Module 1. Introduction to Statistics (April 2023)

Question 1. There is an assumption that there is no significant difference between boys and girls with respect to intelligence. Tests are conducted on two groups and the following are the observations.

	Mean	Standard Deviation	Size
Girls	89	4	50
Boys	82	9	120

Validate the claim with 5% LoS (Level of Significance).

Answer :

Null Hypothesis – H0 : No difference between boys and girls in terms of intelligence.
Alternate Hypothesis – H1 : Boys and girls are different in terms of intelligence

#Two tailed test

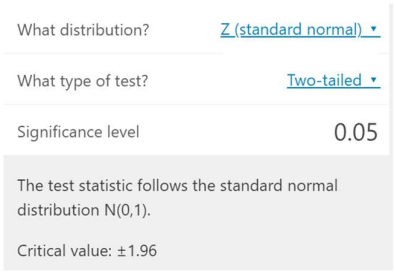
Mean1 = 89
Mean2 = 82
LoS = 5%
N1 = 50
N2 = 120

 # Z Value

$z = [(Mean1 – Mean2) - (\mu_2 - \mu_2)]/\sqrt{(s_1^2/N1 + s_2^2/N2)}$
$\mu_2 - \mu_2 = 0$ for null hypothesis
$z = (89-82)/\sqrt{((4x4)/50 + (9x9)/120)}$
$z = 7.01$

#Z Critical

z critical for LoS = 5% from z-table



Z critical value = -1.96, +1.96

#Conclution

Z Value is not in between Z critical.
Hence, Null Hypothesis is Rejected and Accept Alternate Hypothesis.
Which Means there is difference between the intelligence of boys and girls.

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Question 2. Analyze the below data and tell whether you can conclude that smoking causes cancer or not?

Category	Diagnosed as Cancer	Without Cancer	Total
Smokers	220	230	550
Non-Smokers	350	640	990
Total	680	910	1590

Answer :

Null Hypothesis – H0 : Smoking Causes Cancer.
Alternate Hypothesis – H1 : No relation between Smoking and Cancer.

#Chi-Square test

Expected value (e) = (row total * column total)/table total

Expected value table using Excel

Category	Diagnosed as Cancer	Without Cancer
Smokers	235.22	423.40
Non-Smokers	314.78	566.60

Now,

X^2 = (Observed value – Expected value)^2 / Expected Value

Expected

Category	Diagnosed as Cancer	Without Cancer
Smokers	235.22	423.40
Non-Smokers	314.78	566.60

X^2 = sum of all = 102.77

From table X^2 critical (LoS 5%) = 3.841

The X^2 value of 102.77 is larger than the critical value of 3.84, so the null hypothesis can be rejected.

Hence, it can be concluded that cancer is not dependent on smoking.