CHI SQUARE TEST FOR INDEPENDENCE OF ATTRIBUTES.

$$\chi^2 = \sum\left[\frac{(O_i - E_i)^2}{E_i}\right]$$

where $O_i \rightarrow$ Observed frequency

$E_i \rightarrow$ Expected frequency

$$E_i = \frac{(\text{row total } B_i)(\text{column total } A_j)}{\text{whole total}}, \quad i = 1 \text{ to } s, \; j = 1 \text{ to } t$$

Degrees of freedom, $\nu = (s-1)(t-1)$.

1) On the basis of information noted below, find out whether the new treatment is comparatively superior to the conventional one.

	Favourable	Not favourable	Total
New	60	30	90
Conventional	40	70	110
Total	100	100	200

Soln:

To find E_i:

$\frac{90 \times 100}{200} : 45$	$\frac{90 \times 100}{200} : 45$
$\frac{110 \times 100}{200} : 55$	$\frac{110 \times 100}{200} : 55$

O_i	E_i	$O_i - E_i$	$(O_i - E_i)^2 / E_i$
60	45	15	5
30	45	-15	5
40	55	-15	4.09
70	55	15	4.09

$\sum \frac{(O_i - E_i)^2}{E_i} : 18.18$

Step 1: Formulating H_0 & H_1:

H_0: There is no difference between new & conventional treatment.

H_1: There is difference between new & conventional treatment

Step 2: Los at $\alpha = 5\%$.

Step 3 : Test statistics, $\chi^2 = \frac{\sum (O_i - E_i)^2}{E_i}$

$= 18.18$

Step 4 : Degrees of freedom, $v = ((s-1) * (t-1))$

$v = (2-1 * 2-1)$

$= 1 * 1$

$= 1$

$\therefore$ Tab value, $\chi^2_\alpha = 3.841$

Step 5 : Conclusion :

$\chi^2 = 18.18 > 3.841 = \chi^2_\alpha$

$\therefore$ H_0 is rejected at 5 % LOS

(i.e.,) There is difference between new & conventional treatment.

2) Two researchers A and B adopted different techniques while rating the students level. Can you say that the techniques adopted by them are significant?

Researchers	Below avg.	Avg.	Above Avg.	Genius	Total
A	40	33	25	2	100
B	86	60	44	10	200
Total	126	93	69	12	300

Soln:

To find E_i

$\frac{100 \times 126}{300} : 42$ $\quad \frac{100 \times 93}{300} : 31$ $\quad \frac{100 \times 69}{300} : 23$ $\quad \frac{100 \times 12}{300} : 4$

$\frac{200 \times 126}{300} : 84$ $\quad \frac{200 \times 93}{300} : 62$ $\quad \frac{200 \times 69}{300} : 46$ $\quad \frac{200 \times 12}{300} : 8$

O_i	E_i	$O_i - E_i$	$(O_i - E_i)^2 / E_i$
40	42	-2	0.0952
33	31	2	0.129
25	23	2	0.173
2	4	-2	1
86	84	2	0.047
60	62	-2	0.064
44	46	-2	0.086
10	8	2	0.5

$$\sum \frac{(O_i - E_i)^2}{E_i} = 2.097$$

Step 1 : Formulating H_0 and H_1 :

H_0 : There is no difference between the two researches.

H_1 : There is difference between the two researches.

Step 2 : LOS at $\alpha = 5\%$.

Step 3 : Test statistics, $\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$

$= 2.097$.

Step 4 : Degrees of freedom, $v = ((4-1) * (2-1))$

$= (3 * 1)$

$= 3$

$\therefore$ Tab value is $\chi^2_\alpha = 7.115$

Step 5 : Conclusion :

$\chi^2 = 2.097 < 7.115 = \chi^2_\alpha$

$\therefore$ H_0 is accepted at 5% LOS.

(a) There is no difference between the two Researchers.