10.2

#1 POTATO CHIPS

mean(μ) S.D.(σ)

SRS

RIDER WOOD FARMS : $\sim N(175, 25)$ $n_R = 20$

Cam ber ley : $\sim N(180, 30)$ $n_c = 20$

PART A

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

SHAPE: Approximately Normal since both populations distribution are approximately Normal

Center: $\mu_{\bar{x}_c - \bar{x}_R} = \mu_c - \mu_R = 180 - 175 = 5$ GRAMS

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

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

PART 1 B

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

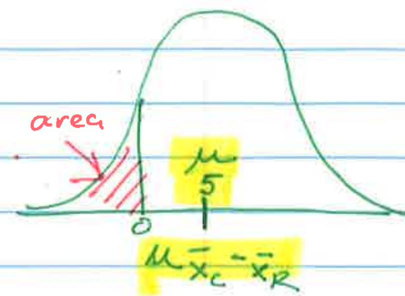
OPTION 1 Use the information from (1A)

RIDERWOOD FARMS: $\mu_R = 175$

CAMBERLEY: $\mu_C = 180$

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

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



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

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

FIND THE ZSCORE FOR 0: $Z = \frac{0-5}{8.73} = -.57$

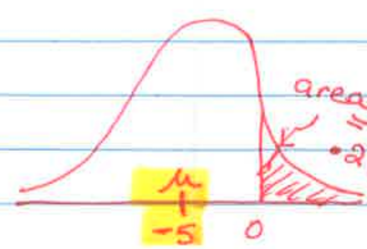
normalcdf $(-E99, -.57, 0, 1) = .28$

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

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

FIND ZSCORE FOR 0: $Z = \frac{0-(-5)}{8.73} = +.57$

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



$\mu_{\bar{x}_R - \bar{x}_C} = -5$

$\sigma_{\bar{x}_R - \bar{x}_C} = 8.73$

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

PART A - Construct CI

STEP I

DEFINE CI / TOH

μ_T = TRUE mean Capacity of TARGET PLASTIC BAGS (gms)
μ_B = TRUE 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

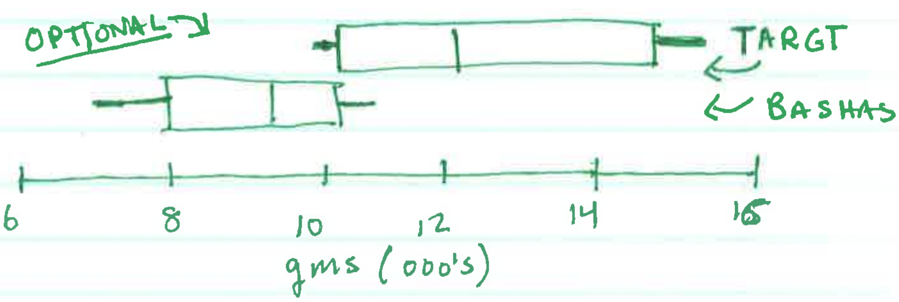
CONDITIONS:

① Random – random samples taken from BOTH stores

② INDEPENDENT –
- The samples were selected independently
- It is reasonable to assume that there are 10(5) = 50 plastic bags at each store.

③ Population standard deviation unknown (t-statistic)

④ NORMAL
- We were not told the 2 samples were Normal.
- The sample was small so CLT does not apply
- There fore Graph BOTH Samples to Check:

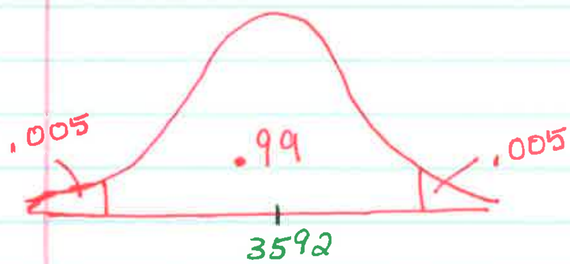


The samples appear approximately normal since both graph do not show outliers or skewness.

2 – Plastic Bags (Cont)

PART A – (Cont) CI

STEP 3: CALCULATIONS



FORMULA:

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

2Var Stats

target $\begin{cases} \bar{x} = 12{,}825.8 \\ S_x = 1{,}912.5 \end{cases}$

Bashas $\begin{cases} \bar{y} = 9{,}234 \\ S_y = 1{,}474.20 \end{cases}$

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

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

$3592 \pm 4{,}972$

$(-1380, 8564)$

degrees of freedom

Using the conservctive df approch, take the smaller of the 2 semple sizes

$df = 5 - 1 = 4$

invT. $(.005, 4) = -4.604$

3 decimals

provide this:

$n_T = 5 \quad n_B = 5$

$df = 4$

$t^* = 4.604$

STEP 4 CONCLUSION

we are 99% confident that the true difference in mean capacity for bags from Target and from Bashas 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 $(-101, 7285)$ $df = 7.513$

Question 2: PLASTIC BAGS

WORK TO SHOW IF CREATING A CONFIDENCE INTERVAL WITH TECHNOLOGY

STEP 1 The same

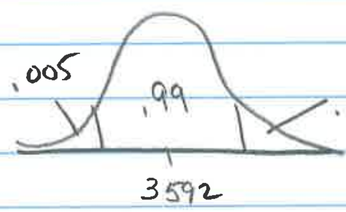
$\mu_T =$

$\mu_B =$

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

STEP 2 CONDITIONS THE SAME

STEP 3 Calculations



$\bar{x}_T = 12{,}826$ $\quad S_T = 1913$ $\quad n = 30$

$\bar{x}_B = 9234$ $\quad S_B = 1474$ $\quad n = 30$

99% CI = (−101, 7285) $\quad$ df = 7.5

STEP 4 Conclusion THE SAME

CALCULATOR STEPS:

STAT TESTS 2-SAMPTINT DATA

POOLED NO

NEVER USE POOLED

RESULTS:

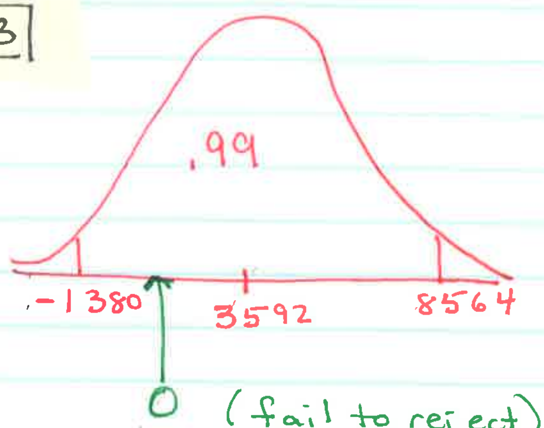
d.f. = 7.5

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

***IF YOU USE TECHNOLOGY, YOU MUST STATE TECH DF.

2 - PLASTIC BAGS (CONT)

PART 2B



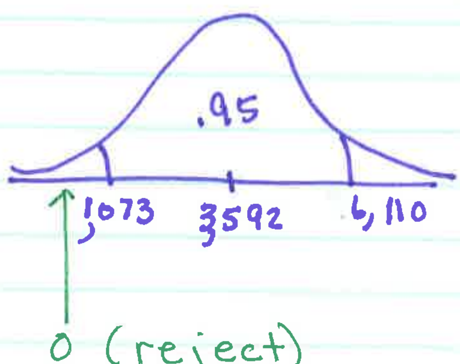
Since the interval includes 0, as a plausible population parameter, there is no difference in the 2 means.

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

ADDITIONAL QUESTIONS TO PONDER:

→ 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.

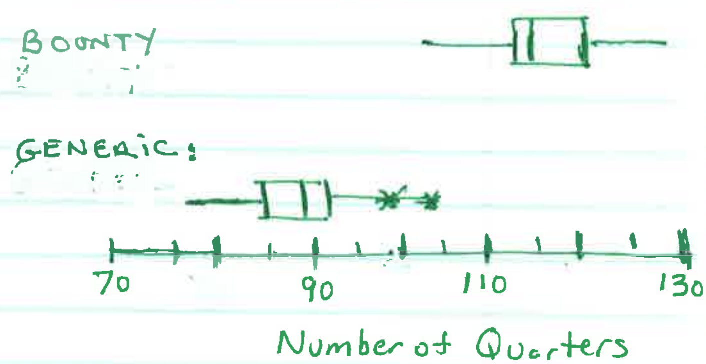
③ The stronger picker upper

PART 3A

5 NUMBER SUMMARY*

	MIN	Q1	MED	Q3	MAX
BOUNTY	103	114	116.5	124	128
GENERIC	77	84	88	90	103

* FIND
① 1 VAR STAT
② BOXPLOT + USETRACE



BOX PLOTS - MUST DO'S
① LABEL AXIS'S
② SET WINDOW
Xmin = 70
Xmax = 130
Xscl = 10

$\boxed{\text{Remember Coss and BS}}$

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 2 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.

PART 3B TOH

① HYPOTHESIS:

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

$H_0: \mu_B - \mu_G = 0$
$H_A \quad \mu_B - \mu_G > 0$ (Bounty holds more Quarters)

② TEST + CONDITIONS

CONDITIONS

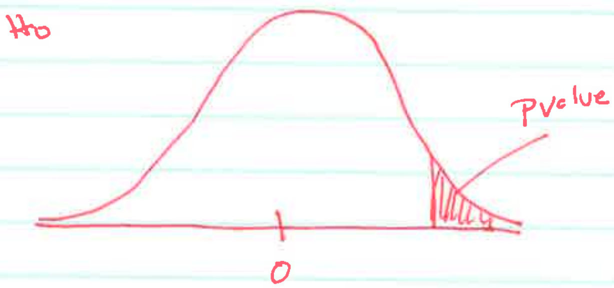
① population standard deviation unknown (t statistic)
② Random – Students used a random sample of each brand.
③ Independent –
- Samples were selected independently
- It's reasonable there are more than 10(30) = 300 paper towels of each brand

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 $(\mu_B - \mu_G)$

3B TOH (cont)

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 $n_2 - 1$

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

$\bar{x}_G = 88.13$ $S_G = 6.30$ $n_g = 30$

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

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

tcdf (17.64, E99, 29)

TECHNOLOGY

STAT TESTS 2-SampTTest: DATA

$> \mu_2$

POOLED NO

ALWAYS

$\mu_1 > \mu_2$

$t = 17.64$

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

$df = 57.8$

SEE PAGE 10 ON WORK TO SHOW W/ TECHNOLOGY

CONCLUDE:

Since the p-value is so small,
We reject Ho.
There is convincing evidence that wet Bounty paper towels can hold more weight, on average, than wet generic paper towels.

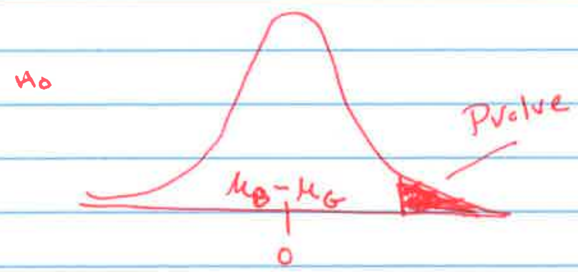
PART 3C Since the pvalue is approximately 0, it is almost impossible to get a differences in means of at least 29.5 quarters by random chance, assuming that the 2 brands of paper towels can hold the same amount of weight when wet.

QUESTION 3B
DOING TOH W/ TECHNOLOGY

STEP 1 THE SAME

STEP 2 THE SAME

STEP 3



$\bar{x}_B = 117.6$ $S_B = 6.64$

$\bar{x}_G = 88.13$ $S_G = 6.30$

$n_B = n_G = 30$

TECHNOLOGY DF = 57.8

$t = 17.64$

pvalue $= P(t > 17.64) = 2.98E^{-25} \cong 0$

STEP 3 THE SAME