Homework 5

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Github Repo: https://github.com/swatimisra/hw5

Problem 1

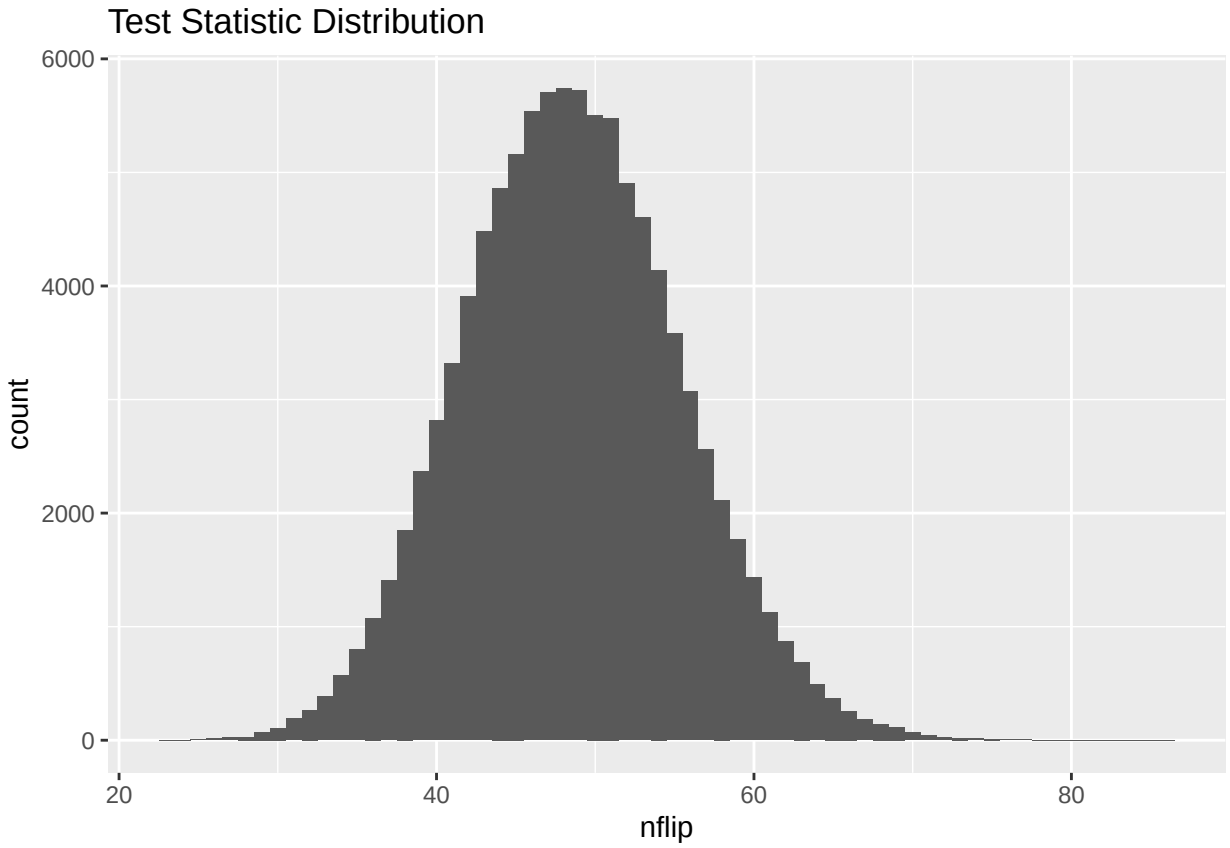
Null Hypothesis

The observed data is consistent with the idea that over the long run, securities trades from the Iron Bank are flagged at the same 2.4% baseline rate as that of other traders.

Test Statistic

The test statistic is the number of flagged securities trades from Iron Bank. In our data, 70 of 2021 traders were flagged by SEC's algorithm.

Plot



This is a plot of the probability distribution of the test statistic assuming that the null hypothesis is true.

P Value

The p-value is 0.00192. This p value is very small.

Conclusion

Since the p-value is so small, and less than 0.05, this means the null hypothesis that over the long run, securities trades from the Iron Bank are flagged at the same 2.4% baseline rate as that of other traders should be rejected. There may be suspicious activity occuring in the trades from the Iron Bank.

Problem 2

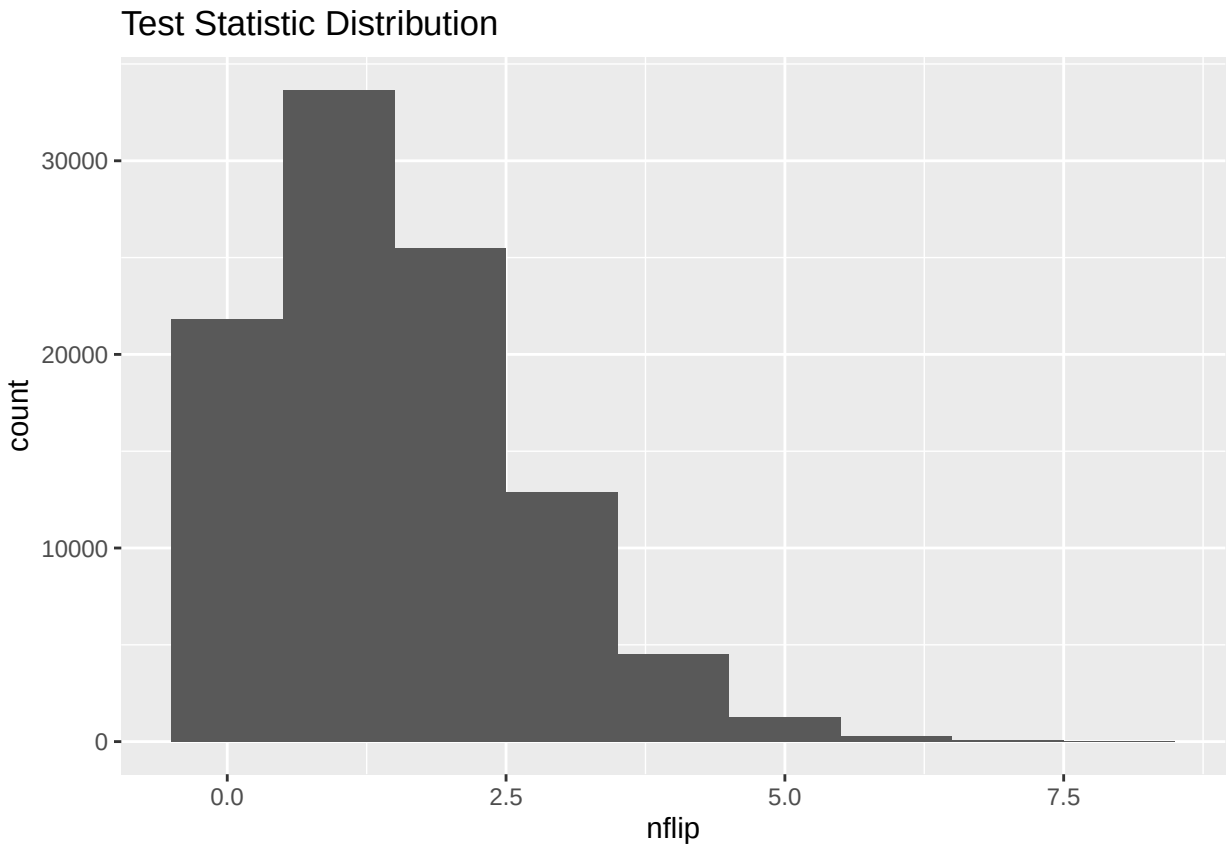
Null Hypothesis

On average, restaurants in the city are cited for health code violations at the same 3% baseline rate.

Test Statistic

The test statistic is the number of restaurants in the city that had health code violation reports. In our data, the 50 inspections of Gourmet bites had 8 health code violations being reported.

Plot



This is a plot of the probability distribution of the test statistic assuming that the null hypothesis is true.

P Value

The p-value is 5×10^{-5}.

Conclusion

Since the p-value is so small, and less than 0.05, this means the null hypothesis that on average, restaurants in the city are cited for health code violations at the same 3% baseline rate should be rejected. There may be more health code violations than the 3% baseline.

Problem 3

Part B

Table 1: Table of Sentences and P-values

Sentence	P_value
1	0.513
2	0.926
3	0.076
4	0.489
5	0.484
6	0.009
7	0.328
8	0.988
9	0.084
10	0.059

The sentence that has been produced by the LLM but watermarked by asking the LLM to subtly adjust its frequency distribution over letters is sentence 6. We know this because this sentence is the only sentence with a p-value below 0.05 which means we can reject the null hypothesis that the sentence follows the "typical" English letter distribution.