SDS315 Homework 4 Report

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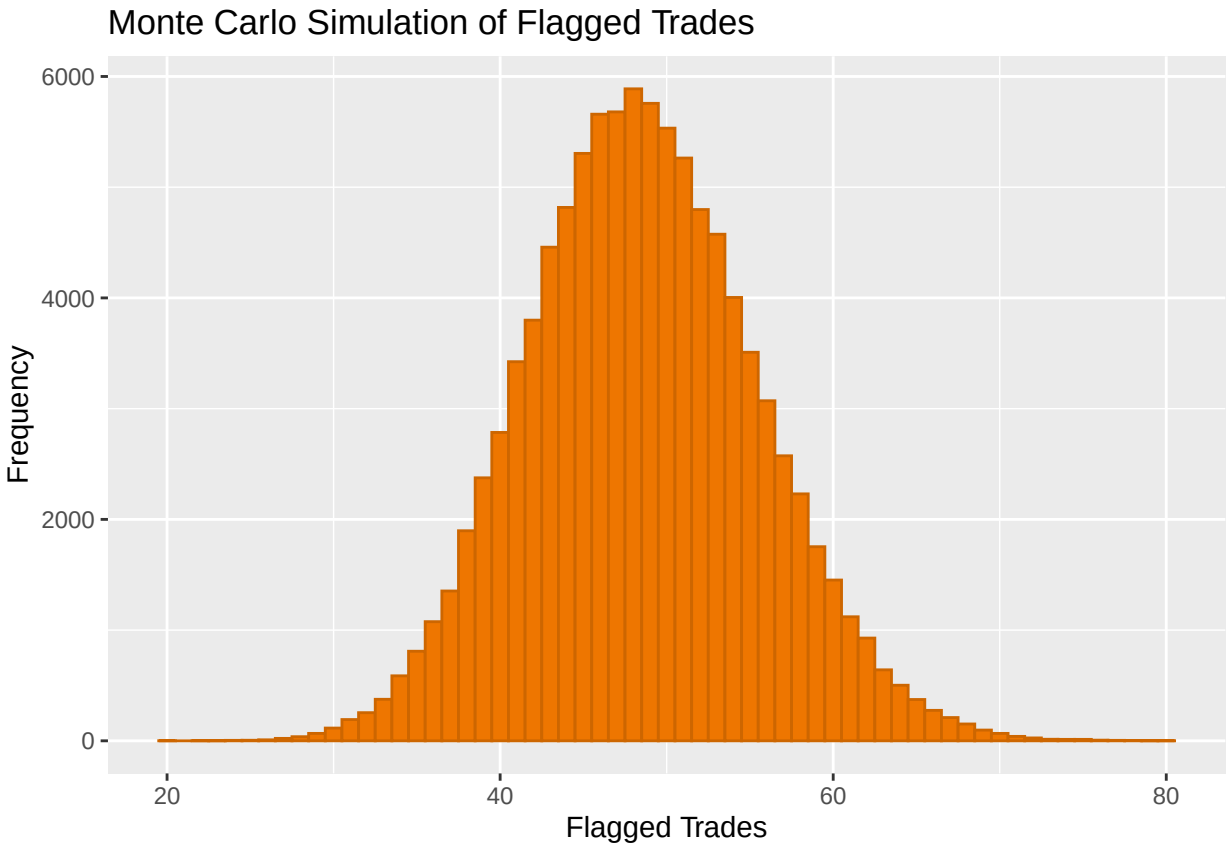
Contents

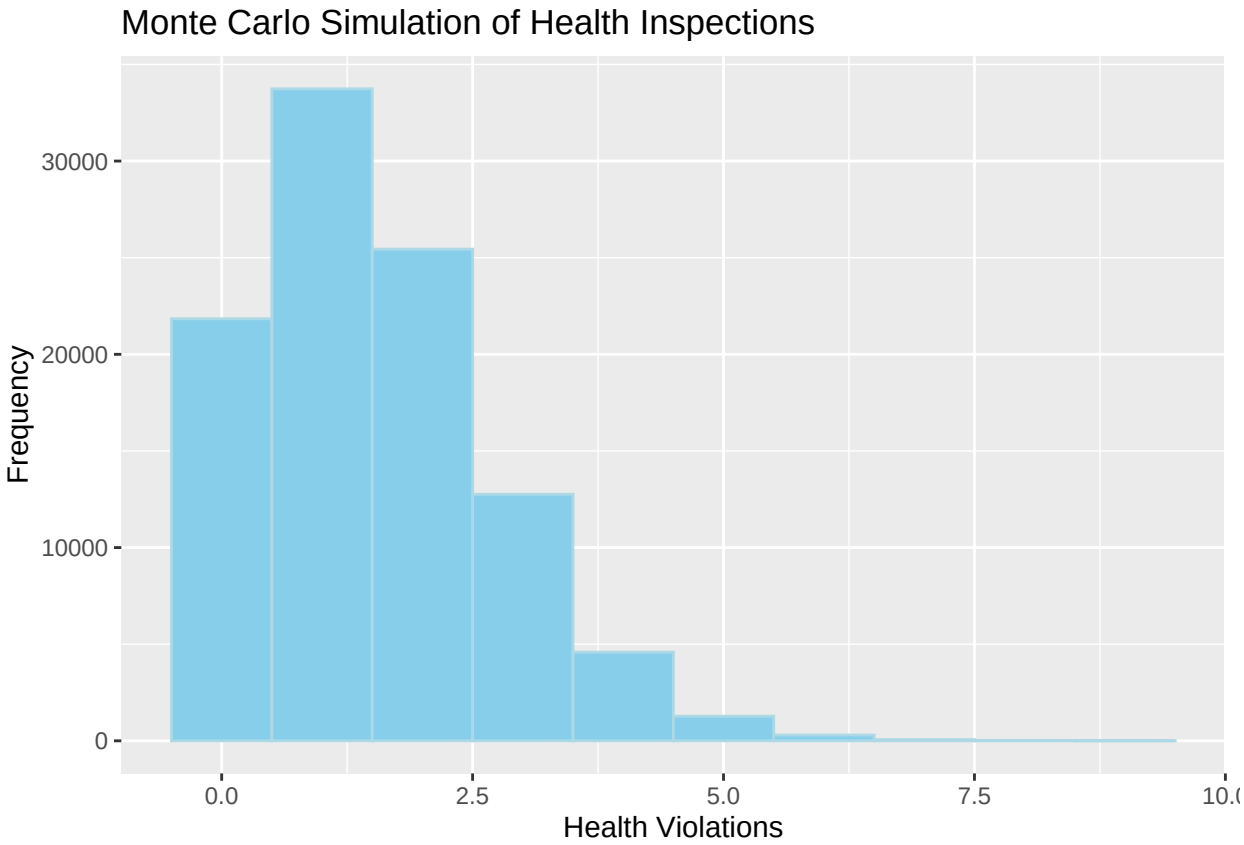
The link to the Github repo containing the R file can be found here.

Problem 1



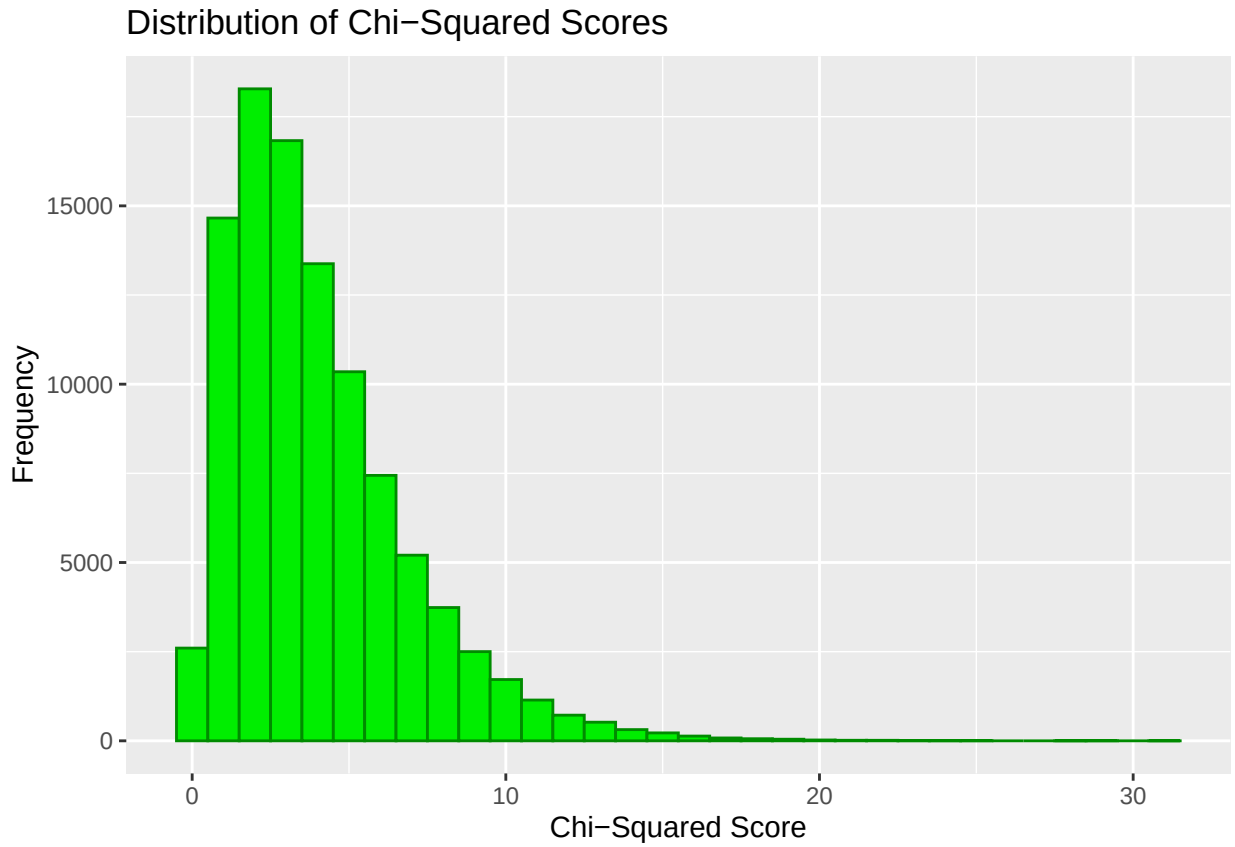
The null hypothesis is that the flagged trades are not illegal, that is, the flagged trades are simply a random aberration and not a result of malicious intent. To validate the null hypothesis, I used the 70 flagged trades and contrasted them against the total 2021 trades to search for the p value. By utilizing a Monte Carlo simulation with 100000 trials, a p-value of 0.00188 was obtained. As the p-value is less than 5%, and even less than 1%, we can reject the null hypothesis and conclude that there likely were illegal trades happening at Iron Bank.

Problem 2



In this problem, the null hypothesis is that Gourmet Bites' high rate of health code violations is not due to faulty restaurant upkeep, but rather due to bad luck and random chance. To test this hypothesis, I used a Monte Carlo simulation run 100000 times, with a baseline of 50 tests and 3% odds of a faulty test. Running this test yields the p-value of 1.1×10^{-4}. As this result is less than even .1%, the null hypothesis can be discarded. It can be concluded that Gourmet Bites high rates of health code violations is not due to chance, and that the restaurant should be investigated.

Problem 3



To determine whether this judge showed bias in their jury selection, a chi-squared test was used. The null hypothesis is that the judge is not biased in their selections, and rather, the anomalies are due to chance. First, the expected proportion of ethnic groups was collected, along with the selection data of the judge in question. Then the chi-squared test was carried out. The sums of the square of the difference between the expected and actual value divided by the expected value was calculated 100000 times in a Monte Carlo simulation, and the resulting distribution was plotted above. Then, the chi-squared score of the judge was calculated and compared with the distribution. This yielded a p-score of 0.01493, which is less than 5 percent. As such, the null hypothesis can be assumed to be false, implying that the judge is racially or ethnically biased in their selections. The judge might believe that certain races are better able to act as jurors, or might be more biased towards their own race, preferring to select people like themselves more. To investigate further, more data could be collected on this specific judge to determine exactly what biases they have. Alternatively, data could be collected on other judges to examine if bias is prevalent between judges when selecting their juries.

Problem 4

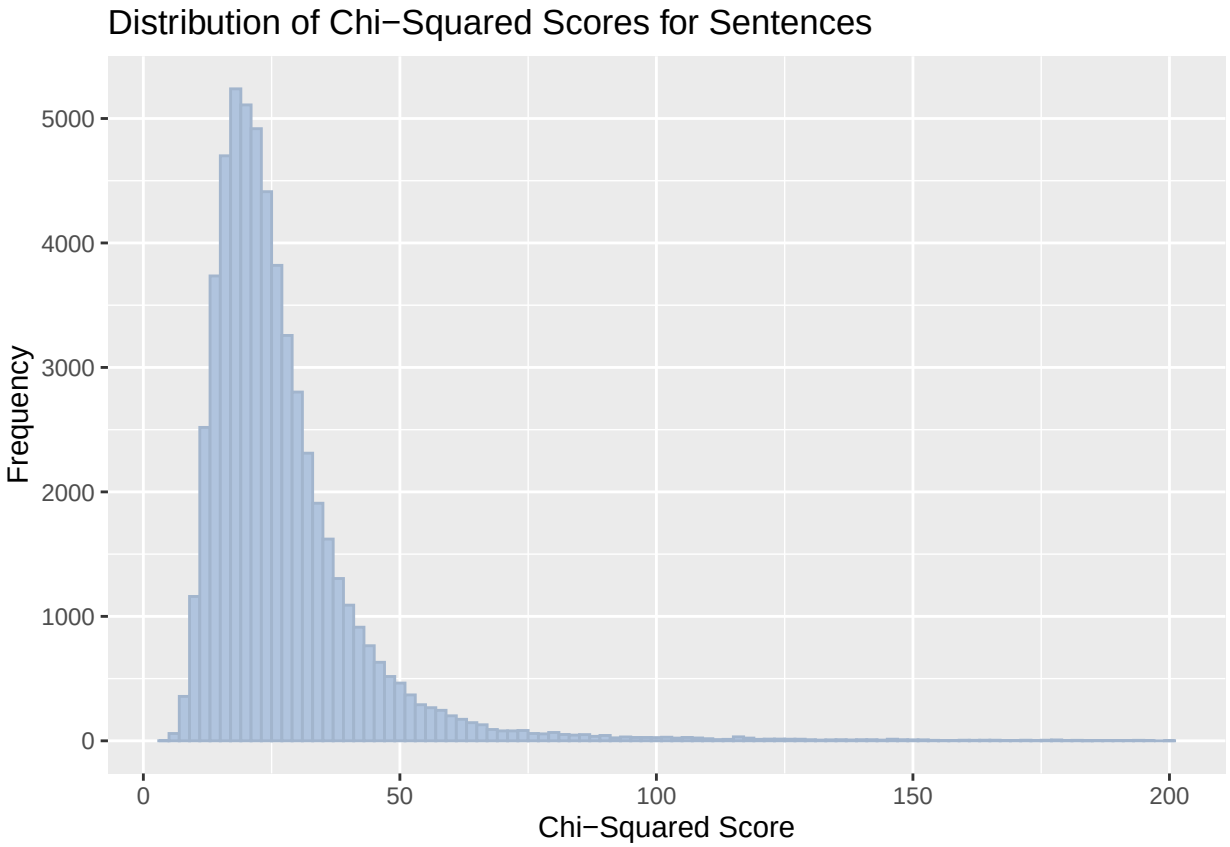


Table 1: Sentence P-Values

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

Sentence 6 is likely the one that has been produced by an LLM. Its p-score is the lowest, and is below 5%, implying that does not follow the standard distribution for written English sentences. The sentence, "Feeling vexed after an arduous and zany day at work, she hoped for a peaceful and quiet evening at home, cozying up after a quick dinner with some TV, or maybe a book on her upcoming visit to Auckland", is the LLM generated sentence.