Test 2 Solutions (PRACTICE)

Problem 1 15 min

12 11

| Multiple Guess 1 | Multiple Guess 2 |
|---|---|
| ~~1 skip~~ | 1 a |
| 2 b | 2 b |
| 3 a | 3 b |
| 4 a | 4 c |
| 5 b | 5 d |
| 6 b | 6 a |
| 7 a | 7 c |
| 8 c | ~~8 skip~~ (a) |
| 9 b | 9 d |
| 10 c | 10 a |
| 11 d | 11 b |
| 12 b | 12 c |
| 13 c | ~~13 skip~~ (a) |

1. Which of the following are statistics?
   - a. All of these choices.
   - b. median
   - c. mean pop par
   - d. standard deviation

Misleading

   - e. the population mean
   - f. the population standard deviation
   - g. the sample proportion
   - h. the population proportion, $\pi$

2. What is the distribution of the values of a statistic called?
   - a. a sample
   - b. a sampling distribution
   - c. Central Limit Theorem
   - d. a mean

3 Which of the following defines the sampling distribution of $\bar{x}$?
   - a. It is the distribution of the sample means for all samples of the same size from the population.
   - b. It is the probability distribution of a population mean.
   - c. It is the probability distribution of the sample proportion based on a random sample of size *n*.
   - d. It is the probability distribution of the sample means for all possible sample sizes from the population.

4 When can the Central Limit Theorem be safely applied using the conservative rule?

Problem 1

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- a. When $n$ is greater than 30
- b. When $n$ is greater than or equal to 10
- c. When $n$ is less than 10
- d. When $n$ is greater than 20

$= \bar{X}$

5. Suppose a random sample of 15 snow throwers has a mean lifespan of 20 years. If it is known that $\sigma = 4$, what is the test statistic for testing $H_0: \mu = 18$ versus $H_a: \mu < 18$?

No Right Answer

- a. 0.026
- b. z = −1.94 $z = +1.94$
- c. −0.50
- d. t = 1.94 with df = 14 ✗: σ known

$T = Z = \frac{\bar{X} - 18}{4/\sqrt{15}} = \frac{20-18}{1.033} = 1.94$ (+)

~~Ha 1-sided to left~~ so answer can ~~only be b since C is wrong.~~

6. What is the probability of a Type I error of a test $H_0: \pi = 0.62$ versus $H_a: \pi \neq 0.62$ of if a 0.05 level of significance is used for the test?

$\alpha =$

- a. 0.62
- b. 0.05
- c. The sample data is needed to determine the probability of a Type I error for a test.
- d. 0.10

This prob should have taken less 1 second, plus 1 second to check.

---

7. Suppose 15 students pass an exam in a class of size 25. If the population proportion of students who pass the exam is 0.65, what are the mean and standard deviation for the sampling distribution of $p$? $\sim \hat{p}$

$\hat{p} = .6$

- a. $\mu_p = 0.65, \sigma_p = 0.095$
- b. $\mu_p = 0.05, \sigma_p = 0.0455$
- c. $\mu_p = 0.60, \sigma_p = 0.095$
- d. $\mu_p = 0.60, \sigma_p = 0.098$

$\hat{p}$ No.

$X \sim Binom(25, .65)$

$\hat{p} \sim N(p, \sqrt{pq/n})$

$= N(.65, .477/5)$

$= N(.65, .095)$

$\mu_1 = \mu_2$

8. When are two population means considered identical?

- a. when $\bar{x}_1 = \bar{x}_2$
- b. when $\sigma_1 = \sigma_2$

Problem 1



- c. when $\mu_1 = \mu_2$
- d. when $\mu_1 > \mu_2$

**9.** What is the test statistic for testing whether or not the true proportion of adults who visit a dentist regularly is indeed $\mu = 0.72$ or whether it is less? Suppose a random sample of 30 adults found that the proportion who visited a dentist regularly was $p = 0.67$.

- a. $z = 0.61$
- b. $z = -0.6099$
- c. $z = -0.5824$
- d. $z = 7.8044$

$H_0: p = .72 = p_0$

$H_A: p < .72$

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0 / n}} = \frac{.67 - .72}{\sqrt{.72(.28)} / \sqrt{30}} =$$

$$\sqrt{p_0 q_0 / n} \quad = \frac{-.05}{.08} = -.6099$$

Problem 1

2 sided

10 What is the *P*-value for a test of $H_0: \pi = 0.4$ versus $H_a: \pi \neq 0.4$ with a test statistic of $z = 1.8$?

- a. 1.928
- b. 0.9641
- c. 0.072
- d. 0.036

$z = \dfrac{\hat{p} - .4}{\sqrt{\text{whatever}}} = 1.8$

.036

1.8

pval = $2 \cdot \Phi(z)$ = .072

11. Which of the following is *not* true with regards to a *P*-value?
   - a. A *P*-value indicates the strength of the evidence against the null hypothesis. ✓ T
   - b. A *P*-value does not tell us the probability that the null hypothesis is true. T
   - c. A *P*-value is a probability and must be between 0 and 1. ✓ T
   - d. The larger the *P*-value the more conclusive the evidence is against the null hypothesis. F

   Small p-value ⇒ reject Ho

12. If a computer is not available, what is a conservative estimate of the number of degrees of freedoms for the *t* curve when computing a two-sample confidence interval for the difference between two independent population means if $n_1 = 40$ and $n_2 = 20$?
   - a. 60
   - b. 19
   - c. 39
   - d. 20

   $d.f. = \min(n_1, n_2) - 1 = 19$

Problem 1



13. The following *Minitab* output shows a comparison in yield for two types of wheat planted by Farmer Fred. What can you conclude from the information given?

bushels/acre ?

Two-sample T for Yield

```
Field  N   Mean   StDev  SE Mean
1      6  2.940   0.303     0.12
2      6  2.960   0.373     0.15

Difference = mu (1) - mu (2)
Estimate for difference:  -0.020000
95% CI for difference:  (-0.463483, 0.423483)
T-Test of difference = 0 (vs not =): T-Value = -0.10  P-Value = 0.921  DF = 9
```

all the $\sqrt{n}$ stuff in here

Close to zero.

practically

- a. There is no evidence to support a difference in the yield of the two types of wheat.
- b. The hypotheses being tested are $H_0: \mu_1 - \mu_2 = 0$ versus $H_a: \mu_1 - \mu_2 > 0$. Can't tell.
- c. The test statistic is $z = -0.10$. No, t statistic
- d. A 90% confidence interval for the difference in the mean yields is (–0.46, 0.42).

NO!

Problem 2 25 minutes

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1. Fill in the blank. An unbiased statistic is a statistic whose mean value is ___=___ the population characteristic estimated.

- a. equal to
- b. half the value of
- c. greater than
- d. less than

.2 What is the confidence level associated with an interval for estimating $\pi$ that has the form $\left(p-1.96\sqrt{\frac{p(1-p)}{n}}, p+1.96\sqrt{\frac{p(1-p)}{n}}\right)$?

$1.96 \to .025$

- a. 5%
- b. 95%
- c. 90%
- d. 1.96

3. Consider the Minitab output given below. What is the value for the sample proportion used to compute the 95% confidence interval?

```
Sample    X    N   Sample p          95% CI
1        38   70     ???       (0.419421, 0.662552)
```

$p \in \hat{p} \pm 1.96 \cdot SE_{\hat{p}}$

symmetric find midpt $= \hat{p}$

$.6625 - .4194 = .2431$ ; $\frac{}{2} \to .12155$

- a. 0.6625
- b. 0.542857
- c. 38
- d. 0.4194

split diff $\begin{cases} .6625 - .1255 = .54095 \\ .4194 + .1255 = .5449 \end{cases}$

$-$OR$-$ (Duh!) $\hat{p} = 38/70 = .54285$!

4. What sample size should be used if we would like to estimate the mean age of the college students at a particular campus with 99% confidence? We would also like to be accurate within 3 years and we will assume the population is normally distributed with a standard deviation of 4.5 years.

- a. A sample size of at least 14 should be used.
- b. A sample size of at least 9 should be used.

$X \sim N(\mu, 4.5)$

$\bar{X} \sim N(\mu, \frac{4.5}{\sqrt{n}})$

Margin error $= M$

$99\% \text{ C.I.} = \bar{X} \pm \left(z_{\frac{.01}{2}} \cdot \frac{4.5}{\sqrt{n}}\right)$

$M = 3 = 2.57\left(\frac{4.5}{\sqrt{n}}\right) \to \sqrt{n} = 3.86$

$n = 14.86$

$z_c = 2.576$

Problem 2

- c. A sample size of at least 15 should be used.
- d. A sample size of at least 26 should be used.

---

**5.** How are *t* distributions distinguished from one another?

- a. their standard deviation
- b. All *t* distributions are exactly the same. NO!
- c. their mean
- d. their degrees of freedom ✓

6. What is a point estimate for the population mean of GPA based on the Minitab output below from a random sample of data from the population?

```
One-Sample T: GPA
Variable     N     Mean    StDev   SE Mean           99% CI
GPA        200  2.63000  0.58033   0.04104  (2.52328, 2.73672)
```

$\mu \in 99 C.I.$

- a. 2.63
- b. (2.52328, 2.73672)
- c. 0.58
- d. 200

point est.

interval

**7.** Which of the following is the test statistic for a hypothesis of a population mean if the population standard deviation is unknown?

going 2b a t!

- a. $z = \dfrac{\bar{x} - \mu_{\text{hypothesized}}}{\frac{\sigma}{\sqrt{n}}}$
- b. $t = \dfrac{\bar{x} - \mu_{\text{hypothesized}}}{\frac{\sigma}{\sqrt{n}}}$, df=n-2
- c. $t = \dfrac{\bar{x} - \mu_{\text{hypothesized}}}{\frac{s}{\sqrt{n}}}$, df=n-1 ✓

Problem 2

○ d. $z = \dfrac{p - \pi_{hypothesized}}{\sqrt{\dfrac{\pi_{hypothesized}(1 - \pi_{hypothesized})}{n}}}$

Not proportion!

8. Which of the following is the correct formula for constructing a confidence interval for $\mu$ when $\sigma$ is unknown and either the sample size is large or the population distribution is normal?

● a. $\bar{x} \pm (\text{t critical value}) \dfrac{s}{\sqrt{n}}$

○ b. $p \pm (\text{z critical value}) \sqrt{\dfrac{p(1-p)}{n}}$

○ c. $\bar{x} \pm (\text{z critical value}) \dfrac{\sigma}{\sqrt{n}}$

○ d. $\mu \pm (\text{z critical value}) \dfrac{\sigma}{\sqrt{n}}$

$\sigma$ unknown.

Confusing

$\mu \in \bar{X} \pm Z_c \cdot SE_{\bar{X}}$, $\sigma$ unknown.

only signif @ 10% level.

Problem 2

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$H_0: \mu = 30$
$H_A: \mu > 30$

9. Suppose the P-value equals 0.09 for testing whether grocery stores stocked on average more than 30 varieties of potato chips. Which of the following conclusions would be correct for testing the $H_0: \mu = 30$ versus $H_a: \mu > 30$ hypotheses ?

- a. It can be concluded that stores stock more than 30 varieties on average using the $\alpha = 0.01$ significance level. NO
- b. It can be concluded that stores stock more than 30 varieties on average using the $\alpha = 0.05$ significance level. NO
- c. It can be concluded that on average stores ~~do not~~ stock more than 30 varieties using the $\alpha = 0.10$ significance level.
- d. It can be concluded that on average stores do not stock more than 30 varieties using the $\alpha = 0.05$ significance level.

weasel-worded but only choice

10. Which of the following is the correct null hypothesis for testing whether two population means are the same?

- a. $H_0: \mu_1 - \mu_2 = 0$ ✓
- b. $H_0: \bar{x}_1 - \bar{x}_2 = 0$ ← No,
- c. $H_0: \mu_1 - \mu_2 \neq 0$ Alternative
- d. $H_0: \mu_1 - \mu_2 = 1$ wierd

11. If two independent random samples gave the following information, what would be the *t* value for testing that the population means are identical? Assume the populations are approximately normal.

Sample A: $n_A = 10, \bar{x}_A = 10, s_A = 5$ Sample B: $n_B = 20, \bar{x}_B = 12, s_B = 6$

- a. $t = 2.0$
- b. $t = -0.96$
- c. $t = 5.79$
- d. $t = -2.24$

$$t = \frac{\Delta \bar{X} - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{-2}{\sqrt{\frac{25}{10} + \frac{36}{20}}} = -2/\sqrt{4.3} = \frac{-2}{2.07} = -.96$$

n = 6.

12. What can be concluded from the following *Minitab* output in a study the heights of six randomly chosen first graders at the beginning of the school year (September) and the end of the school year (June)?

Paired T for height in June - height in September

June - Sept : should be > 0 if grew,

Problem 2

| | N | Mean | StDev | SE Mean |
|---|---|---|---|---|
| height in June | 6 | 45.2833 | 5.4609 | 2.2294 |
| height in Septem | 6 | 43.8333 | 5.4924 | 2.2423 |
| Difference | 6 | 1.45000 | 1.16404 | 0.47522 |

include $\sqrt{n}$ stuff

95% lower bound for mean difference: 0.49241

T-Test of mean difference = 0 (vs > 0): T-Value = 3.05 P-Value = 0.014

- ○ a. Since the mean difference is 1.45 we can conclude that students grown on average 1.45 inches per year and thus there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.01$ level. X p = .014
- ○ b. The ~~data support the theory that there is not a difference~~ between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.05$ level.
- ● c. The data support the theory that there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.05$ level. ✓ (p-value)
- ○ d. The data support the theory that there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.01$ level. X .014

Problem 2



$p_{common}$.

13. What is the formula $p_c = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$ used to compute?

[ No Way to remember this. ]

- (●) a. It is the test statistic for comparing two population proportions.
- ( ) b. It is the standard deviation used when constructing a confidence interval for $\pi_1 - \pi_2$. X S.D. common p.
- ( ) c. It is the pooled standard deviation for two proportions. No!
- ( ) d. It is the statistic for estimating the common population proportion when $\pi_1 = \pi_2$. X

$\hat{p}$. $z = (\hat{p}_1 - \hat{p}_2) / \sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}$ (in Hypo test Setting).

25 min ⇒ 40 minutes so far,

10 min. for Next two problems!

Problem 3 This took 25 minutes

Risky Behavior. The National AIDS Behavioral Surveys interviewed a random sample of 2673 adult heterosexuals. Of these, 170 said they had more than one sexual partner in the past year. Assume these people told the truth. We would like to make inference about the true population proportion $\pi$ of heterosexual risky behavior.

4

a. Calculate the sample proportion $\hat{p}$; you should calculate both the "old" (good-enough for the last 100 years) and the "new" Wilson estimates.

$\hat{p} = \frac{170}{2673} = .0636$ $\tilde{p} = \frac{X+2}{n+4} = \frac{172}{2677} = .0643$

4

b. Calculate the $(1-\alpha)$ confidence intervals for $\pi$ using $\alpha = .05$

$\pi \in p \pm 1.96\, SE_\pi = p \pm 1.96\sqrt{pq/n}$

FWIW: $SE_{\hat{p}} = \sqrt{\frac{.0636(1-.0636)}{2673}} = .00456$

$\times 1.96 = .00894$

$.0636 \pm (\quad) = (.0547, .0725)$

$SE_{\tilde{p}} = \sqrt{\frac{.0643(\quad)}{2677}} = .00473$

$\times 1.96 = .00928$

$.0643 \pm (\quad) = (.055, .0736)$

10 min. 4

c. Suppose another sample was taken with $X$=148, the number of "successes" for risky behavior. What is the confidence interval for this result?

$\hat{p} = .0554$

$\tilde{p}$ - forget it. but -

$\tilde{p} = \frac{150}{2677} = .0560$

$.056 \pm 1.96\sqrt{\frac{.056(.944)}{2677}}$

$.056 \pm .00871$ *

$(.04729, .06471)$ Wilson

$SE_{\hat{p}} = \sqrt{\frac{.0554(1-.0554)}{2673}} = \boxed{.00442}$

$1.96 SE_{\hat{p}} = .00865$

$(1-\alpha)CI = .0554 \pm .00865 \overset{\text{Regular}}{=} \boxed{(.04675, .06405)}$

* Last digit thanks to C-Hein.

Problem 3

3

d. What does the (1- $\alpha$ ) confidence interval mean? I.e., suppose the true $\pi$ =0.06 and you are able to get 100 samples.

It means the true proportion falls in these confidence intervals (1-α)% of the time. If N=100, out intervals would not include 0.06 about 5 times out of 100.

4

e. Suppose a similar study was done in Sweden, with $N_{SW}$=3141 and $X_{SW}$=243. We think that the Swedes might be more *risqué* than those in the US. Design an appropriate test of this belief and comment on its results. Do this for both the traditional and Wilson estimates.

regular

$\hat{p}_{sw} = \frac{243}{3141} = .0774$

WILSON

$\tilde{p}_1 = \tilde{p}_{us} = \frac{X+2}{n+4} = \frac{172}{2677} = .064$

$\tilde{p}_2 = \tilde{p}_{sw} = \frac{245}{3145} = .078$

(using Wilson here, not true for both)
Null Test

$\hat{p} = \frac{n_1\hat{p}_1 + n_2\hat{p}_2}{n_1+n_2} = \frac{X_1+X_2}{n_1+n_2} = \frac{416.07}{5814} = .0710$

$SE_{Dp} = \sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)} = \sqrt{.0664\left(\frac{1}{2673}+\frac{1}{3141}\right)} = .006775$

$H_0: \pi_{us} - \pi_{sw} = 0$

$H_a: \pi_{us} - \pi_{sw} < 0.$

$z = \frac{\tilde{p}_1 - \tilde{p}_2}{SE_{Dp}} = \frac{.064 - .078}{.0068} = -2.06$ (−.0137)

RESECT Ho

OLD WAY

$z = \frac{.063 - .077}{.0068} = -2.06$

We know this is significant even for a 2-sided test at $\alpha = .05$; This one-sided test is significant at the 2% level (p-val = .0197)

Problem 3 WRONG Answer



d. What does the (1- $\alpha$ ) confidence interval mean? I.e., suppose the true $\pi$ =0.06 and you are able to get 100 samples.

It means the true proportion falls in these confidence ~~Intervals~~ $(1-\alpha)$ percent of the time. If $N=100$, our Intervals would not inclued 0.06 5 times out of 100.

e. Suppose a similar study was done in Sweden, with $N_{SW}$=3141 and $X_{SW}$=243. We think that the Swedes might be more *risqué* than those in the US. Design an appropriate test of this belief and comment on its results. Do this for both the traditional and Wilson estimates.

WRONG ANSWER
(See the difference)

$$\hat{p}_{SW} = \frac{243}{3141} = .0774 \qquad \tilde{p}_{SW} - \text{forget it.}$$

$$1.96 \cdot SE_{\hat{p}_{SW}} = 1.96\sqrt{\frac{.0774(1-.0774)}{3141}} = 1.96\sqrt{\frac{.07141}{3141}}$$

$$= 1.96(.00476)$$

but, we do the comparison thing

$$H_0: \pi_{us} - \pi_{sw} = 0$$

$$H_0: \pi_{us} - \pi_{sw} < 0.$$

$$z = \frac{(\hat{p}_{us} - \hat{p}_{sw}) - 0}{\sqrt{\frac{\hat{p}_{us}(1-\hat{p}_{us})}{n_1} + \frac{\hat{p}_{sw}(1-\hat{p}_{sw})}{n_2}}} = \frac{(.0636 - .0774)}{\sqrt{.00456 + .00476}}$$

$$= \frac{-.0138}{.0965} = -.14$$

FAIL TO Reject $H_0$

Problem 3

3

f. Comment on the difference between your tests based on the Wilson and the traditional estimates.

There was hardly any difference at all in the two techniques, each resulted in a z score of -2.06, which was significant at the 2% level, giving good evidence in favor of the alternative hypotheses, causing us to reject the Null Hypothesis of "no difference"

Don't feel bad if you didn't have time to do a complete analysis.

3

g. List some confounding factors in this survey. For example, truth bias might be present because respondees might be unwilling to tell the truth.

O Sample might not be random (SRS), can't tell from the problem. Where were the interviews conducted?

O SRS: Were equal numbers of people in their 70's interviewd as those less than 50? Age has an effect on promiscuity. Then again, that's a hypothesis. Come to think of it, how would you test that?

O SRS: Some of the multiple partners might be paired together! Violates independence assumption of SRS.

O Interviewer bias: was there something about the demeanor of the worker which "turned people off," or made them not wish to answer?

O might not be telling the truth

O might need to differentiate between MEN and WOMEN, one traditionally believes men are more risky than women.

O might need to differentiate between <u>married</u> and <u>single</u> people in the survey. The inclusion of marrieds would UNDERESTIMATE the prevalence of risky behavior.

O One should handle the item above by a CONDITIONAL probability concept, i.e. risky behavior given singe, etc.

O Samples might have location bias, i.e. difference cities might have difference "risky" tendencies.

O After Clinton-Lewinsky, it depends on what the definition of "is" is, and how one would answer the question in the affirmative.

O If might not admit to not being heterosexual.

O Cultural bias: some countries might admit more easily than others. Might be interviewing foreigners in the home country.

O People might not REMEMBER their promiscuous behaviors.

Problem 4  This took About 25 minutes !

4. Suppose we have normal populations, $X_1 \sim N(\mu_1, \sigma_1)$ and $X_2 \sim N(\mu_2, \sigma_2)$, where $\sigma$ is unknown. You obtain 2 samples and the summary statistics are

| | N | Sx | $\bar{X}$ |
|---|---|---|---|
| $X_1$ | 26 | 29.88 | 254.5 |
| $X_2$ | 19 | 31.8 | 262.1 |
| *All* | 45 | 30.58162 | 257.7 |

7pts

a. Compute the (1-$\alpha$) confidence intervals for $\mu_1$ and $\mu_2$. Use $\alpha = .05$.   d.f.=18

$\mu_1 \in \bar{x}_1 \pm t_{\frac{\alpha}{2}} \cdot \frac{29.88}{\sqrt{26}}$, d.f.=25

$= 254.5 \pm 2.06(5.86)$

$= 254.5 \pm 12.0715$

$= (242.2, 266.42)$

$\mu_2 \in 262.1 \pm t_{\frac{\alpha}{2}} \cdot \frac{31.8}{\sqrt{19}}$

$= 262.2 \pm 2.101(7.3)$

$= 262.2 \pm 15.34$

$(246.9, 277.5)$

6p

b. Are the means equal? State and perform the appropriate test and discuss, including the p-value.

$H_0: \mu_1 - \mu_2 = 0$

$H_a: \mu_1 - \mu_2 \neq 0$.

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - 0}{\sqrt{\frac{29.88^2}{26} + \frac{31.8^2}{19}}} = \frac{-7.6}{\sqrt{34.34 + 53}}$$

$$= \frac{-7.6}{\sqrt{87.6}} = \frac{-7.6}{9.357} = -.812$$

Note: t close to -1, not far from z = -1, so won't be signif. @ $\alpha = .05$

d.f. use $\min(n_1-1, n_2-1) = 18$

$t_{18, .05}$ critical $= 2.101$ (See part a!)

CANNOT REJECT.

15 minutes so far

Problem 4

6pts

c. Since our sample size is relatively small, it would be better to use a pooled estimate for the standard deviation. We can do this is the standard deviations are the same. Perform the appropriate test (also using $\alpha = .05$) of the hypothesis that the standard deviations are the same. Recall that $F_{a,b} = \frac{S^2_{whatever?}}{S^2_{whatever?}} \geq 1$ since $\sigma^2 < 0$.

Put larger S on top, so $F_{18,25} = \frac{(31.8)^2}{(29.88)^2} = 1.133$

Closest is $F_{20,25}$ or $F_{15,25}$

| | $F_{20,25}$ | $F_{15,25}$ |
|---|---|---|
| .10 | 1.72 | 1.77 |
| .05 | 2.01 | 2.09 |

Not Signif.

∴ We conclude $\sigma_1 = \sigma_2$. So we can pool

7min.

6pts

d. If you accepted $H_0$ in part c. redo the test in part b using the pooled standard deviation. Discuss what difference, if any, using a pooled variance made in your inference. The sample standard deviation for all 45 data points is 30.58162.

8min.

Yeah, like I have time for thiss ...

Pooled: $N = 45$, $S_p = 30.58$, pooled $S_{\bar{x}} = 7$

$$t = \frac{-7.6}{\frac{30.58}{\sqrt{45}}} = \frac{-7.6}{4.55} = -1.66$$

NOW we are (barely) Signif @ .10 level but not at .05

$t_{44}$

| | .05 (.10 pval) | .025 (.05 p-val) |
|---|---|---|
| $t^c_{45} =$ | 1.68 | 2.02 |
| $t^c_{50} =$ | 1.67 | 2.01 |
| $z =$ | 1.645 | 1.96 |

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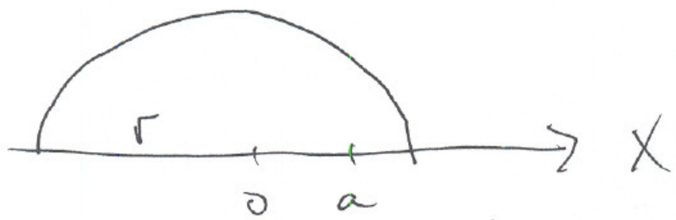
Extra Credit #1 Thanks to Anthony Macaluso.

X is a r.v. with pdf the semi-circle, i.e., $-r \le X \le r$, and the equation for the circle y is according to the classic formula for circle, $r^2 = x^2 + y^2$




$a = 1/3$

Hint ①: Area of a Chord @ a = $R^2 \tan^{-1}\left(\sqrt{\left(\frac{R}{a}\right)^2 - 1}\right) - r\sqrt{R^2 - r^2}$.

a. Calculate r

$A = (\pi r^2) * .5 = 1.0$

$r = \sqrt{\frac{2}{\pi}} = .7979$

b. Write an expression to evaluate $Pr(X \le a)$.

$x^2 + y^2 = r^2$

$y = \sqrt{r^2 - x^2}$

$A = \int_{-r}^{1/3} \sqrt{r^2 - x^2}\, dx$ ...

Hint 2: $\int \sqrt{a^2 - x^2} = \frac{1}{2} x \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1}\left(\frac{x}{a}\right) + C$

c. Find this probability.

Evaluate using handy Hin. — OR —

use the chord Area equation, keeping proper scaling to Account for