30. AP Stats. The College Board reported that 60% of all students who took the 2004 AP Statistics exam earned scores of 3 or higher. One teacher wondered if the performance of her school was different. She believed that year's students to be typical of those who will take AP Stats at that school and was pleased when 65% of her 54 students achieved scores of 3 or better. Can she claim her school is different? Explain.

H_0: $p = .60$ percentage of students at this school scoring 3 or better is same as national 60%.

H_A: $p \neq .60$ percentage of students at this school scoring 3 or better is different from national 60%.

Conditions

✓ — $np = (54)(.60) = 32.4$
$nq = (54)(.40) = 21.6$ ≥ 10

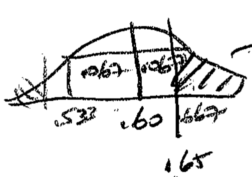
✓ — SRS (assume typical for this school)

✓ — indep (assumed)

✓ — 54 < 10% of all students

by hand

$\hat{p} = .65$ $\sigma_{\hat{p}} = \sqrt{\frac{(.6)(.4)}{54}} = .067$



normalcdf(.65, 999, .60, .067) = .2278

p-value = 2(.2278) = $\boxed{.456}$

(or could find test statistic: $z = \frac{.65 - .60}{.067} = .75$
normalcdf(.75, 999, 0, 1) = .2278 × 2)

by calculator

Perform a 1propZtest in TI84 using:

$p_0 = .60$
$x = 35$
$n = 54$
prop $\neq p_0$

$z = .75$
p-value = $\boxed{.470}$

With significance level of .05, p-value = .456 is high so we fail to reject H_0. We do not have sufficient statistical evidence to conclude that the percentage of students at this school scoring 3 or better is any different from the national 60%.

21. WebZine. A magazine is considering the launch of an online edition. The magazine plans to go ahead only if it's convinced that more than 25% of current readers would subscribe. The magazine contacts a simple random sample of 500 current subscribers, and 137 of those surveyed expressed interest. What should the company do? Test an appropriate hypothesis and state your conclusion. Be sure the appropriate assumptions and conditions are satisfied before you proceed.

$H_0: p = .25$ The percentage of interested subscribers is 25%.

$H_A: p > .25$ The percentage of interested subscribers is greater than 25%.

Conditions

✓ — $np = (500)(.25) = 125$
$nq = (500)(.75) = 375$ ≥ 10

✓ — SRS "simple random sample"

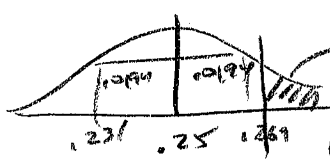
✓ — indep (implied by SRS)

✓ — 500 < 10% of all subscribers

by hand

$\hat{p} = \frac{137}{500} = .274$ $\sigma_{\hat{p}} = \sqrt{\frac{(.25)(.75)}{500}} = .0194$

$\left(z = \frac{.274 - .25}{.0194} = 1.24\right)$



p-value
$= \text{normalcdf}(.274, 999, .25, .0194)$
(or $= \text{normalcdf}(1.24, 999, 0, 1)$)
for test statistic
$= \boxed{.108}$

by calculator
Perform 1prop z-test in TI 84
using: $p_0 = .25$
$x = 137$
$n = 500$
prop $> p_0$

$z = 1.24$
p-value $= \boxed{.1076}$

With significance level of .05, p-value of .108 is high so we fail to reject H_0.
We do not have sufficient statistical evidence to conclude that the percentage of interested subscribers is greater than 25%.

8. Candy. Someone hands you a box of a dozen chocolate-covered candies, telling you that half are vanilla creams and the other half peanut butter. You pick candies at random and discover that the first three you eat are all vanilla.

a) If there really were 6 vanilla and 6 peanut butter candies in the box, what is the probability you would have picked three vanillas in a row?

b) Do you think there really might have been 6 of each? Explain.

c) Would you continue to believe it if the fourth one you try is also vanilla? Explain.

a) binomial/Bernoulli?
no b/c probability of vanilla is not constant trial to trial

$P(\text{ex 3 vanilla}) = \left(\frac{6}{12}\right)\left(\frac{5}{11}\right)\left(\frac{4}{10}\right) \approx \boxed{.091}$

b) This is like a p-value, not unusual b/c it is higher than .05, so it is reasonable to have 6 of each.

c) $P(\text{ex 4 vanilla})$
$= \left(\frac{6}{12}\right)\left(\frac{5}{11}\right)\left(\frac{4}{10}\right)\left(\frac{3}{9}\right)$
$= .03$

now $p < .05$, so this would now be considered unusual.

3. Negatives. After the political ad campaign described in Exercise 1a, pollsters check the governor's negatives. They test the hypothesis that the ads produced no change against the alternative that the negatives are now below 30% and find a P-value of 0.22. Which conclusion is appropriate? Explain.

a) There's a 22% chance that the ads worked.

b) There's a 78% chance that the ads worked.

c) There's a 22% chance that the poll they conducted is correct.

d) There's a 22% chance that natural sampling variation could produce poll results like these if there's really no change in public opinion.

Correct wording is: If there is really no change in the percentage of the governor's negatives (still 30%) we would have a trial with a percentage negative as low as this trial (we aren't given this value) or lower just due to chance.

23. Women executives. A company is criticized because only 13 of 43 people in executive-level positions are women. The company explains that although this proportion is lower than it might wish, it's not surprising given that only 40% of all their employees are women. What do you think? Test an appropriate hypothesis and state your conclusion. Be sure the appropriate assumptions and conditions are satisfied before you proceed.

$H_0: p = .40$ percentage of executives who are female is 40%.

$H_A: p < .40$ percentage of executives who are female is less than 40%.

conditions

✓ — $np = (43)(.4) = 17$ ≥ 10
$nq = (43)(.6) = 25$

✓ — SRS no but assume representative

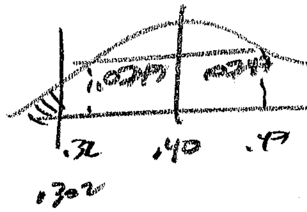
✓ — indep (assumed)

✓ — 43 < 10% of all executives (maybe?)

by hand

$\hat{p} = \frac{13}{43} = .302$ $\quad \sigma_{\hat{p}} = \sqrt{\frac{(.40)(.60)}{43}} = .0747$

$\left(z = \frac{.302 - .40}{.0747} = -1.3\right)$



p-value
= normalcdf(−999, .302, .40, .0747)
= $\boxed{.095}$

by calculator

Perform a 1PropZTest in TI-84
using: $p_0 = .40$
$x = 13$
$n = 43$
prop < p_0

$z = -1.3$
p-value = $\boxed{.0955}$

With significance level of .05, p-value = .095 is high so we fail to reject H_0. We do not have sufficient statistical evidence to conclude that the percentage of executives who are female is less than 40%.

15. Smoking. National data in the 1960s showed that about 44% of the adult population had never smoked cigarettes. In 1995 a national health survey interviewed a random sample of 881 adults and found that 52% had never been smokers.

a) Create a 95% confidence interval for the proportion of adults (in 1995) who had never been smokers.

b) Does this provide evidence of a change in behavior among Americans? Using your confidence interval, test an appropriate hypothesis and state your conclusion.

a) conditions

✓ — $np = (881)(.44) = 387$ ≥ 10
$nq = (881)(.56) = 493$

✓ — SRS "random sample"

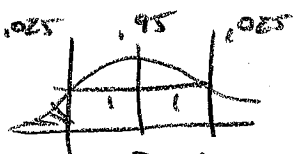
✓ — indep (implied by random)

✓ — 881 < 10% of adults

by hand

$\hat{p} = .52$ $\quad SE_{\hat{p}} = \sqrt{\dfrac{(.52)(.48)}{881}} = .0168$

z^* for 95%:



$z^* = \text{invNorm}(.025, 0, 1)$
$= \pm 1.96$

$CI = \hat{p} \pm z^* SE_{\hat{p}}$

$= .52 \pm (1.96)(.0168)$ We are 95% confident that between 48.71% and 55.29% of adults have never been smokers.

$= .52 \pm .032928$

$= (.4871, .5529)$

b) H_0: $p = .44$ percentage of adults who never smoked is the historic 44%
H_A: $p \neq .44$ percentage of adults who never smoked has changed from 44%.

44% is not within the confidence interval, so we reject H_0 as unlikely. We do have sufficient statistical evidence to conclude that the percentage of adults who never smoked has changed from 44%.