

## Assessment - Intero. to Statistics

Q-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% level of significance

⇒ Given data

Girls Mean  $\bar{x}_1 = 89$   
 standard deviation  $s_1 = 4$   
 size  $n_1 = 50$

Boys mean  $\bar{x}_2 = 82$   
 S.D  $s_2 = 9$   
 size  $n_2 = 120$

Hypotheses

$$H_0 : \mu_1 - \mu_2 = 0$$

$$H_1 : \mu_1 - \mu_2 \neq 0$$



t test

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left(\frac{s_1^2}{n_1}\right) + \left(\frac{s_2^2}{n_2}\right)}}$$

$$t = \frac{(89 - 92)}{\sqrt{\left(\frac{4^2}{50}\right) + \left(\frac{9^2}{120}\right)}}$$

$$= \frac{7}{\sqrt{(0.32) + (0.675)}}$$

$$\approx \frac{7}{\sqrt{(1.995)}}$$

$$\approx \frac{7}{1.411}$$

$$t \approx 4.95$$

$$\alpha = 5\%$$

for two tailed test at 5% level of significance with degree of freedom to min of  $(n_1 - 1)$  and  $(n_2 - 1)$ , smaller one  
 $(119, 119) \approx 119$ , critical value



3

Critical value  $\approx \pm 2.009$

since

$$|t| = 4.95 > 2.009$$

We reject Null Hypothesis

there is significant difference b/w boys  
and girls with respect to  
intelligence at the 5% level of  
significance.



Q-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

2

$H_0$  (Null Hypothesis) = Cancer is dependent on smoking

$H_1$  (Alternate Hypothesis) = Cancer is not dependent on smoking

frequency =  $\frac{\text{Row total} \times \text{column total}}{\text{Grand Total}}$

$$E_{\text{smokers, cancer}} = \frac{550 \times 680}{1590} \approx 197.17$$

$$E_{\text{smokers, No cancer}} = \frac{550 \times 910}{1590} \approx 352.82$$

$$E_{\text{non-smokers, cancer}} = \frac{990 \times 680}{1590} \approx 352.82$$

$$E_{\text{non-smokers, No cancer}} = \frac{990 \times 910}{1590} \approx 637.18$$



~~Exercise~~  
Calculation

$$\chi^2 = \sum = \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

$$\chi^2 = \frac{(220 - 197.18)^2}{197.18} + \frac{(230 - 352.82)^2}{352.82} + \frac{(350 - 352.82)^2}{352.82} + \frac{(640 - 637.18)^2}{637.18}$$

$$\chi^2 = \frac{484.8}{197.18} + \frac{91.723}{352.82} + \frac{0.194}{352.82} + \frac{7.77}{637.18}$$

$$\approx 2.461 + 0.26 + 0.001 + 0.012$$

$$\approx 2.734$$

Degree of freedom

$$df = (\text{Number of Rows} - 1) \times (\text{Number of column} - 1)$$

$$= (2 - 1) \times (2 - 1)$$

$$= 1$$

at  $\alpha = 5\%$  LOS, the critical value is approximately 3.841

Since  $2.734 < 3.841$ .

so, Null hypothesis can be rejected.



which means when given data,  
it can be significantly concluded  
that current is not dependent on  
concentration.