053; Based on 5% significance level, I will fail to reject the null hypothesis and conclude this patient does not have a high HC level.

c) p = .0001; Based on 5% significance level, I will reject the null hypothesis and conclude this patient has a high HC level.

d) p = .001; Based on 5% significance level, I will reject the null hypothesis and conclude this patient has a high HC level.

e) p = .0562; Based on 5% significance level, I will fail to reject the null hypothesis and conclude this patient does not have a high HC level.

Question 9

An experimenter flips a coin 100 times and gets 57 heads. Test the claim that the coin is fair against the two-sided claim that it is not fair at the level α=.01.

$\hat{p} = 57/100 = 0.57$

$H_0: p = 0.5 \quad H_A: p \neq 0.5$

a) H_0: p = .5, H_a: p ≠ .5; z = 1.40; Reject H_0 at the 1% significance level.

~~b) H_0: p = .5, H_a: p > .5; z = 1.41~~; Fail to reject H_0 at the 1% significance level.

~~c) H_0: p = .5, H_a: p ≠ .5; z = 1.41; Fail to~~ reject H_0 at the 1% significance level.

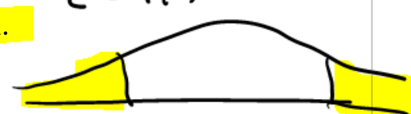
d) H_0: p = .5, H_a: p ≠ .5; z = 1.40; Fail to reject H_0 at the 1% significance level.

~~e) H_0: p = .5, H_a: p > .5; z = 1.40; Re~~ject H_0 at the 1% significance level.

Test statistic:

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = \frac{0.57 - 0.5}{\sqrt{\frac{0.5(0.5)}{100}}}$$

$z = 1.4$



$p\text{-value} = P(Z \le -1.4 \text{ or } Z \ge 1.4)$ FRQ

$= 2 * \text{pnorm}(-1.4) = 0.1615 > 0.01$

```
> before=c(31,38,62,52,28)
> after=c(27,36,58,49,24)
> t.test(before,after,alternative = "greater",paired = T)

 Paired t-test

data:  before and after
t = 8.5, df = 4, p-value = 0.0005253
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 2.547261      Inf
sample estimates:
mean of the differences
                    3.4
```

Test statistic : $t = 8.5$

p-value $= 0.0005 < 0.05$

R H_0

Question 10

In a experiment on relaxation techniques, subject's brain signals were measured before and after the relaxation exercises with the following results:

mean of the differences μ_D

Diff = Before − After

Person	1	2	3	4	5
Before	31	38	62	52	28
After	27	36	58	49	24

Paired t-test

$H_0: \mu_D = 0 \quad H_A: \mu_D > 0$

Assuming the population is normally distributed, is there sufficient evidence to suggest that the relaxation exercise slowed the brain waves? (Use α=0.05)

a) Fail to reject the null hypothesis which states there is no change in brain waves.

b) Reject the null hypothesis which states there is no change in brain waves in favor of the alternate which states the brain waves slowed after relaxation.

c) There is not enough information to make a conclusion.

Question 11

An auditor for a hardware store chain wished to compare the efficiency of two different auditing techniques. To do this he selected a sample of nine store accounts and applied auditing techniques A and B to each of the nine accounts selected. The number of errors found in each of techniques A and B is listed in the table below:

$H_0: \mu_D = 0 \quad H_A: \mu_D < 0$

Diff = A − B

```
> t.test(a,b,alternative = "less",paired = T)

 Paired t-test

data:  a and b
t = 1.9761, df = 8,
p-value = 0.9582 ← FRH0
alternative hypothesis: true difference in means
is less than 0
95 percent confidence interval:
   -Inf 8.626833
sample estimates:
mean of the differences
            4.444444
```

Errors in A	Errors in B
45	31
48	37
46	39
48	37
52	54
50	45
49	49
40	41
45	50

Does the data provide sufficient evidence to conclude that the number of errors in auditing technique A is fewer than the number of errors in auditing technique B at the 0.1 level of significance? Select the [Alternative Hypothesis, Value of the Test Statistic]. (Hint: the samples are dependent)

a) [A < B, 1.976]

b) [$\mu_D = 0$, 1.976]

c) [$\mu_D < 0$, 1.976]

d) [$\mu_D < \mu_1$, 1.976]

e) [$\mu_D \le 0$, 1.976]

f) None of the above

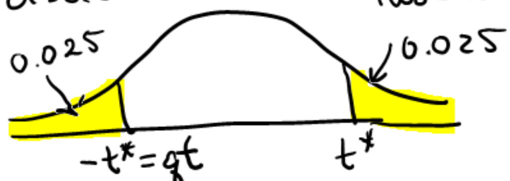
Question 12

An auditor for a hardware store chain wished to compare the efficiency of two different auditing techniques. To do this he selected a sample of nine store accounts and applied auditing techniques A and B to each of the nine accounts selected. The number of errors found in each of techniques A and B is listed in the table below:

Paired T-test

$H_0: \mu_D = 0$ $H_A: \mu_D \neq 0$

$\alpha = 0.05$ Two-tail



> qt(.025,8)
[1] -2.306004

Reject H_0 if $T \le -2.31$ or $T \ge 2.31$

Errors in A	Errors in B
27	13
30	19
28	21
30	19
34	36
32	27
31	31
22	23
27	32

Does the data provide sufficient evidence to conclude that the number of errors in auditing technique A is different from the number of errors in auditing technique B at the 0.05 level of significance? Select the [Rejection Region, Decision of Reject (RH_0) or Failure to Reject (FRH_0)]. (Hint: the samples are dependent)

a) [$-t < -2.31$ or $t < -2.31$, FRH_0]

b) [$t < -2.31$, FRH_0]

c) [$z < -2.31$ and $-z < -2.31$, FRH_0]

d) [$t > 2.31$, RH_0]

e) [$-t < 2.31$ and $t < 2.31$, RH_0]

f) None of the above

Question 13

Rejecting a true null hypothesis is classified as

Type I : RH_0 when H_0 is true

Type II : FRH_0 when H_0 is false.

a) Power

b) Type II error

c) Type I error

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Quiz 13

Question 1

In a hypothesis test, if the computed P-value is less than 0.001, there is very strong evidence to

a) reject the null hypothesis.

b) retest with a different sample.

c) fail to reject the null hypothesis.

Question 2

See question 10 in quiz 12.

In a experiment on relaxation techniques, subject's brain signals were measured before and after the relaxation exercises with the following results:

Person	1	2	3	4	5
Before	32	38	66	52	28
After	26	36	57	48	23

Assuming the population is normally distributed, is there sufficient evidence to suggest that the relaxation exercise slowed the brain waves? (Use α=0.05)

a) Reject the null hypothesis which states there is no change in brain waves in favor of the alternate which states the brain waves slowed after relaxation.

b) There is not enough information to make a conclusion.

c) Fail to reject the null hypothesis which states there is no change in brain waves.

Question 3

See question 9 in quiz 12

An experimenter flips a coin 100 times and gets 43 heads. Test the claim that the coin is fair against the two-sided claim that it is not fair at the level α=.01.

a) H_o: p = .5, H_a: p < .5; z = -1.41; Fail to reject H_o at the 1% significance level.

b) H_o: p = .5, H_a: p < .5; z = -1.40; Reject H_o at the 1% significance level.

c) H_o: p = .5, H_a: $p \neq$ .5; z = -1.40; Fail to reject H_o at the 1% significance level.

d) H_o: p = .5, H_a: $p \neq$ .5; z = -1.40; Reject H_o at the 1% significance level.

e) H_o: p = .5, H_a: $p \neq$ .5; z = -1.41; Fail to reject H_o at the 1% significance level.

Question 4

Identify the most appropriate test to use for the following situation:
In a experiment on relaxation techniques, subject's brain signals were measured before and after the relaxation exercises. We wish to determine if the relaxation exercise slowed the brain waves.

a) Matched pairs

b) One sample *t* test

c) Two sample *t* test

d) Two sample *z* test

Question 5

To use the two sample *t* procedure to perform a significance test on the difference of two means, we assume:

a) The populations' standard deviation are known.

b) The samples from each population are independent.

c) The distributions are exactly normal in each population.

d) The sample sizes are large.

Question 6

Solid fats are more likely to raise blood cholesterol levels than liquid fats. Suppose a nutritionist analyzed the percentage of saturated fat for a sample of 6 brands of stick margarine (solid fat) and for a sample of 6 brands of liquid margarine and obtained the following results:

$$Stick = [25.5, 26.7, 26.5, 26.6, 26.3, 26.4]$$
$$Liquid = [16.5, 17.1, 17.5, 17.3, 17.2, 16.7]$$

We want to determine if there a significant difference in the average amount of saturated fat in solid and liquid fats. What is the test statistic? (assume the population data is normally distributed)

a) t = 25.263

b) z = 39.604

c) t = 39.604

d) t = 39.104

e) z = 39.104

$H_0: \mu_S = \mu_L \quad H_A: \mu_S \neq \mu_L$

```
> stick
[1] 25.5 26.7 26.5 26.6 26.3
[6] 26.4
> liquid
[1] 16.5 17.1 17.5 17.3 17.2
[6] 16.7
> t.test(stick,liquid)

 Welch Two Sample t-test

data:  stick and liquid
t = 39.604, df = 9.8276, p-value = 3.608e-12
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 8.759808 9.806859
sample estimates:
mean of x mean of y
 26.33333  17.05000
```

Question 7

It has been observed that some persons who suffer acute heartburn, again suffer acute heartburn within one year of the first episode. This is due, in part, to damage from the first episode. The performance of a new drug designed to prevent a second episode is to be tested for its effectiveness in preventing a second episode. In order to do this two groups of people suffering a first episode are selected. There are 55 people in the first group and this group will be administered the new drug. There are 75 people in the second group and this