Date
Page

Hypothesis Testing

Problem 1.

1) State Hypothesis.

$H_0 = p = .05$.
$H_a = p \neq .05$.

Two Tailed Test

2) Alpha is. $\alpha = 0.10$.
as two tailed test.
$1/2 \times 0.10 = 0.05$.
$z_{0.5} = 1.645$. z critical.

Step 4= ~~For~~ To reject the null hypothesis the observed value must be greater than 1.645 or < -1.645.

Step 5- $p = \frac{46}{384} = 0.165$

Step 6. Calulate z value by.

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$= \frac{0.165 - 0.05}{\sqrt{\frac{(0.05) - (0.95)}{200}}}$$

$$= \frac{0.115}{0.045} = 0.255.$$

The observed value of 'Z' is ~~in~~ otha not to be rejection region (~~Observed Z = 0.255 <~~
Observed $Z = 0.255 <$ Table $Z_0 = 1.645$.
So we can accept the null hypothesis.
So we can conclude the about 5% of the nation's children had autism..

Hypothesis Testing
Problem 2.

Date
Page

A Company with a fleet of 150 cars found that the emission system of 7 out of the 22 cars tested failed to meet pollution guidelines.
a) Write hypothesis to test if more than 20% of the entire fleet might be out of compliant.

b) Test the hypothesis based on the binomial distribution and report the p-value.

c) Is the test significant at 10%, 5% and 1% level.

Ans. Hypo → More than 20% of the fleet is out of compliant.

$H_0 = 0.20$

$H_a = 0.20$

$n = 22$

$x = 7$

Step 1 - This is not satisfied, since

$p_0 = (22(.20) = 4.4 < 10$

$n(1-p_0) = 22(1-0.20) = 17.6 \geq 10$

Thus all conditions are not satisfied
Test should not be proceeded with.

Scanned with CamScanner

Hypothesis Testing

Problem ~~Q~~.3

→ 44% of the adult population had never smoked.

~~Ho = 44%~~ $H_0 = P = 44\%$

~~Ha ≠ 44%~~. $H_a = P > 44\%$.

$\alpha = 0.02$, $x = 891$, $n =$

Ha = more than 44% of the population had never smoked.

So this will be a one tailed test.

$\alpha = 0.02$.

$$Z\ score = \frac{\hat{P} - P}{\sqrt{\frac{P \cdot q}{n}}}$$

$P = 0.44$ $\quad x = 891$

$q = 1 - p = 1 - 0.44 = 0.56$.

$$\hat{p} = \frac{463}{891} = 0.519.$$

0.079.

0.2464

$$Z\ score = \frac{0.519 - 0.44}{\sqrt{\frac{0.44 \times 0.56}{891}}} = \cancel{\ \ }$$

Zscore = 4.75.

Zcritical = 2.20.

We will reject the null hypothesis as Zcritical < Zscore.

PROBLEM 4·
LENSE.

→ Null hypothesis :- The distance from the lense to the object & distance from the lense to real image is not same.

Alt hypothesis :- The distance from the lense to the object and distance from the lense to real is not same.

$H_0 = \mu_a = \mu_\beta$.

$H_a = \mu_A \neq \mu_\beta$.

Step 2 → Z score.

Step 3 → $\alpha = 0.05$.

this is a two tailed test

$\alpha = \frac{0.05}{2} = 0.025$.

Step 4 → Desicion Rule.

~~For~~ If Z-critical < z score then we will reject the null hypothesis.

Step 5 - Collecting the data

$\bar{S}_1 = 28.6$ cm.

$\sigma_1 = 0.1$ cm.

$n_1 = 25$.

for distance from lens to Real image S_2

$\bar{S}_2 = 13.8$ cm

$\sigma_2 = 0.5$ cm.

$n_2 = 25$.

For Z score. $= \dfrac{\bar{S}_1 - \bar{S}_2}{\sqrt{\frac{(\sigma_1)^2}{n_1} + \frac{(\sigma_2)^2}{n_2}}}$

→ Contn.

Scanned with CamScanner

cont Problem 4.

LENSE.

$$= \frac{26.6 - 13.8}{\sqrt{\frac{(0.1)^2}{25} + \frac{(0.5)^2}{25}}}$$

0.36
0.02+0.14
0.161

$$= \frac{12.8}{0.102}$$

Z. Score. = 125.51

Now using z table:

z critical = 1.96.

~~Pvalues = 0.00~~.

As Zcritical < zscore

we will reject null hypothesis.

Problem 5.

Ans→ $n = 52$, $\bar{x} = 98.2846$, $S = 0.6824$.
$\alpha = 0.02$ $\mu = 98.6$.

$H_0 = \mu = 98.6$.
$H_a = \mu \neq 98.6$.

This would be a 2 tailed test.
so $\alpha = \frac{0.02}{2} = 0.01$.

$$t\,score = \frac{\bar{x} - \mu}{\frac{S}{\sqrt{n}}}$$

$$= \frac{98.2846 - 98.6}{\frac{0.6824}{\sqrt{52}}}$$

$\Rightarrow$ t score $= 3.333$.

using t table,
t-critical $= 2.008$
P. value $= \cancel{0.0016}$ 0.0016.

t critical < t score $= 2.008 < 3.333$
p value < significance level $= 0.0016 < 0.02$.
we will reject null Hypothesis.

———— X ———— X ———— X ———— X ————

Problem 6 :

Car.

$H_0 = \mu_A = \mu_B$.
$H_A = \mu_A = \mu_B$.

Default $\alpha = 0.05$.
Two tailed test $\alpha = \frac{0.05}{2} = 0.025$.

~~test~~ test.

t-test =

$$df = \frac{\left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right]^2}{\left[\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}\right]}$$

$$t_{test} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

For sample of regular tank.
$\mu_A = \bar{x}_1 = 23.1$
$n_1 = 10$
$s_1 = 3.72$, $\bar{x}_1 = \mu_A = 23.1$

For sample of premium tank.

$\bar{x}_2 = \mu_B = 25.1$
n_2 10
$s_2 = 3.44$

$$DF = \left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right]^2$$

→ cont Prob 6.

$$Df = \frac{\left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right]^2}{\left[\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}\right]}$$

$$= \frac{(1.38 + 1.18)^2}{\frac{(1.38)^2}{9} + \frac{(1.18)^2}{9}}$$

$$= \frac{6.55}{0.36}$$

$$Df = 18$$

$$t\text{-test} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$= \frac{23.1 - 25.1}{\sqrt{\frac{(3.72)^2}{10} + \frac{(3.46)^2}{10}}}$$

t. test = 1.24

t. critical = 2.10

P = 0.22

t - critical ~~$\geq$~~ t-score.

~~2.10 > 1.24~~ Reject null hypothesis.

2.10 > 1.24.

we will accept the null hypothesis.

For Pvalue > significance value.
0.22 > 0.05.
we will accept the null hypothesis

So,
there is no difference between the mileage of regular and premium tank of the car.
$\mu_A = \mu_B$.

—x—x—x—x—x—x—x—x—x—x—

Problem 7

Cereal.

For sample of children

$\bar{x}_1 = \mu_A = 46.8$.

$x_1 = 19$

$\bar{S}_1 = 6.41$

For Sample of Adult

$x_2 = \mu_B = 10.16$.

$x_2 = 29$.

$\bar{S}_2 = 7.47$.

$$Df = \frac{\left[\frac{s_1^2}{x_1} + \frac{s_2^2}{x_2}\right]^2}{\left[\frac{\left(\frac{s_1}{x_1}\right)^2}{x_1 - 1} \cdot \frac{\left(\frac{s_2}{x_2}\right)^2}{x_2 - 1}\right]}$$

$$= \frac{(2.16 + 1.92)^2}{\frac{(2.16)^2}{18} + \frac{(1.92)^2}{28}} = \frac{16.48}{0.38}.$$

$= df = 43$.

Now

$$t\text{-test} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(S_1)^2}{x_1} + \frac{(S_2)^2}{x_2}}}.$$

$$\frac{6.41 - 7.47}{\frac{(6.41)^2}{19} + \frac{(7.47)^2}{29}} = \frac{36.38}{1.96}.$$

t. test = 18.10.
t α = 2.01.
P-value 0.0001.

Here, t critical < t test.
2.01 < 18.10.

Pvalue < significance value
0.001 < 0.05.
So, we will reject the null hypothesis.

Sugar content in cereal brand of children and adult are not equal.