AP Statistics
Unit 06 – HW #5
Significance Tests: Proportions

Name Key
Period

1. A company's old antacid formula provided relief for 70% of the people who used it. The company tests a new formula to see if it is better and gets a P-value of 0.27. Is it reasonable to conclude that the new formula and the old ones are equally effective? Explain.

$H_0: p = 0.70$
$H_A: p > 0.70$

No! we never accept the null. we only fail to reject it. in this case, the sample we took did not give us convincing evidence that the new formula provides better relief.

For the following problems, do all four steps of the hypothesis testing.

2. Advances in medical care such as prenatal ultrasounds examination now make it possible to determine a child's sex early in a pregnancy. There is a fear that in some cultures some parents may use this technology to select the sex of their children. A study from Punjab, India reports that, in 1993, in one hospital, 56.9% of the 550 live births that year were boys. It's a medical fact that male babies are slightly more common that female babies. The study's authors report a baseline for this region of 51.7% male live births. Is there evidence that the proportion of male births has changed? $\neq$

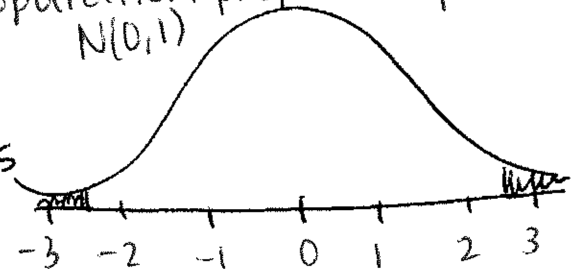
State: $H_0: p = 0.517$ where p = the true proportion of babies born who are male
$H_A: p \neq 0.517$
$\hat{p} = 0.569$
$\alpha = 0.05$

Plan: Random: all live births in one hospital ✓
10% condition: 5500 < all live births ✓
Large counts: $np \geq 10$ $\quad nq \geq 10$
$(0.569)(550) \geq 10 \quad (0.431)(550) \geq 10$
$313 \geq 10$ ✓ $\quad 237 \geq 10$ ✓

because our conditions are met, we will perform a 1-sample z-test for the population proportion p.

Do: 1-PropZTest
p_0: 0.517
x: 313
n: 550
prop: $\neq p_0$

z = 2.445
p-value = 0.0145



Conclude: Because our p-value 0.0145 is less than our significance level $\alpha = 0.05$, we reject the null. There is convincing evidence that

3. In a rural area, only about 30% of the wells that are drilled find adequate water at a depth of 100 feet or less. A local man claims to be able to find water by "dowsing"- using a forked stick to indicate where the well should be drilled. You check with 80 of his customers and find that 27 have wells less than 100 feet deep. What do you conclude about his claim?

State: $H_0: p = 0.3$ where p is the true proportion of wells found using a dowsing rod.
$H_A: p > 0.3$

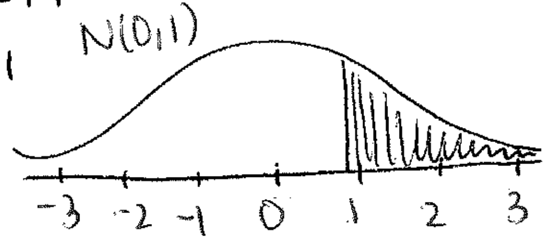
$\hat{p} = 27/80 = 0.3375$ $\alpha = 0.05$

Plan: Random: 80 random customers ✓
10% condition: 800 < all wells checked
Large counts: $np \geq 10$ $nq \geq 10$
$(0.3)(80) \geq 10$ $(0.7)(80) \geq 10$
$24 \geq 10$ ✓ $56 \geq 10$ ✓

because our conditions are met, we will perform a 1-sample z-test for the population proportion p.

DO: 1-PropZTest:
p_0: 0.3
x = 27
n = 80
prop: $> p_0$

test statistic: 0.7319
p-value: 0.2321



Conclude: Because our p-value 0.2321 is greater than our significance level $\alpha = 0.05$, we fail to reject the null. There is not convincing evidence that the true proportion of well found using a dowsing rod is greater than 30%.

because "declinining" and "change" are both mentioned, H_A could be $<$ or $\neq$.

4. The National Center for education statistics monitors many aspects of elementary and secondary education nationwide. Their 1996 numbers are often used as a baseline to assess changes. In 1996, 34% of students had not been absent from school even once during the previous month. In the 2000 survey, responses from 8302 students showed that this figure has slipped to 33%. Officials would, of course, be concerned if student attendance were declining. Do these figures give evidence of a change in student attendance?

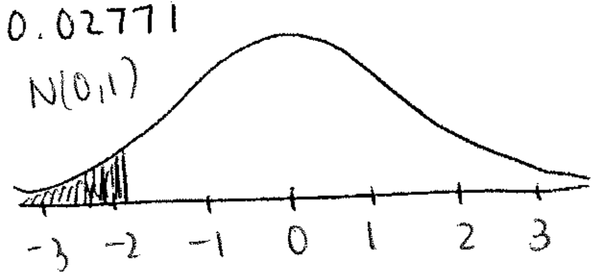
State: $H_0: p = 0.34$ where p = the true proportion of students who missed a day of school.
$H_A: p < 0.34$ $\hat{p} = 0.33$ $\alpha = 0.05$

Plan: Random: National center for Education Statistic (assumed random survey)
10% condition: 83020 < all students nationwide
Large Counts: $n\hat{p} \geq 10$ $n\hat{q} \geq 10$
$(0.33)(8302) \geq 10$ $(0.67)(8302) \geq 10$
$2740 \geq 10$ ✓ $5562 \geq 10$ ✓

because our conditions are met, we will perform a 1-sample z-test for the population proportion p.

Do: 1-Prop ZTest:
p_0: 0.34
x: 2740
n: 8302
prop: $< p_0$

test statistic: −1.916
p-value: 0.02771



Conclude: Because our p-value 0.02771 is less than our significance level $\alpha = 0.05$, we reject the null. There is convincing evidence that the true proportion of students who missed a day of school is less than 34%. (it is declining).

5. A local high school makes a change that should improve student satisfaction with the parking situation. Before the change, 37% of the school's student approved of the parking that was provided. After the change, the principal surveys an SRS of 200 of the over 2500 students at the school. In all, 83 students say that they approve of the new parking arrangement. The principal cites this as evidence that the <u>change was effective</u>. Perform a test of the principal's claim at the $\alpha = 0.05$ significance level.

<u>State</u>: $H_0: p = 0.37$ where p = the true proportion of students satisfied with the school's parking arrangement.

$H_A: p > 0.37$

$\hat{p} = 83/200 = 0.415$ $\alpha = 0.05$

<u>Plan</u>: Random: SRS ✓

10% condition: 2000 < 2500 total students at the school ✓

Large counts: $n\hat{p} \geq 10$ $n\hat{q} \geq 10$

$(0.415)(200) \geq 10$ $(0.585)(200) \geq 10$

$83 \geq 10$ ✓ $117 \geq 10$ ✓

because our conditions are met, we will perform a 1-sample z-test for the population proportion p.

<u>Do</u>: <u>1-PropZTest</u>:

p_0: 0.37

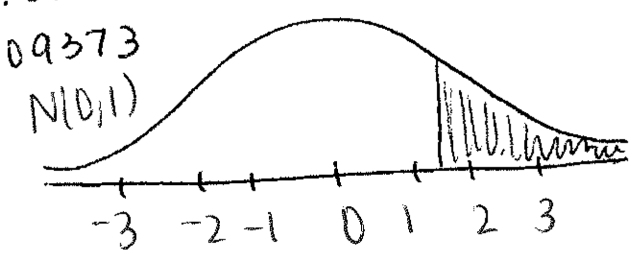
X: 83

n: 200

prop: $> p_0$

test statistic: 1.3181

p-value: 0.09373



<u>Conclude</u>: Because our p-value 0.09373 is greater than our significance level $\alpha = 0.05$, we fail to reject the null. There is not convincing evidence that the change in parking arrangement was effective in increasing the true proportion of satisfied students.

6. We hear that newborn babies are more likely to be boys than girls. Is this true? A random sample of 25,468 firstborn children included 13,173 boys.
   a. Do these data give convincing evidence that firstborn children are more likely to be boys than girls?

State: H_0: $p = 0.50$ where p = the true proportion of firstborn children who are boys.
H_A: $p > 0.50$

$\hat{p} = 13173/25468 = 0.517$ $\alpha = 0.05$

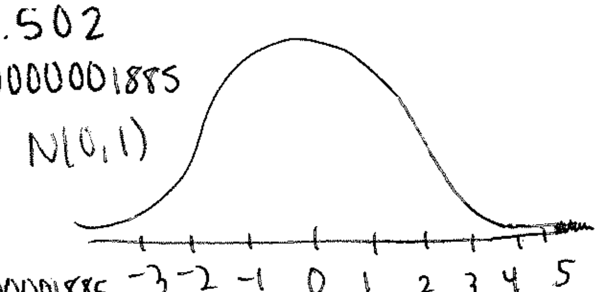
Plan: Random: random sample of newborns ✓
10% condition: 254680 < all firstborn children
Large counts: $n\hat{p} \geq 10$ $n\hat{q} \geq 10$
$(0.517)(25468) \geq 10$ $(0.483)(25468) \geq 10$
$13173 \geq 10$ ✓ $12295 \geq 10$ ✓

because our conditions are met, we will perform a one-sample z-test for the population proportion p.

DO: 1-PropZTest:

p_0: 0.50
x: 13173
n: 25468
prop: $\neq p_0$

test statistic: 5.502
p-value: 0.00000001885



Conclude: Because our p-value 0.00000001885 is less than our significance level $\alpha = 0.05$, we reject the null. There is convincing evidence that the true proportion of firstborn children who are boys is greater than 50%.

b. To what population can the results of this study be generalized: all children or all firstborn children? Justify your answer.

Firstborn children because that is the population we sampled.