This ~~is~~ seems like the same, but the alternative test is different.

The cereal magnate's son, who the father called a "tree-hugging snag,[1]" upon taking over operations was appalled to hear the company may be cheating customers by selling them less cereal than was printed on the box. He doesn't care if the weight is *more* than printed, just not *less*. He has 28 boxes randomly pulled from the line and the weights of the contents tested. If the average weight of the sample is significantly less at the 5% level, he will stop production and have the machines adjusted.

The boxes advertise 18 oz of cereal. His sample average was 17.6 oz. Use the same sample standard deviation of 1.2 oz.

$\bar{X} = 17.6$ oz
$\mu_0 = 18.0$ oz
$n = 28$
$s = 1.2$ oz

Conduct a test at the 5% level. Do we stop production?

1. Give a description of the population parameter.

   mean weight of cereal in cereal box population

2. State the ~~null~~ hypotheses
   a. Null Hypothesis: $H_0: \mu = 18.0$
   b. Alternative hypothesis: $H_A: \mu < 18.0$

3. Check the [two] technical conditions: ① Randomly selected boxes ② $n \geq 30$ ✗ No! However, the original distribution is Normal, so we can let it slide

4. Calculate the appropriate test statistic (z or t):

$$\boxed{t = \frac{\bar{X} - \mu}{s/\sqrt{n}}} = \frac{17.6 - 18.0}{1.2/\sqrt{28}} = -1.76 \qquad df = n-1 = 27$$

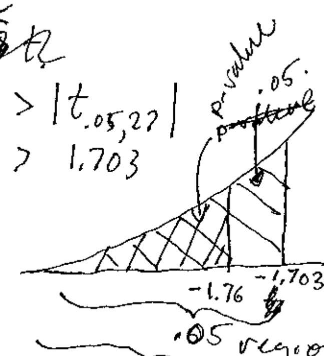
the closest is $t_{.05,27} = -1.703$

5. Calculate the p-value:

   p-value < .05

Since $|t| > |t_{.05,27}|$

$1.76 > 1.703$



thus p-value is smaller than .05

6. Summarize (reject? Or not):

   Reject the null hypothesis

Generate a 90% Confidence interval for the population parameter:

$$\boxed{\bar{X} \pm t_{\frac{\alpha}{2}, df} (SE)_{\bar{X}}}$$

$\bar{X} \pm t_{.05,27} \frac{s}{\sqrt{n}}$

$17.6 \pm 1.703 \left(\frac{1.2}{\sqrt{28}}\right)$

$17.6 \pm 1.703 (.228)$

$17.6 \pm .39$

$(17.21, 17.99)$

$\alpha = 1 - .90 = .10$

$\alpha/2 = .10/2 = .05$

$df = n - 1 = 28 - 1 = 27$

$(SE)_{\bar{X}} = s/\sqrt{n}$

$\bar{X} = 17.6$ oz

$s = 1.2$ oz

$n = 28$

$t_{.05,27} = 1.703$

[1] Sensitive New Age Guy

Professor Creel purchases a bag of filberts that states on the package, "*no more than 10%* shriveled and bitter." After eating 40 filberts, he encounters 8, or 20%, that are shriveled, bitter, and completely inedible. Should he drive through the blowing snow to Price Chopper to return the (uneaten) filberts get back his hard-earned $3.56. Do a test at the 1% level (.01 level) to be safe. (Price Chopper won't accept returns based on the weaker 10% or .1 level tests).

$\pi = .10$ (10%)
$\hat{p} = 8/40 = .20$ (20%)
$\alpha = .01$
$n = 40$

1. Give a description of the population parameter.
   π is the proportion of shriveled, bitter filberts in a bag
2. State the ~~null~~ hypotheses
   a. Null Hypothesis: $H_0: \pi = .10$
   b. Alternative hypothesis: $H_A: \pi > .10$
3. Check the [two] technical conditions: ① Random (assume filbert choice unbiased) ✓
   ② $n\pi = 40(.10) = 4 \leq 10$ ✗ $n\pi$ is not ≥ 10
   NO!
   does not pass condition test
4. Calculate the appropriate test statistic (z or t):
   $$\boxed{z = \frac{\hat{p} - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}} = \frac{.20 - .10}{\sqrt{\frac{.10(.90)}{40}}} = \frac{.10}{\sqrt{.0025}} = \frac{.10}{.05} = 2.00$$
5. Calculate the p-value:
   $\Phi(2.00) = .9733$ p-value $= \underbrace{1 - .9733}$ $= .0267$
   b/c critical region is to the right of $z = 2$ and .9733 represents the region to the left.
6. Summarize (reject? Or not):
   Since the p-value (.0267) is greater than the test level .01, do not reject at 1% level

If the test is not rejected at the 99% level, at what level would it be rejected? It would be rejected at the 5% level

Generate a 98% Confidence interval for the population parameter:

$$\boxed{\hat{p} \pm z_{\alpha/2} (SE)_{\hat{p}}}$$

$$\hat{p} \pm z_{.01} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$.2 \pm 2.326 \sqrt{\frac{.2(.8)}{40}}$$

$$.2 \pm 2.326 \sqrt{.0040}$$

$$.2 \pm 2.326 (.063)$$

$$.2 \pm .14$$

$$(.06, .34)$$

$\hat{p} = .20$
$\alpha = 1 - .98 = .02$
$\alpha/2 = .02/2 = .01$
$(SE)_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Professor Creel purchases a 24 oz bag of Tropical Extravaganza mixed nuts that states on the package, "*no less* than 40% almonds." After his experience with the filberts, he ~~obsessively separates and weighs~~ randomly samples nuts from the bag, and finds 16 cashews, ~~5oz~~ 20 brazil nuts, ~~6oz~~ 24 macadamia nuts, and ~~9oz~~ 36 almonds (ie 36 almonds and 60 other nuts). Back to Price Chopper? Do a test at the 1% level.

$\pi = .40$

$\hat{p} = \frac{36}{96} = .375$

$n = 96$

1. Give a description of the population parameter.

   The ratio of Almonds to all nuts in the Tropical Extr. nut population

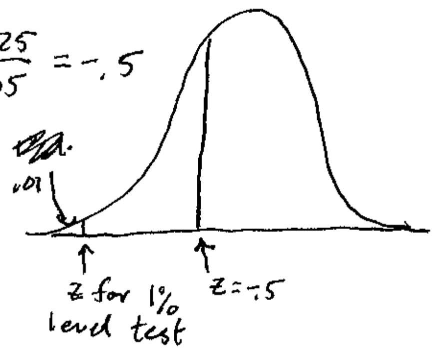
2. State the null hypotheses
   a. Null Hypothesis: $H_0 : \mu = .40$
   b. Alternative hypothesis: $H_A : \mu < .40$

3. Check the [two] technical conditions: ① Random? yes

   ② $n\pi \geq 10$? $96(.40) \geq 10$ yes!

4. Calculate the appropriate test statistic (z or t):

$$z = \frac{\hat{p} - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} = \frac{.375 - .4}{\sqrt{\frac{.4(1-.4)}{96}}} = \frac{-.025}{\sqrt{.24/96}} = \frac{-.025}{\sqrt{.0025}} = -\frac{.025}{.05} = -.5$$



5. Calculate the p-value:

$$\Phi(-.5) = .3085 = p\text{-value}$$

6. Summarize (reject? Or not):

   Do not reject! z is not $\leq z_{.01}$

Generate a 98% Confidence interval for the population parameter:

$\hat{p} = .375 \qquad \alpha = 1 - .98 = .02$

$n = 96 \qquad \frac{\alpha}{2} = \frac{.02}{2} = .01$

$(SE)_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$z_{.01} = 2.326$

$$\hat{p} \pm z_{\alpha/2}(SE)_{\hat{p}}$$

$$\hat{p} \pm z_{.01}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$.375 \pm 2.326\sqrt{\frac{.375(.625)}{96}}$$

$$.375 \pm 2.326\sqrt{.00244}$$

$$.375 \pm 2.326(.049)$$

$$.375 \pm .115$$

$$(.26, .49)$$

with such a wide CI, it seems that it would be hard to tell if T.E. mixed nuts advertised honestly

A skinflint cereal magnate wants to make sure that the cereal box filling machines are not filling boxes with more cereal than is advertised on the box. He doesn't care if the weight is less than printed, just not more. He has a 144 boxes randomly pulled from the line and the weights of the contents tested. If the average weight of the sample is significantly greater at the 5% level, he will stop production and have the machines adjusted.

The boxes advertise 18 oz of cereal. His sample average was 18.24 oz with a sample standard deviation of 1.2 oz

Setup your data

$n = 144$ boxes
$\bar{x} = 18.24$ oz
$\mu = 18.0$ oz
$s = 1.2$ oz

Conduct a test at the 5% level. Do we stop production?

1. Give a description of the population parameter.

   The mean weight of all the cereal boxes.

2. State the null hypotheses
   a. Null Hypothesis: $H_0 : \mu = 18.0$
   b. Alternative hypothesis: $H_A : \mu > 18.0$

3. Check the [two] technical conditions: ① Randomly selected boxes ✓ ② $n \geq 30$ } 2 of them

4. Calculate the appropriate test statistic (z or t):

   $df = n - 1 = 143$

   $$\boxed{t = \frac{\bar{x} - \mu}{s/\sqrt{n}}} = \frac{18.24 - 18.0}{1.2/\sqrt{144}} = \frac{.24}{1.2/12} = 2.4$$

   $t_{.01,100} = 2.364$ ← closest t in table

5. Calculate the p-value:

   p-value $< .01$ b/c $t > t_{.01,100}$

6. Summarize (reject? Or not):

   Reject the null hypothesis. Stop production & adjust the machines

Generate a 90% Confidence interval for the population parameter:

Always write Equation

$$\boxed{\bar{x} \pm t_{\frac{\alpha}{2}, df} (SE)_{\bar{x}}}$$

$$\bar{x} \pm t_{.05,100} \frac{s}{\sqrt{n}}$$

$$18.24 \pm 1.660(.1)$$

$$(18.07, 18.41)$$

$\alpha = 1 - .90 = .10$ $\quad \alpha/2 = .01/2 = .05$

$\bar{x} = 18.24$

$t_{\frac{\alpha}{2}, df} = t_{.05,100} = 1.660$

$(SE)_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{1.2}{\sqrt{144}} = \frac{1.2}{12} = .1$

Notice that 18.0 (rejected above) is <u>not</u> in this interval