# Hypothesis Testing

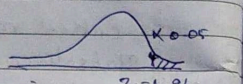
1. step - 1

Null Hypothesis : General consensus of the nations children had autism by chemicals

$H_0: \mu = 0.05$

$H_1: \mu > 0.05$ Alternate Hypothesis : General consensus of the nations children had autism by chemicals in envir

- step-2 : Statistical test used z test
- step-3 : alpha $\alpha = 0.05$
- step 4 : decision rule




z score > z critical - reject $H_0$

P value $\leq \alpha$ - reject Null Hypothesis

step 5 : gathered data shown

step 6 : $z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$ $\therefore n = 384$ $x = 46$ $p = 0.05$

$\hat{p} = 46/384 = 0.12$

$q = 1 - p$

$= \frac{0.12 - 0.05}{\sqrt{0.05 \times 0.95 / 384}} = \frac{0.07}{0.0001} = 0.07$

step 7 : Conclusion

$z_c = 0.07 < 1.96$, hence fail to reject null hypothesis

$P_v = 0.4721 > 0.05$, hence its failed to reject $H_0$.

step 8 : Business Implication

They agree that the autism of children is due to chemical in the environment. So they take necessary steps to prevent children by taking vaccination to prevent autism.

2. step 1 Null Hypothesis : company fleet of cars will be out of compliance

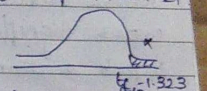
Alternate Hypothesis : company fleet of cars will be more out of compliance

$H_0 : \mu = 0.2$ $H_1 : \mu > 0.2$

step-2 Statistical test to be used is t test $df = n - 1 = 22 - 1 = 21$

step-3 10%, 5%, 1% $\alpha = 0.1, 0.05, 0.01$

step-4 decision rule - one tailed right test




t score > t critical / P value $\leq \alpha$ - reject $H_0$

step-5 gathered data shown $n = 22$ $\bar{x} = 150$ $\mu = 0.2$ $s = 7$

step-6 $t = \frac{\bar{x} - \mu}{s\sqrt{n}} = \frac{150 - 0.2}{7\sqrt{22}} = \frac{149.8}{32.8} = 4.57$

step-7 Conclusion

$t_c$ - 10% - 4.57 > 1.323, 5% - 4.57 > 1.721, 1% - 4.57 > 2.528

P value - 0.00008319 < 0.1, 0.05, 0.01, hence Reject $H_0$.

step-8 Business Implication

The company decried that the fleet in the cars are out of complains with more then 2%. So the company accept to go with alternate hypothesis.

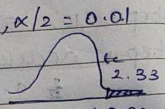
t score belongs to the critical region. so we reject $H_0$ and accept $H_1$. P value can also be reject $H_0$ at the significance level of 0.1, 0.05, 0.01 because your p-value does not exceed the significance alpha.

3. Step-1 Null: There is no difference in Adult population had ever Smoked
Alternate: There is difference in Adult population had ever smoked
$H_0: \mu = .44 \quad H_1: \mu > .44$

Step-2 Statistical test to be used is z test

Step-3 Significance level of 98% is $\alpha = 0.02, \alpha/2 = 0.01$

Step-4 decision rule - One tailed right test
z critical is 2.33
z score > z critical / P value $\leq \alpha$ - reject $H_0$




Step-5 gathered data shown $n = 891 \quad \bar{x} = 463 \quad \sigma = 1600 \quad \mu = .44$

Step-6 $z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{463 - .44}{1600/\sqrt{891}} = 8.63$

P value: $P(z \geq 8.63)$
$= 1 - P(z \leq 8.63) = 1 - 1.000 = 0.000$

Step-7 Conclusion
Zc = 8.63 > 2.33 / $P_V = 0.00 < 0.02$
Hence reject null hypothesis for both

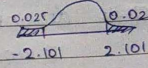
Step-8 Business Implication
Business came to an decision by accepting alternate hypothesis .44 had increase the number of years with never smoked.

4. Step-1 Null - lense focal length is equal to 9cm
Alternate lense focal length is not equal to 9cm
$H_0: \mu_1 = \mu_2 \quad , H_1: \mu_1 \neq \mu_2$

Step-2 Statistical test to be used t test

Step-3 & $\alpha = 0.05 \quad \alpha/2 = 0.025 \quad df = n_1 + n_2 - 2 = 25 + 25 - 2 = 48$

Step-4 decision rule - two tailed test
critical value = 2.101
t score > critical / Pvalue $\leq \alpha$ - reject null Hypothesis




Step-5 gathered data shown $n = 25 \quad \bar{x}_1 = 26.6 \quad \bar{x}_2 = 13.8 \quad S_1 = 0.1 \quad S_2 = 0.5$

Step-6 $t = \frac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{(26.6 - 13.08) - 0}{\sqrt{\frac{(0.1)^2}{25} + \frac{(0.5)^2}{25}}} = \frac{12.8}{\sqrt{0.0104}} = 125.49$

P value is 0.000

Step-7 Conclusion
tc = 125.49 > 2.101 / P-value = 0.00 < 0.05 - Reject $H_0$
Hence you can reject Null hypothesis at the significance level 0.05, because your p-value does not exceed 0.05.

Step-8 Business Implication
Manufacture decreased by taking hypothesis found difference in the lenses they made at 9cm with point ten or more in inches.

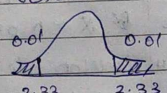
b) focal length $= \frac{1}{S_1} + \frac{1}{S_2} = \frac{1}{f} = \frac{1}{0.1} + \frac{1}{0.5} = \frac{6}{0.5} = 12$

5. Step-1 Null : body temperture will be at 98.6
Alternate : body temperture will not be at 98.6
$H_0 : \mu = 98.6$ $H_1 : \mu \neq 98.6$

Step-2 Statistical test to be used is z test

Step-3 $\alpha = 0.02$ $\alpha/2 = 0.01$

Step-4 decision rule - two tailed test
z score > z critical / Pvalue ≤ α - reject $H_0$




Step-5 gathered data are shown $n = 52$ $\bar{x} = 98.2846$ $\sigma = 0.6824$

Step-6 (1) $z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{98.2846 - 98.6}{0.6824/\sqrt{52}} = \frac{-0.3154}{0.095} = -3.32$

Pvalue 0.001

(2) $H_0 : \mu = 98.2$ $H_1 : \mu \neq 98.2$

$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{98.2846 - 98.2}{0.6824/\sqrt{52}} = \frac{0.0846}{0.095} = 0.89$

Pvalue $= 2 \times P(z > 0.89) = 2 \times [1 - P(z < 0.89)$
$= 2 \times (1 - 0.8133) = 2 \times 0.1867 = 0.37$

Step-7 Conclusion
$98.6 - c = -3.32 > -2.33$, P.V = 0.001 < 0.02 - Reject $H_0$
$98.2 - c = 0.89 < 2.33$, P.V = 0.37 > 0.02 - Failed to Reject $H_0$

Step-8 Business Implication
a) No this not satisfied because sample number is greater than 30. So not constructing t interval.
b) $98\% = \frac{98}{100} = 0.98$ ; $1 - 0.98 = 0.02$ $\alpha = 0.02$

6. Step-1 Null : Car in its fleet runs a tank for gas milage with regular gas is same as to premium gas
$H_0 : \mu_1 = \mu_2$
Alternate : Car in its fleet runs a tank for gas milage with regular gas is not same as to premium gas
$H_1 : \mu_1 \neq \mu_2$

Step-2 Statistical test used a t test

Step-3 alpha $\alpha = 0.05$ $df = n_1 + n_2 - 2 = 10 + 10 - 2 = 18$

Step-4 decision rule - one tailed right test
t score > t critical / p value ≤ α - reject $H_0$


Step-5 gathered data are shown

Step-6 $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$

$\bar{x}_1 = \frac{\Sigma x_1}{n_1} = \frac{231}{10} = 23.1$ $\bar{x}_2 = \frac{\Sigma x_2}{n_2} = \frac{251}{10} = 25.1$

$s_1^2 = \frac{\Sigma x_1^2}{n_1} - (\bar{x}_1)^2 = \frac{5461}{10} - (23.1) = 12.49$

$= \frac{23.1 - 25.1}{\sqrt{12.88\left(\frac{1}{10} + \frac{1}{10}\right)}}$ $s_2^2 = \frac{\Sigma x_2^2}{n_2} - (\bar{x}_2)^2 = \frac{6407}{10} - (25.1)^2 = 10.69$

$= \frac{-2}{1.606} = -1.245$ // $s^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} = \frac{10(12.49) + 10(10.69)}{10 + 10 - 2}$

$= \frac{124.9 + 106.9}{18} = 12.88$

Step-7 Conclusion
c : $-1.245 < 2.101$ - fail to reject $H_0$
P.value - 0.2428 > 0.05

Step-8 There is not enough evidence to reject $H_0$ at the significance level 0.05, because your p-value is > 0.05 testing car with regular gas is same as premium gas because it depends upon the milage and they drive of uno. It a budget friendly for car drivers.