

This project is based on info collected from:

<http://www.robweir.com/blog/2010/02/microsoft-random-browser-ballot.html>  
to illustrate applied hypothesis testing (Chi-squared test for independence)

The problem described at the URL above involves a computer programming error (later fixed), which caused a browser-choice ballot to display the browser selections non-randomly (unequally). Each browser should be appearing about 1/5th of the time in positions 1, 2, 3, 4, and 5 on the ballot.

Observed 10,000 counts of ballot position when using...

...Internet Explorer (IE) to run the ballot software:

Position	IE	Firefox	Opera	Chrome	Safari
1	1304	2099	2132	2595	1870
2	1325	2161	2036	2565	1913
3	1105	2244	1374	3679	1598
4	1232	2248	1916	590	4014
5	5034	1248	2542	571	605

...Firefox to run the ballot software:

IE	Firefox	Opera	Chrome	Safari
2494	2489	1612	947	2458
2892	2820	1909	1111	1268
2398	2435	2643	1891	633
1628	1638	2632	3779	323
588	618	1204	2272	5318

From the website:

"But is [the pattern we see in the tables] a statistically significant result? . . . This is not a question one answers with debate. To go beyond intuition you need to perform a statistical test. In this case, a good test is Pearson's Chi-square test, which tests how well observed results match a specified distribution. In this test we assume the null-hypothesis that the observed data is taken from a uniform distribution.

The test then tells us the probability that the observed results can be explained by chance. In other words, what is the probability that the difference between observation and a uniform distribution was just the luck of the draw? If that probability is very small, say less than 1%, then we can say with high confidence, say 99% confidence, that the positions are not uniformly distributed. However, if the test returns a larger number, then we cannot disprove our null-hypothesis. That doesn't mean the null-hypothesis is true. It just means we can't disprove it. In the end we can never prove the null hypothesis. We can only try to disprove it."

Results for the Chi-squared test when using IE:

X-squared = 13340.23, df = 16, p-value < 2.2e-16

...and when using Firefox:

X-squared = 14831.41, df = 16, p-value < 2.2e-16

### Project Questions (refer to textbook as needed)

1. State the null and alternative hypotheses (in words or symbols) for the Chi-squared test

Ho:  $\mu =$

and H1:  $\mu \neq$