Boys and girls are asked which of 3 TV programs they liked best, A, B or C.

Ask 50 boys and 50 girls.

	A	B	C	TOTALS
Girls				50
Boys				50
Results	22	52	26	100

EXPECTED RESULTS

	A	B	C	TOTALS
Girls	11	26	13	50
Boys	11	26	13	50
	22	52	26	100

What if there were 60 girls and 40 boys?

	A	B	C	TOTALS
Girls				60
Boys				40
	22	52	26	100

We would expect the girl/total ratio to be the same for each movie.

EXPECTED RESULTS

	A	B	C	TOTALS
Girls	**13.2**			60
Boys				40
	22	52	26	100

Proportion of girls is…

$$\frac{\text{GIRLS}}{\text{TOTAL}} = \frac{60}{100} \qquad 22 \text{ x } \frac{60}{100} = \mathbf{13.2}$$

EXPECTED RESULTS

	A	B	C	TOTALS
Girls	13.2	31.2	15.6	60
Boys	8.8	20.8	10.4	40
	22	52	26	100

$$\textit{Expected} = \textit{Column Total} \times \frac{\textit{Row Total}}{\textit{Grand Total}} = \frac{RC}{T}$$

$$\textit{Boys who liked A} = 22 \times \frac{40}{100} = 8.8$$

EXPECTED RESULTS

	A	B	C	TOTALS
Girls	13.2	31.2	15.6	60
Boys	8.8	20.8	10.4	40
	22	52	26	100

OUTCOME

	A	B	C	TOTALS
Girls	16	25	19	60
Boys	6	27	7	40
	22	52	26	100

$$\chi 2 = \sum \frac{(Outcome - Expected)^2}{Expected}$$

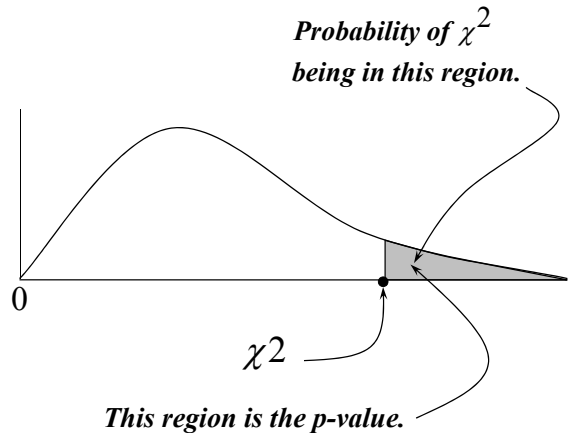
$$\frac{(16-13.2)^2}{13.2} = 0.5939$$

$$\chi 2 = \frac{(16-13.2)^2}{13.2} + \frac{(25-31.2)^2}{31.2} + \bullet\bullet\bullet + \frac{(7-10.4)^2}{10.4}$$

$$\chi 2 = 6.42$$

$$df = (rows-1)\cdot(columns-1) = (2-1)\cdot(3-1) = 2$$

If Gender and Movie Choice were independent, the two matrices would be approximately the same and χ^2 would be distributed as below.



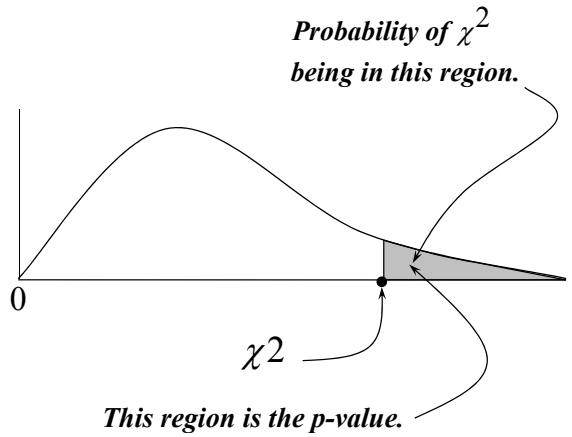
Form the Hypotheses

Ho: Gender and Movie Choice are Independent

Ha: Gender and Movie Choice are Dependent

Identify the significance level $\alpha = 5\%$ or $\alpha = 1\%$

If the p-value is less than α, then REJECT Ho.



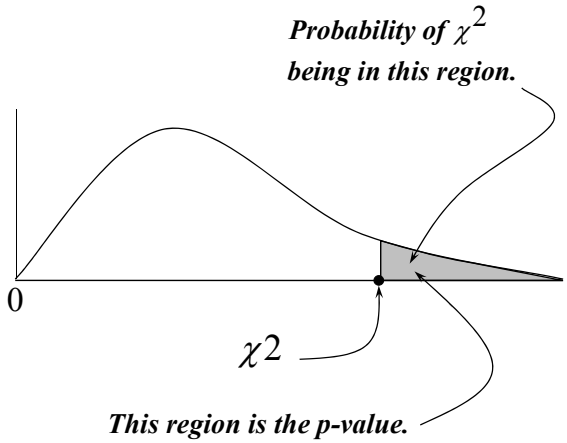
Form the Hypotheses

Ho: Gender and Movie Choice are Independent

Ha: Gender and Movie Choice are Dependent

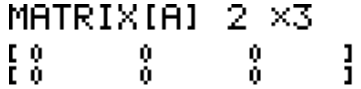
If you REJECT Ho, then you conclude that Ha is true ... that the variables are related.

If you FAIL TO REJECT Ho, then you cannot conclude anything.



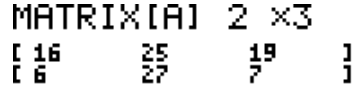
To use the calculator to perform a $\chi 2$-test,

2ND - MATRIX



Highlight **EDIT** *and press* **ENTER**

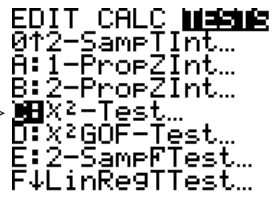
Select the size of the Matrix (Rows & Columns) Then enter the OUTCOME data.



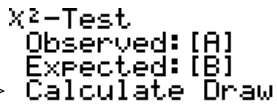
To use the calculator to perform a χ^2-test,

Then **STAT** ⇨ **TESTS**

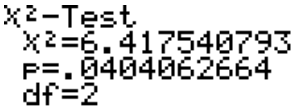
Select ⇨



Select ⇨



Results ⇨



Page 715/Problem 25

A sociologist is researching the question: "Is there a relationship between the level of education and job satisfaction?" For a random sample of 270 workers she determines each individual's education level and level of job satisfaction. The results are recorded in the following table:

	Job Satisfaction Level		
Educ	**Low**	**Med**	**High**
Coll	**20**	**70**	**30**
HS	**15**	**60**	**25**
Grade	**15**	**25**	**10**

Perform a chi-square test of independence to determine if educational level and job satisfaction are dependent at 5%.

DVD Purchases

Columbia Casa advertising would like to determine if gender is related to the number of DVDs purchased that year. A random sample of 300 people were interviewed and their responses are summarized in the following table.

	Number of DVDs Purchased per Year		
	0-20	**21-40**	**Above 40**
Male	**50**	**55**	**35**
Female	**40**	**70**	**50**

Based on the sample data, can the advertising firm conclude that the number of DVDs purchased per year is based upon gender? (Use $\alpha = 5\%$)