CHI-SQUARE TEST FOR HOMOGENEITY OF POPULATIONS

*This test is used to determine if a single categorical variable has the same distribution in 2 (or more) distinct populations from **2 (or more) samples**.*

To determine if there was an association between race and opinions about schools, researchers surveyed 3 randomly selected groups of parents and asked them "Are high schools in your state doing an excellent, good, fair or poor job or don't you know enough to say?".

	Black Parents	**Hispanic Parents**	**White Parents**	**TOTAL**
Excellent	12	34	22	**68**
Good	69	55	81	**205**
Fair	75	61	60	**196**
Poor	24	24	24	**72**
Don't Know	22	28	14	**64**
TOTAL	**202**	**202**	**201**	**605**

DETERMINE EXPECTED COUNTS:

Expected Count = (Row Total)(Column Total)/ Sample Size

	Black Parents		**Hispanic Parents**		**White Parents**	
	Actual	Expected	Actual	Expected	Actual	Expected
Excellent	12	22.7	34	22.7	22	22.6
Good	69	68.5	55	68.5	81	68.1
Fair	75	65.4	61	65.4	60	65.1
Poor	24	24.0	24	24.0	24	23.9
Don't Know	22	21.4	28	21.4	14	21.3

H STATE NULL AND ALTERNATIVE HYPOTHESES

H_o : There is no relationship between race and opinions about schools

H_a : There is a relationship between race and opinions about schools

A DETERMINE THAT CONDITIONS FOR TEST ARE ACCEPTABLE:

- Random… yes (random samples were used)
- Every expected count ≥ 5… yes (see above)
- Independent... yes (assuming responses are independent and $N_B > 2{,}020$, $N_H > 2{,}020$ and $N_W > 2{,}010$)

T PERFORM TEST USING…

FORMULA/TABLE C:

a) Chi-Square Statistic: $X^2 = \Sigma (O_i - E_i)^2 / E_i =$

$(12 - 22.7)^2/22.7 + (34 - 22.7)^2 /22.7 + \ldots + (14 - 21.3)^2 / 21.3 = 22.43$

b) Degrees of Freedom = $(r - 1)(c - 1) = (5 - 1)(3 - 1) = 8$

Number of rows in table — Number of columns in table

c) *P*-Value

i) Table C

Any X^2 statistic > 21.95 (df = 8) has a P-value < .005

ii) Calculator:

X^2 cdf (22.43, 100, 8) → p = .004

CALCULATOR:

a) Store observed counts in a [R,C] matrix:

MATRIX → EDIT → 1: [A] → 5 X 3 → Enter Counts → QUIT

b) Perform X^2 Test:

STAT → TESTS → C: X^2 – Test → X^2 = 22.4, P-value = .004

NOTE:

If MATRIX [A] = Observed Counts, MATRIX [B] = Expected Counts

S STATE CONCLUSION IN CONTEXT:

There is significant evidence (P-value < .005) to reject H_o and conclude that there **is** a relationship between race and opinions about schools… to determine specific comparisons, use 2-way table techniques. For example, a greater percentage of Whites consider schools *good* compared to Hispanics etc.