Solutions

1. In a study of the television viewing habits of children, a developmental psychologist selects a random sample of 100 first grade boys and 200 first grade girls. Each child is asked which of the following TV programs they like best: The Lone Ranger, Sesame Street, or The Simpsons. Results are shown in the contingency table below.

	Lone Ranger	Sesame Street	The Simpsons	Total
Boys	50	30	20	100
Girls	50	80	70	200
Total	100	110	90	300

2. Will you use a chi-squared test of homogeneity or independence?

Homogeneity

3. State the hypotheses to be tested.

H_0: The true distributions of TV viewing program preference are the same across boys + girls.

H_A: The true distributions of TV viewing program preference are not all the same across boys + girls

4. Make a table of expected counts.

	Lone Ranger	Sesame Street	The Simpsons
Boys	$\frac{100 \cdot 100}{300} = 33.3$	$\frac{110 \cdot 100}{300} = 36.6$	$\frac{90 \cdot 100}{300} = 30$
Girls	$\frac{100 \cdot 200}{300} = 66.6$	$\frac{110 \cdot 200}{300} = 73.2$	$\frac{90 \cdot 200}{300} = 60$

5. Compare the table of expected counts to the table of observed counts. Do you think you will find evidence in favor of the alternative hypothesis? Briefly explain.

$$\chi^2 = \sum_{i=1}^{6} \left(\frac{observed_i - expected_i}{\sqrt{expected_i}} \right)^2 = \left(\frac{50 - 33.3}{\sqrt{33.3}} \right)^2 + \left(\frac{30 - 36.6}{\sqrt{36.6}} \right)^2 + \left(\frac{20 - 30}{\sqrt{30}} \right)^2$$

$$+ \left(\frac{50 - 66.6}{\sqrt{66.6}} \right)^2 + \left(\frac{80 - 73.2}{\sqrt{73.2}} \right)^2 + \left(\frac{90 - 60}{\sqrt{60}} \right)^2 = 19.3$$

6. Calculate the chi squared test statistic.

Yes, I do think I will find evidence in favor of H_A because the numbers in the table of expected counts are different from the numbers in the table of observed counts.

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7. What distribution does the test statistic follow under the null hypothesis?

Chi-Squared distribution on 2 df

8. Below is a picture of the distribution you named above. Draw a vertical line at the test statistic.

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curve(dchisq(x,2),xlim=c(0,25))
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$\chi^2 = 19.3$
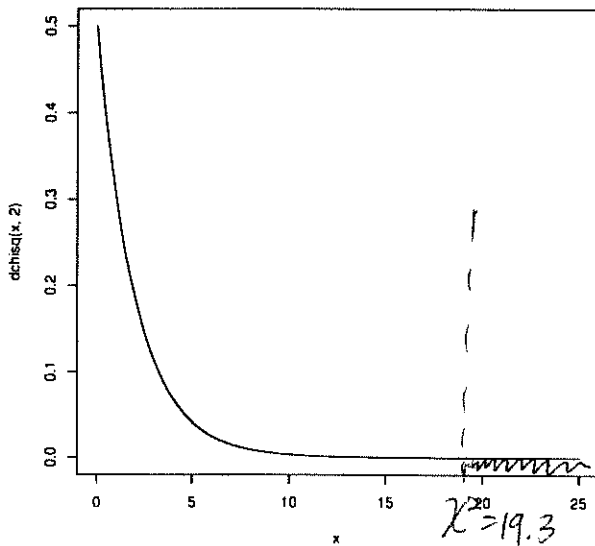
9. Based on the picture above, estimate the p-value.

p-value < 0.0001

10. Write a conclusion in the context of the problem.

There is strong evidence that the true distributions of TV viewing program preference are not all the same across boys + girls (p-value < 0.0001 from χ^2-stat = 19.3 on 2 df)

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