Test of Goodness of Fit

Lecture 42
Section 14.3

Robb T. Koether

Hampden-Sydney College

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Outline

Introduction

- The TI-83 will compute χ^2 areas, but not χ^2 percentiles. (That's ok.)
- After performing the χ^2 test by hand, we will see how to do it on the TI-83.
- It turns out that there is no special function for a goodness-of-fit test.
- We will also see that the χ^2 test with one degree of freedom is equivalent to the single-proportion Z test.

TI-83 - Chi-Square Probabilities

- To find a chi-square probability (*p*-value) on the TI-83,
  - Press `DISTR`.
  - Select χ^2`cdf`.
  - Press `ENTER`.
  - Enter the lower endpoint, the upper endpoint, and the degrees of freedom.
  - Press `ENTER`.
- The probability appears.

Computing the p-value

- In this example, $df = 5$.
- To find the p-value, use the TI-83 to calculate the probability that χ^2_5 would be at least as large as 3.4.
- p-value $= \chi^2$`cdf(3.4,E99,5)` $= 0.6386$.
- Accept H_0.
- We conclude that the die is fair.

Goodness-of-Fit Test on the TI-83

- Be careful! There is a function called χ^2`-Test`, but it does not perform this test.
- Some TI-84s may have a GOF-Test.
- To perform a goodness-of-fit test on the TI-83, do the following.
  - Put the observed counts in list L_1.
  - Put the hypothetical proportions in list L_1.
  - Multiply L_1 by the sample size and store as L_1. These are the expected counts.
  - Calculate $(L_1-L_2)^2/L_2$.
  - Go to `LIST > MATH` and select `sum` (item #5).
  - Enter `Ans` and press `ENTER`. The value of χ^2 appears.
  - Then use χ^2`cdf` to find the *p*-value.

Example - Male vs. Female Births

- Suppose we observe 1000 births and find that 520 are male and 480 are female.
- Does this indicate that male births and female births are not equally likely?
- Let p_1 = proportion of male births.
- Let p_2 = proportion of female births.
- $H_0 : p_1 = 0.50, p_2 = 0.50$
  $H_1 : H_0$ is not true.
- $\alpha = 0.05$.

Example - Male vs. Female Births

- We have the table

	Male	Female
Observed (Expected)	520 (500)	480 (500)

Example - Male vs. Female Births

- The test statistic is

$$\chi^2 = \sum_{\text{all cells}} \frac{(O - E)^2}{E}.$$

- Calculate

$$\begin{aligned} \chi^2 &= \frac{(520 - 500)^2}{500} + \frac{(480 - 500)^2}{500} \\ &= 0.8 + 0.8 \\ &= 1.6 \end{aligned}$$

Example - Male vs. Female Births

- The p-value is

$$p\text{-value} = \chi^2\texttt{cdf(1.6,E99,1)} = 0.2059.$$

- Accept H_0.
- The proportion of male births is 50%.

Example - Male vs. Female Births

- Perform the above test as a two-tailed one-proportion Z test. That is, let the alternative hypothesis be
$$H_1 : p_1 \neq p_2.$$
- What is the p-value?
- What is the value of the test statistic Z?
- Square that number. What do you get?

Summary

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- The TI-83 will compute χ^2 areas, but not χ^2 percentiles. (That's ok.)
- The TI-83 will not perform the goodness-of-fit test, although we can do it using lists.
- The goodness-of-fit test with with only two cells is equivalent to the one-proportion Z test.