AP Stats Ch 22 - Extra Practice **Name:** Solutions **Per:** ___

23. Pain. Researchers comparing the effectiveness of two pain medications randomly selected a group of patients who had been complaining of a certain kind of joint pain. They randomly divided these people into two groups, then administered the pain killers. Of the 112 people in the group who received medication A, 84 said this pain reliever was effective. Of the 108 people in the other group, 66 reported that pain reliever B was effective.

a) Write a 95% confidence interval for the percent of people who may get relief from this kind of joint pain by using medication A. Interpret your interval.

b) Write a 95% confidence interval for the percent of people who may get relief by using medication B. Interpret your interval.

c) Do the intervals for A and B overlap? What do you think this means about the comparative effectiveness of these medications?

d) Find a 95% confidence interval for the difference in the proportions of people who may find these medications effective. Interpret your interval.

e) Does this interval contain zero? What does that mean?

f) Why do the results in parts c and e seem contradictory? If we want to compare the effectiveness of these two pain relievers, which is the correct approach? Why?

(Use a calculator to find all these confidence intervals – not by hand and assume conditions for inference are met).

(a) $\hat{p}_A = \frac{84}{112}$ Perform 1PropZInt using: $x = 84$, $n = 112$, C-level $= .95$

$\boxed{(.66981, .83019)}$

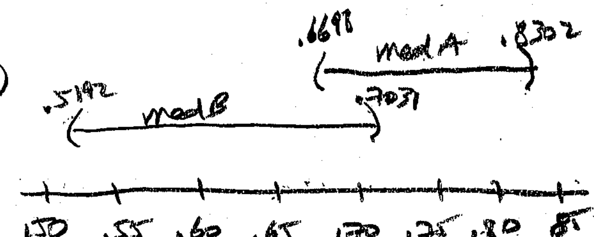
We are 95% confident that between 66.98% and 83.02% of patients find medication A effective.

(b) $\hat{p}_B = \frac{66}{108}$ Perform 1PropZInt using: $x = 66$, $n = 108$, C-level $= .95$

$\boxed{(.51917, .70305)}$

We are 95% confident that between 51.92% and 70.31% of patients find medication B effective.

(c)



Yes, the confidence intervals overlap, which seems to suggest we can't conclude there is a difference.

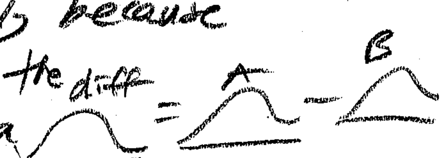
(d) Perform a 2PropZInt using: $x1 = 84$, $n1 = 112$, $x2 = 66$, $n2 = 108$, C-level $= .95$

$\boxed{(.01689, .26089)}$

We are 95% confident that between 1.7% and 26.1% more patients find medication A effective than med. B.

(e) No the confidence interval does not contain zero, which suggests that we can conclude that medicine A is more effective than B.

(f) The 2 sample test is correct. It is incorrect to compare overlap in 2 confidence intervals calculated separately because that approach doesn't correctly account for the variance of a difference. With 2, it is a diff = A − B situation so



$\sigma^2_{diff} = \sigma^2_A + \sigma^2_B$

$\sigma_{diff} = \sqrt{\sigma_A^2 + \sigma_B^2} = \sqrt{\frac{p_A q_A}{n_A} + \frac{p_B q_B}{n_B}}$ handles this correctly.

11. Teen smoking, part I. A Vermont study published in December 2001 by the American Academy of Pediatrics examined parental influence on teenagers' decisions to smoke. A group of students who had never smoked were questioned about their parents' attitudes toward smoking. These students were questioned again two years later to see if they had started smoking. The researchers found that among the 284 students who indicated that their parents disapproved of kids smoking, 54 had become established smokers. Among the 41 students who initially said their parents were lenient about smoking, 11 became smokers. Do these data provide strong evidence that parental attitude influences teenagers' decisions about smoking?

a) What kind of design did the researchers use?
b) Write appropriate hypotheses.
c) Are the assumptions and conditions necessary for inference satisfied?
d) Test the hypothesis and state your conclusion.
e) Explain in this context what your P-value means.
f) If that conclusion is actually wrong, which type of error did you commit?

a) prospective observational study

b) $H_0: p_L = p_S$ proportion teenager smokers same for lenient & strict parents

$H_A: p_L > p_S$ proportion teenager smokers higher for lenient parents

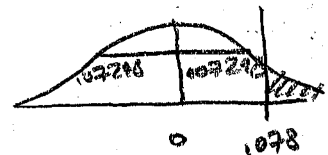
c) ✓ $n_L p_L = 11$ ✓ – SRSs (assumed)
– $n_L q_L = 41 - 11 = 30$ ≥ 10 ✓ – groups indep (assumed)
– $n_S p_S = 54$ ✓ – 338 < 10% of all teen smokers
– $n_S q_S = 284 - 54 = 230$

$\boxed{\text{Yes}}$

d) $\hat{p}_L = \frac{11}{41} = .268$ $\hat{p}_S = \frac{54}{284} = .190$

$\hat{p}_L - \hat{p}_S = .268 - .190 = .078$

$SE_{\hat{p}_L - \hat{p}_S} = \sqrt{\frac{(.268)(.732)}{41} + \frac{(.190)(.81)}{284}} = .07298$



p-value = normalcdf(.078, 999, 0, .07298)

$= \boxed{.1426}$

With $\alpha = .05$, $p = .1426$ is high so we fail to reject H_0. We do not have SSE to conclude parental attitude influences teenagers' decisions about smoking.

e) If parental attitude has no effect on teenager smoking, there is a 14.26% probability of having a difference as large as the 7.8% difference we saw in this study (or higher) just due to natural, random sampling variation.

f)

	T	F
R	I	
NR		II

we failed to reject, so if this is wrong it is a type II error.

13. Teen smoking, part II. Consider again the Vermont study discussed in Exercise 11.

a) Create a 95% confidence interval for the difference in proportion of children who may smoke and have approving parents and those who may smoke and have disapproving parents.
b) Interpret your interval in this context.
c) Carefully explain what "95% confidence" means.

(a) $CI = (\hat{p}_L - \hat{p}_S) \pm z^* SE_{\hat{p}_L - \hat{p}_S}$

$= .078 \pm (1.96)(.07298)$

$= \boxed{(-.0650, .2210)}$

(b) We are 95% confident that between 6.5% fewer and 22.1% more teenagers who have lenient parents smoke than teenagers who have strict parents.

(c) If we repeated this study many times with the same sample size, and constructed confidence intervals for each, 95% of these confidence intervals would contain the true difference in proportion of teenagers who smoke (lenient − strict parents.)

29. Intentional walk. During the 2004 baseball season, San Francisco Giants' slugger Barry Bonds was such a dangerous hitter that many teams simply chose to walk him rather than throw him a pitch he could hit. Just before a series of games in New York, an analyst advised the Mets that they should pitch to Bonds. As evidence, he reported that thus far in the season the Giants had scored in 37 of 79 innings when Bonds was walked intentionally, but in only 107 of 298 innings when the opponents did not walk him. Does this provide evidence that teams should not intentionally walk Barry Bonds?

Conditions

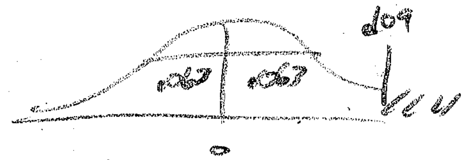
SRS/indep ✓	n<10% pop ✓	success/fail ✓
assumed ✓	79 & 298	37
	<10% of all innings?	79 − 37
		107
		298 − 107

all ≥ 10

$H_0: \hat{p}_W - \hat{p}_{NW} = 0 \quad H_A: \hat{p}_W - \hat{p}_{NW} > 0 \quad \mu_{W-NW} = .468 - .359 = .109$

$\hat{p}_{W} = \frac{37}{79} = .468 \quad \hat{p}_{NW} = \frac{107}{298} = .359$

$SE_{W-NW} = \sqrt{\frac{(.468)(.532)}{79} + \frac{(.359)(.641)}{298}} = .063$



p-value = normalcdf(.109, 999, 0, .063)
= $\boxed{.0418}$

with p = .0418, reject H_0.
There is statistically significant evidence that the increased % of scores in Mets favor when not walking Bonds is valid.