Step 1. Name the test & check conditions

Significance test for a single proportion

Conditions

1: We'll assume that the pennies were spun the same way (random)

2: np_0 $\qquad$ $n(1-p_0)$

$(40)(.5) = 20 > 10$ ✓ $\qquad$ $40(1-.5) = 20 > 10$ ✓

3: $10n = 400 <$ total number of spins of pennies (unbounded) ✓

Step 2. State the hypothesis.

p = true proportion of spins of pennies that come up heads.

$H_0: p = p_0 = 0.5$

$H_a: p \neq p_0$

Step 3 Calculate the test statistic and make a diagram.

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

$p_0 = 0.5$ $x = 10$

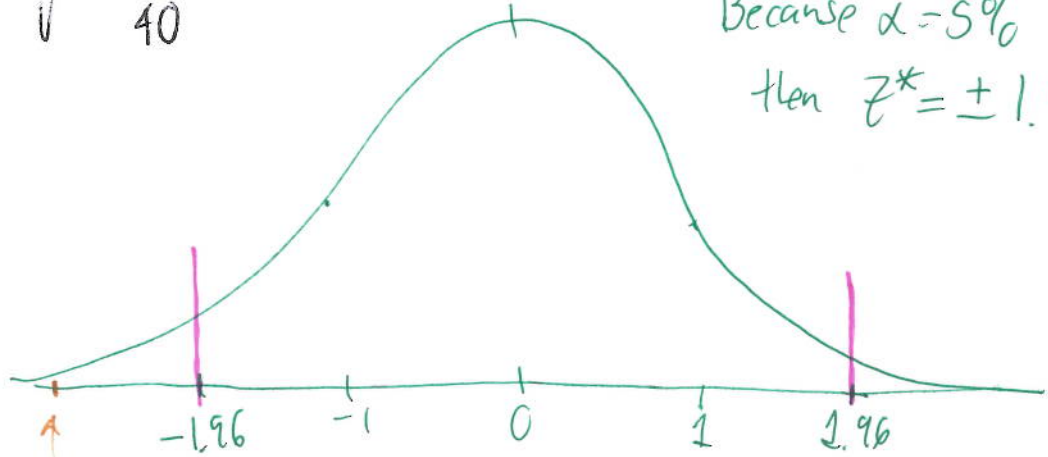
$n = 40$

$\hat{p} = \frac{x}{n} = \frac{10}{40} = 0.25$

$$z = \frac{.25 - 0.5}{\sqrt{\frac{(.5)(.5)}{40}}} = -3.16227766$$

Because $\alpha = 5\%$

then $z^* = \pm 1.96$



$-3.16227766 = z$

Step 4 Write the conclusions.

Because $z \approx -3.162277 < -1.96$ we reject the null hypothesis H_0 in favor of the alternate hypothesis H_a

If heads comes up 50% of the time when spinning pennies, then it would be very rare (more than 3 standard deviations away from the mean) to get 10 heads out of 40.

Thus we have evidence to assert that heads do not come up 50% of the time when spinning pennies.

Identify the test (circle one):

1. Significance test for one proportion (1-PropZTest)
2. Significance test for the difference of two proportions (2-PropZTest)
3. Significance test for a mean (T-Test)
4. Significance test for the difference of two means (2-SampTTest)

Data: Significance level $\alpha =$ 5% = .05

Other: (depending on the test, circle and give the necessary values)

$p_0 =$ .5 $\quad \hat{p} =$ 22/40 = .55 $\quad \overline{x} =$ ____

$\mu_0 =$ ____ $\quad \hat{p}_1 =$ ____ $\quad \overline{x}_1 =$ ____

$n =$ 40 $\quad \hat{p}_2 =$ ____ $\quad \overline{x}_2 =$ ____

$n_1 =$ ____ $\quad x_1 =$ ____ $\quad s =$ ____

$n_2 =$ ____ $\quad x_2 =$ ____ $\quad s_1 =$ ____

$x =$ 22 $\quad s_2 =$ ____

Check the conditions:

1. The sample was obtained at random.
2. $np_0 = 40(.5) = 20 > 10$ ✓ $\quad n(1-p_0) = 40(.5) = 20 > 10$ ✓
3. $10n = 400 <$ total number of students ✓

State the hypotheses:

H_0: $p = p_0$

H_a: $p \neq p_0$

where (circle and describe in words the appropriate symbol(s)): $p, p_1, p_2, \mu, \mu_1, \mu_2$)

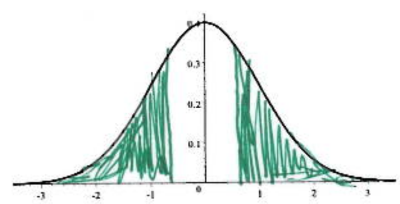
p = true proportion of students that carry a backpack to school

Compute the test statistic, p-value, and label and complete the sketch:

Test statistic: $\boxed{z = \dfrac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}}$ = .6325

formula

P-value = .5271



Is the sample significant? No

Yes/No

Conclusions:

(Circle one) We reject/don't reject the null hypothesis.

Explain in context.

Because P-value = .5271 > .05 = α, ~~we reject the null hyp~~ we don't reject the null hypothesis.

If indeed 50% of students bring backpacks to school, then it would be quite likely (probability 52.71%) to get a sample as extreme or more than 22 out of 40.

Thus, we have no evidence to believe that the truth is not 50%.

Identify the test (circle one):

1. Significance test for one proportion (1-PropZTest)
2. Significance test for the difference of two proportions (2-PropZTest)
3. Significance test for a mean (T-Test)
4. Significance test for the difference of two means (2-SampTTest)

Data: Significance level $\alpha =$ .05 = 5%

Other: (depending on the test, circle and give the necessary values)

$p_0 =$ .5 $\hat{p} =$ 544/1027 ≈ .529698 $\overline{x} =$ ____

$\mu_0 =$ ____ $\hat{p}_1 =$ ____ $\overline{x}_1 =$ ____

$n =$ 1027 $\hat{p}_2 =$ ____ $\overline{x}_2 =$ ____

$n_1 =$ ____ $x_1 =$ ____ $s =$ ____

$n_2 =$ ____ $x_2 =$ ____ $s_1 =$ ____

$x =$ 544 $s_2 =$ ____

Check the conditions:

1. The sample is a simple random sample
2. $np_0 = (1027)(.5) = 513.5 \geq 10$ ✓
   $n(1-p_0) = (1027)(.5) = 513.5 > 10$ ✓
3. $10n = 10270 <$ total number of adults. ✓

State the hypotheses:

H_0: $p = p_0$

H_a: $p > p_0$

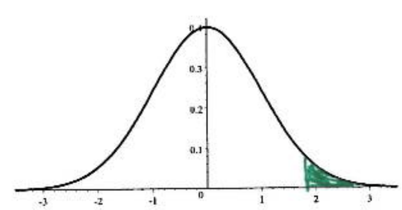
where (circle and describe in words the appropriate symbol(s): $p, p_1, p_2, \mu, \mu_1, \mu_2$)

p = true proportion of adults who believe friends are important for success.

Compute the test statistic, p-value, and label and complete the sketch:

Test statistic: $\boxed{z = \dfrac{\hat{p} - p_0}{\sqrt{\dfrac{p_0(1-p_0)}{n}}}}$ = 1.9035

formula



P-value = .0285

Is the sample significant? Yes

Yes/No

Conclusions:

(Circle one) We reject/don't reject the null hypothesis.

Explain in context.

Because the P-Value = .0285 < .05 = α, we reject the null hypothesis, in favor of the alternate hypothesis.
If the proportion of adults who believe friends are important for success was equal to 50%, then it would be unlikely (probability 2.85%) to get a sample more extreme than 544 out of 1027. Thus we have enough evidence to assert that more than 50% of adults believe good friends are important for success.

Identify the test (circle one):

1. Significance test for one proportion (1-PropZTest)
2. Significance test for the difference of two proportions (2-PropZTest)
3. Significance test for a mean (T-Test)
4. Significance test for the difference of two means (2-SampTTest)

Data: Significance level $\alpha =$ .05

Other: (depending on the test, circle and give the necessary values)

$p_0 =$ .50 $\quad \hat{p} = \frac{148}{283} \approx .523$ $\quad \overline{x} =$ ____

$\mu_0 =$ ____ $\quad \hat{p}_1 =$ ____ $\quad \overline{x}_1 =$ ____

$n =$ 283 $\quad \hat{p}_2 =$ ____ $\quad \overline{x}_2 =$ ____

$n_1 =$ ____ $\quad x_1 =$ ____ $\quad s =$ ____

$n_2 =$ ____ $\quad x_2 =$ ____ $\quad s_1 =$ ____

$x =$ 148 $\quad s_2 =$ ____

Check the conditions:

1. We'll assume that the sample was a simple random sample

2. $np_0 = (283)(.5) = 141.5 > 10$ ✓
$n(1-p_0) = (283)(.5) = 141.5 > 10$ ✓

3. $10n = 2830 <$ children trick-or treating in Connecticut.

State the hypotheses:

H_0 : $p = p_0$

H_a : $p < p_0$

where (circle and describe in words the appropriate symbol(s): $p, p_1, p_2, \mu, \mu_1, \mu_2$)

p = true proportion of children trick-or-treating in Connecticut who would prefer candy over toys.

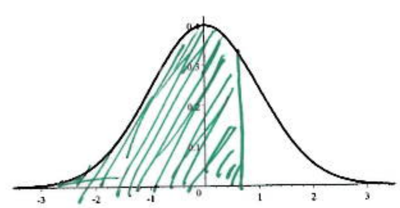
Compute the test statistic, p-value, and label and complete the sketch:

Test statistic: $\boxed{z = \dfrac{\hat{p} - p_0}{\sqrt{\dfrac{p_0(1-p_0)}{n}}}}$ = .7728

formula

P-value = .7802

Is the sample significant? No
Yes/No



Conclusions:
(Circle one) We reject/don't reject the null hypothesis.
Explain in context.

Because P-value = .7802 > .05 we don't reject the null hypothesis.
If 50% of the children prefer the candy over the toys, then it would be quite likely (probability 78.02%) to get a sample as extreme or more than 148 out of 283 children prefering candy over toys.

Use "1" for nowadays and "2" for 1994

$n_1 = 29{,}700$ $\quad$ $n_2 = 6786$

$x_1 = 18{,}711$ $\quad$ $x_2 = 3800$

$\hat{p}_1 = .63$ $\quad$ $\hat{p}_2 = \frac{3800}{6786} = .559976$

Check conditions:

1: Both samples were obtained at random and independently of each other

2: $n_1\hat{p}_1 = x_1 = 18711 > 5$ ✓

$n_1(1-\hat{p}_1) = n_1 - x_1 = 29700 - 18711 > 5$ ✓

$n_2\hat{p}_2 = x_2 = 3800 > 5$ ✓

$n_2(1-\hat{p}_2) = n_2 - x_2 = 6786 - 3800 > 5$ ✓

3: $10n_1 = 297000 <$ total number of U.S households

$10n_2 = 67860 <$ total number of U.S households in 1994

$$(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

$$(.63 - .559976) \pm 1.96 \sqrt{\frac{(.63)(.37)}{29700} + \frac{(.559976)(.440024)}{6786}}$$

$$\begin{cases} .0569934 \\ .0830486 \end{cases}$$ 95% confidence interval for $p_1 - p_2$

"1" for DC & "2" for MM

$x_1 = 93$ $\qquad$ $x_2 = 90$

$n_1 = 273$ $\qquad$ $n_2 = 228$

$\hat{p}_1 = \frac{93}{273} \approx .34065$ $\qquad$ $\hat{p}_2 = \frac{90}{228} \approx .39473$

Find a 90% confidence interval for $p_1 - p_2$

Check conditions

1: Both are random samples and independent

2: $n_1\hat{p}_1 = x_1 = 93 > 5$

$n_1(1-\hat{p}_1) = n_1 - x_1 = 273 - 93 > 5$

$n_2\hat{p}_2 = x_2 = 90 > 5$

$n_2(1-\hat{p}_2) = n_2 - x_2 = 228 - 90 > 5$

3: $10n_1 = 2730 <$ total number of DC

$10n_2 = 2280 <$ total number of MM

90% confidence interval for $p_1 - p_2$:

$(-.1252, .01706)$