

10.2

#1 POTATO CHIPS

161

RIDER WOOD FARMS : $\sim N(175, 25)$ SRS $n_R = 20$
 Camberley : $\sim N(180, 30)$ $n_C = 20$

PART A

Sampling Distribution $\bar{X}_C - \bar{X}_R$

SHAPE: Approximately Normal since both populations distribution are approximately Normal

Center: $\mu_{\bar{X}_C - \bar{X}_R} = \mu_{\bar{X}_C} - \mu_{\bar{X}_R} = 180 - 175 = 5 \text{ GRAMS}$

SPREADS: since we are sampling 2 different farms, it is reasonable they are independent and can calculate the S.D.

$$\sigma_{\bar{X}_C - \bar{X}_R} = \sqrt{\frac{\sigma_{\bar{X}_C}^2}{n_C} + \frac{\sigma_{\bar{X}_R}^2}{n_R}} = \sqrt{\frac{25^2}{20} + \frac{30^2}{20}} = 8.73 \text{ grams}$$

PART 1B

There are 2 ways to do this problem.
Remember you are trying to find the Probability

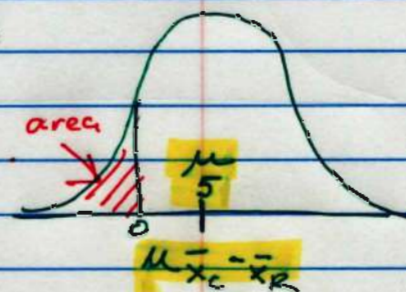
OPTION 1 Use the information from (1A)

RIDERWOOD FARMS: $\mu_R = 175$

CAMBERLEY: $\mu_C = 180$

$\mu_{\bar{X}_C - \bar{X}_R} = 5 \text{ Grams}$

$\sigma_{\bar{X}_C - \bar{X}_R} = 8.73 \text{ Grams}$



* the mean of Riderwood is larger
therefore $\bar{X}_C - \bar{X}_R$ must be negative

$$P(\bar{X}_C - \bar{X}_R < 0) = P(Z < -.57) = .28$$

$$\text{Find the Z score for 0: } Z = \frac{0 - 5}{8.73} = -.57$$

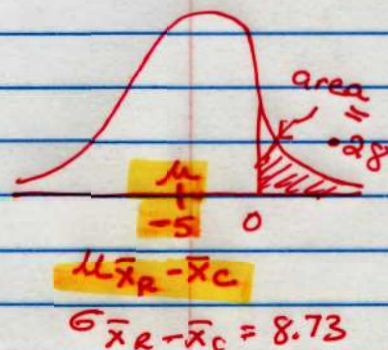
$$\text{normalcdf}(-E99, -.57, 0, 1) = .28$$

OPTION 2: Reverse the order as such + GET SAME RESULT

$$P(\bar{X}_R > \bar{X}_C) = P(\bar{X}_R - \bar{X}_C > 0)$$

$$\text{Find Z score for 0: } Z = \frac{0 - (-5)}{8.73} = .57$$

$$P(Z > .57) = .28$$



CONCLUSION:

THE INSPECTOR SHOULD NOT BE SURPRISED SINCE
A Random sample of 20 potatoes FROM RIDERWOOD FARMS
WILL BE LARGER THAN A Random Sample from
CAMBERLEY will occur about 28% OF THE TIME.

②

PLASTIC GROCERY BAGS

PG 3

PART A - Construct CI

STEP 1

DEFINE CI/TOH

μ_T = mean Capacity OF ^{TARGET} PLASTIC BAGS (gms)
 μ_B = mean Capacity OF BASHAS plastic bags (gms)

ESTIMATE $\mu_T - \mu_B$ at 99% Confidence level

CI: 2 sample t-INTERVAL FOR THE DIFFERENCE OF MEANS

STEP 2

CONDITIONS:

① Random - random samples taken from BOTH stores

② INDEPENDENT -

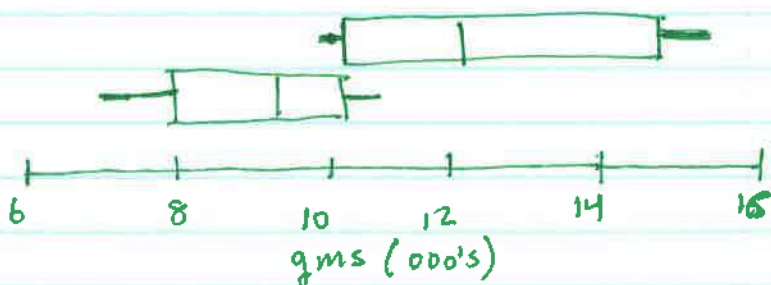
- The samples were selected independently
- It is reasonable to assume that there are 10(s) = 50 plastic bags at each store.

③ Population standard deviation unknown (t-statistic)

④ NORMAL

- We were not told the 2 samples were
- The sample was small so CLT ^{does} Normal.
- Therefore Graph BOTH Samples to Check: not apply

Target
Bashas

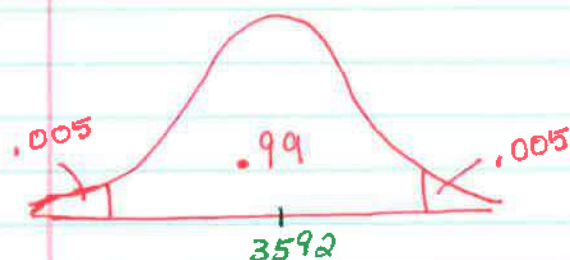


The samples appear approximately normal since both graph do not show outliers or skewness.

2 - Plastic Bags (Cont)

PART A - (Cont) CI

STEP 3: CALCULATIONS



2var Stats

Target $\left\{ \begin{array}{l} \bar{x} = 12,825.8 \\ S_x = 1,912.5 \end{array} \right.$
 Bashtas $\left\{ \begin{array}{l} \bar{y} = 9,234 \\ S_y = 1,474.20 \end{array} \right.$

degrees of freedom

Using the conservative df approach, take the smaller of the 2 sample sizes

$$df = 5 - 1 = 4$$

$$\text{inv T.} (.005, 4) = -4.604$$

provide this:

$$n_T = 5 \quad n_B = 5$$

$$df = 4$$

$$t^* = 4.604$$

3 decimals

Formula:

$$(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

$$\bar{x}_T - \bar{x}_B \quad \text{CI:}$$

$$12826 - 9234 \pm 4.604 \sqrt{\frac{1912.5^2}{5} + \frac{1474.2^2}{5}}$$

$$3592 \pm 4,972$$

$$(-1380, 8564)$$

STEP 4 CONCLUSION

We are 99% confident that the true difference in mean capacity for bags from Target and from Bashtas is in the interval -1,380 to 8,564 gms

METHOD 2

USING TECHNOLOGY TO FIND THE CI:

Review next page

+ NOTICE THIS

CI w/ TECHNOLOGY

IS MORE NARROW $(-101, 1285)$ $df = 7.5$

Question 2: PLASTIC BAGS

1 Pg 5

WORK TO SHOW IF CREATING
A CONFIDENCE INTERVAL
WITH TECHNOLOGY

STEP 1 The same

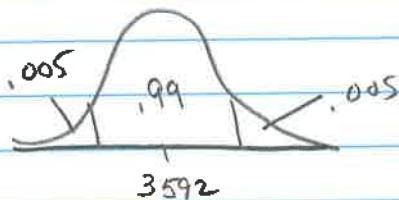
$$\mu_T =$$

$$\mu_B =$$

CI: 2 sample t-interval for $\mu_1 - \mu_2$ @ 99% CL

STEP 2 CONDITIONS THE SAME

STEP 3 Calculations



$$\begin{array}{lll} \bar{x}_T = 12,826 & s_T = 1913 & n = 30 \\ \bar{x}_B = 9234 & s_B = 1474 & n = 30 \end{array}$$

$$99\% \text{ CI} = (-101, 7285) \quad df = 7.5$$

STEP 4 Conclusion THE SAME

CALCULATOR STEPS:

STAT TESTS 2-SAMP TINT

DATA

POOLED NO

NEVER USE POOLED

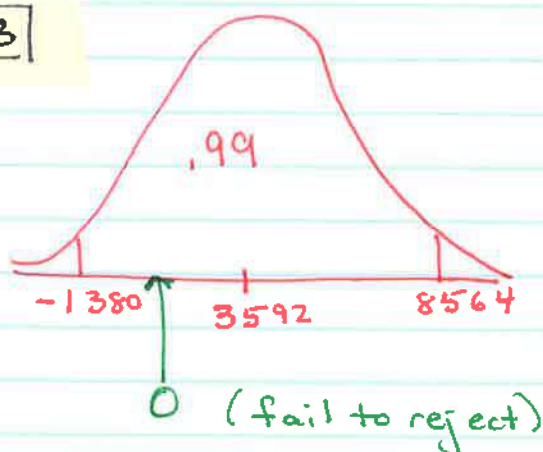
RESULTS:

$$d.f. = 7.5$$

CI = $(-101, 7285)$ ** NOTICE HOW MUCH NARROWER
THE INTERVAL IS WITH TECHNOLOGY

** IF YOU USE TECHNOLOGY, YOU MUST STATE TECH D.F.

PART 2B



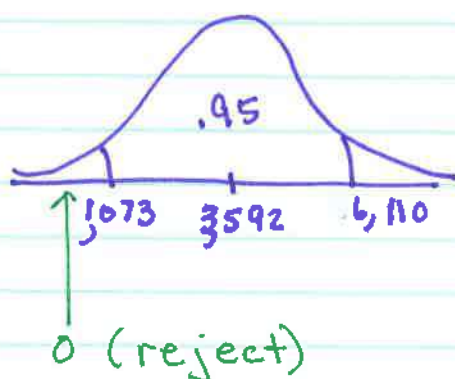
Since the interval includes 0, as a plausible population parameter, there is no difference in the 2 means.

Thus we do not have convincing evidence that there is a difference in mean capacity between the stores.

ADDITIONAL QUESTIONS TO PINDER:

→ However, what would happen if we change to the confidence level to 95%?

Use the technology approach



$df = 7.5$

Since the interval does not include 0, we would have convincing evidence that there is a difference in mean capacity between the stores.

→ What would you suspect to happen if we increase the sample size?

* we would likely find a convincing difference since it seems pretty clear that Target bags have a bigger capacity.

③

The stronger picker upper

PG7

PART 3A

5 NUMBER SUMMARY*

BOUNTY
GENERIC

MIN Q1 MED Q3 MAX
(103, 114, 116.5, 124, 128)
(77, 84, 88, 90, 103)

* FIND

- ① 1 VAR STAT
- ② BOXPLOT + USE TRACE

Box PLOTS - MUST DO'S

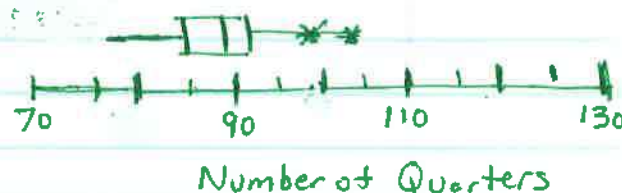
- ① LABEL AXIS'S
- ② SET WINDOW

XMIN = 70
XMAX = 130
XSCL = 10

BOUNTY



GENERIC:



Remember Cuss and BS

BOTH BOUNTY AND THE GENERIC BRAND ARE
ROUGHLY SYMMETRIC

THE CENTER FOR BOUNTY IS MUCH HIGHER THAN
THE GENERIC

THE RANGE OF EACH DISTRIBUTION IS ABOUT THE
SAME, THE IQR OF BOUNTY IS LARGER.
THE GENERIC BRAND HAS A HIGH OUTLIERS.

CONCLUSION

SINCE THE CENTERS ARE SO FAR APART AND
THERE IS ALMOST NO OVERLAP IN THE
2 DISTRIBUTIONS, THE BOUNTY MEAN IS ALMOST
CERTAIN TO BE SIGNIFICANTLY HIGHER THAN GENERIC.

IF THE MEANS WERE REALLY THE SAME, IT
WOULD BE VIRTUALLY IMPOSSIBLE TO GET SO LITTLE
OVERLAP.

① HYPOTHESIS:

μ_B = mean number of Quarters a wet Bounty can hold
 μ_G = mean " " " " " " Generic " "

$$H_0: \mu_B - \mu_G = 0$$

$$H_A: \mu_B - \mu_G > 0$$

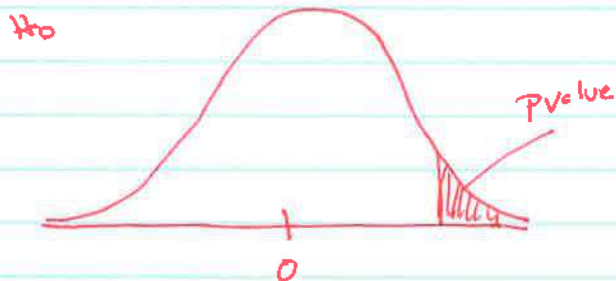
(Bounty holds more Quarters)

② TEST + CONDITIONSCONDITIONS

- ① population standard deviation unknown
- ② Random - Students used a (+ statistic) random sample of each brand.
- ③ Independent -
 - Samples were selected independently
 - It's reasonable there are more than 10(30) = 300 paper towels of each brand
- ④ Normal - The samples were large enough ($n=30+$) for CLT to apply and the 2 distributions are approximately Normal

TEST: 2 SAMPLE T-TEST FOR THE DIFFERENCE OF MEANS ($\mu_B - \mu_G$)

CALCULATIONS



Formula

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

df = smaller of $n_1 - 1$ and $n_2 - 1$

$$\bar{x}_B = 117.6 \quad s_B = 6.64 \quad n_B = 30$$

$$\bar{x}_G = 88.13 \quad s_G = 6.30 \quad n_G = 30$$

$$df = 29 \quad t = \frac{(117.6 - 88.13) - 0}{\sqrt{\frac{6.64^2}{30} + \frac{6.30^2}{30}}} = \frac{29.47}{1.6711} = 17.64$$

$$pvalue = P(t \geq 17.64) = 2.39 E^{-17} \approx 0$$

$\uparrow$
tcdf (17.64, E99, 29)

TECHNOLOGY

STAT TESTS

2-Samp TTEST: DATA

> μ_2

POOLED (NO) ALWAYS

SEE PAGE 10 ON WORK TO SHOW US/ TECHNOLOGY

$\mu_1 > \mu_2$

$t = 17.64$

p (pvalue) = $2.98 E^{-25}$

df = 57.8

CONCLUDE:

Since the p-value is so small,
We reject H_0 .

There is convincing evidence that Wet Bounty paper towels can hold more weight, on average, than wet generic paper towels.

PART 3C

Since the pvalue is approximately 0, it is almost impossible to get a differences in means of at least 29.5 quarters by random chance, assuming that the 2 brands of paper towels can hold the same amount of weight when wet.

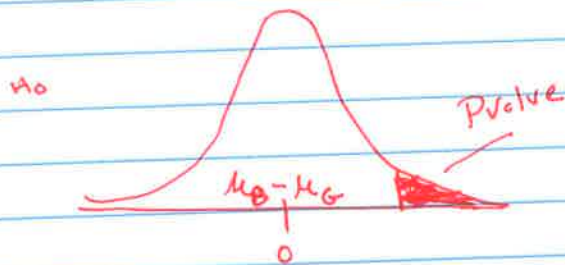
QUESTION 3B
DOING TOST W/ TECHNOLOGY

P610

STEP 1 THE SAME

STEP 2 THE SAME

STEP 3



$$\bar{X}_B = 117.6 \quad S_B = 6.64$$

$$\bar{X}_G = 88.13 \quad S_G = 6.30$$

$$n_B = n_G = 30$$

$$\text{TECHNOLOGY DF} = 57.8$$

$$t = 17.64$$

$$p_{\text{value}} = P(t > 17.64) = 2.98E^{-25} \approx 0$$

STEP 3 THE SAME