

315HW4

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GITHUB REPO

Problem 1 - Iron Bank

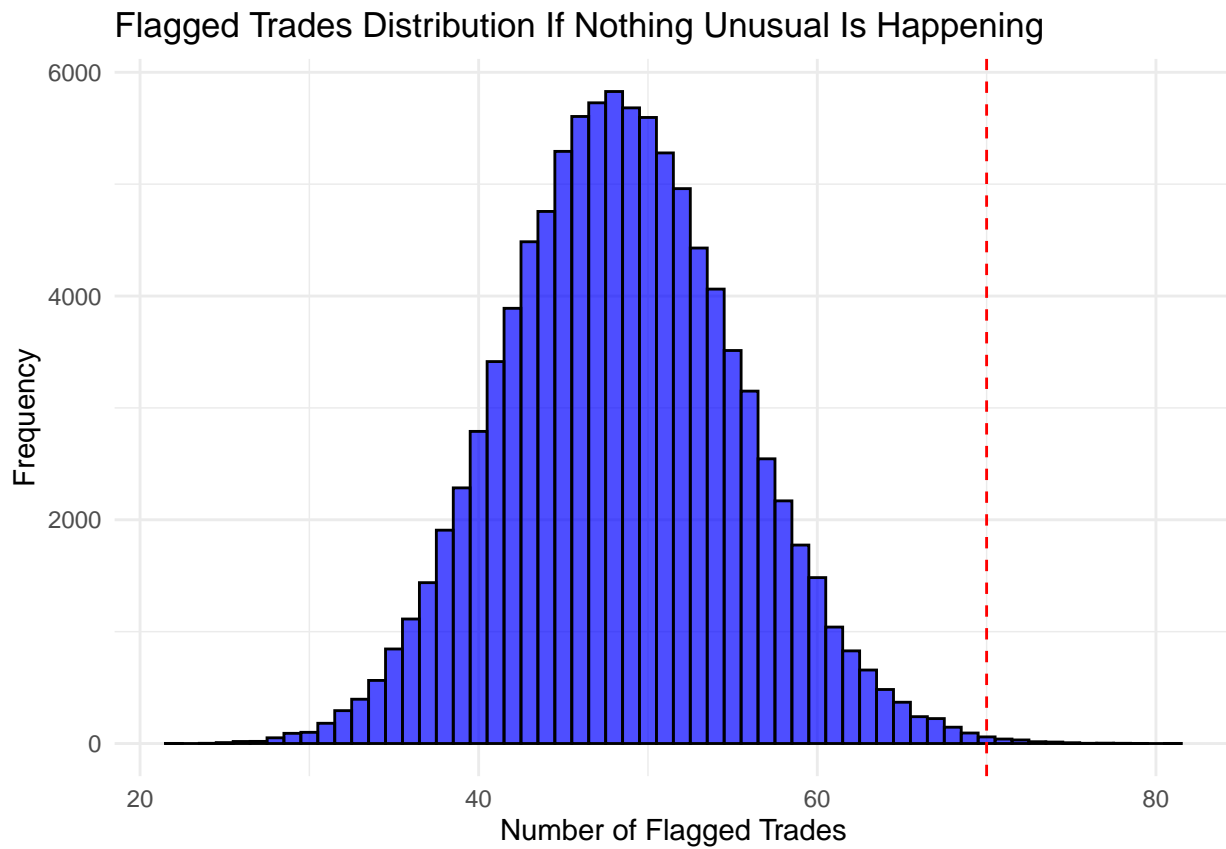
Null Hypothesis

The SEC expects that flagged trades happen randomly at a normal rate of 2.4%. If nothing unusual is happening at Iron Bank, the number of flagged trades should be close to what we would expect based on this normal rate.

Test Statistic

We will measure how many trades were flagged out of 2021 total trades and compare it to what we would expect if everything was normal.

Probability Distribution



[1] 0.00176

The P value is 0.00176, which is very low. This suggests that getting 70 flagged trades, or a rate of 2.4%, by random chance is highly unlikely. This also suggests that something unusual is happening at Iron Bank, and the SEC's decision to investigate the situation is statistically justified.

Problem 2

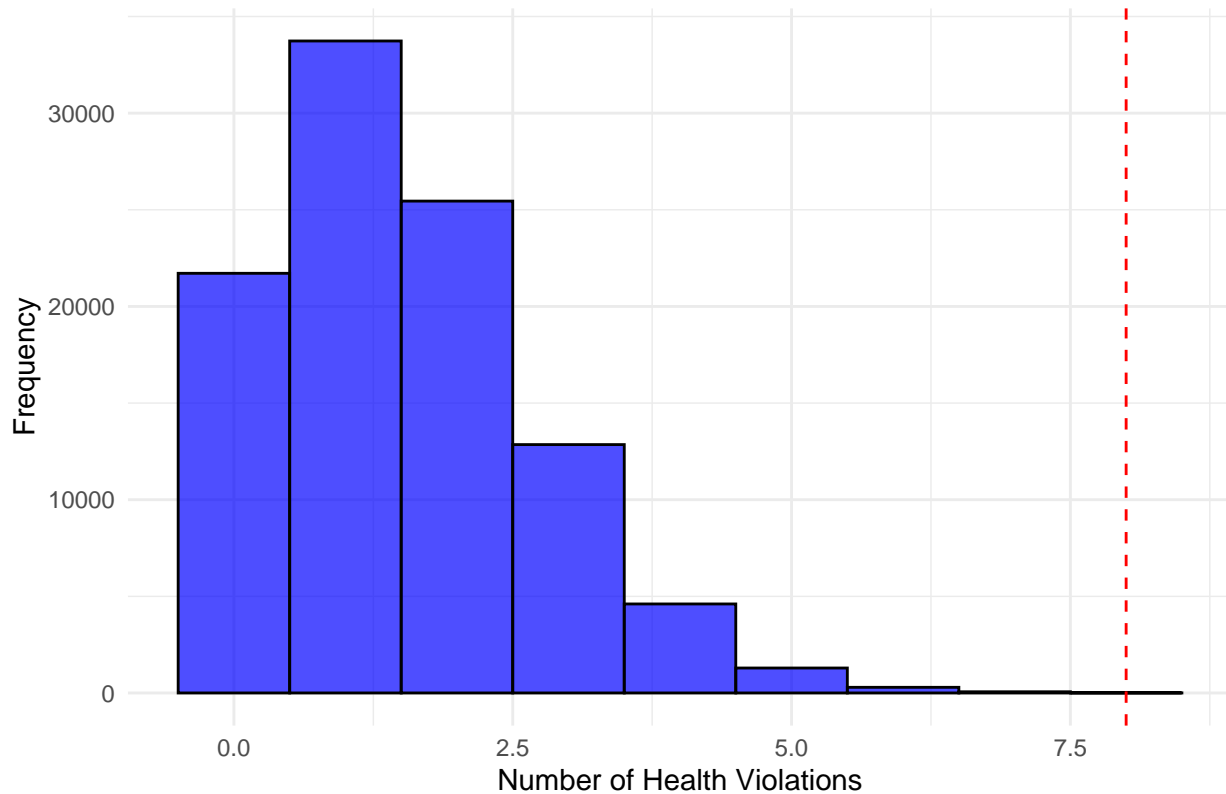
Null Hypothesis

The Health Department assumes that Gourmet Bites has the same violation rate as all restaurants in the city, which is 3%. If this is true, the number of violations should follow the normal pattern.

Test Statistic

The test statistic is the number of health code violations observed** in 50 inspections.

Health Violations Distribution If Gourmet Bites Was Normal



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## [1] 5e-05
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The p-value is 5×10^{-5} , which is extremely low. This means that getting 8 or more violations just by random chance is highly unlikely.

This suggests that Gourmet Bites has a significantly higher rate of health violations than expected, and further investigation is strongly justified.

Problem 3

Null Hypothesis (H_0)

The judge's juries are selected fairly and reflect the county's racial/ethnic proportions. Any differences in jury selection are due to random variation.

Test Statistic (T)

We use a Chi-Square Goodness-of-Fit Test to compare the observed jury composition to the expected distribution based on the county's demographics.

Probability of T Given H_0 ($P(T | H_0)$)

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## X-squared
## 12.42639
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[1] 0.0144468

The test statistic (Chi-Squared) of 12.43 and the p-value of 0.01445, both suggest that we reject the null hypothesis.

This result suggests that the judge's juries do not reflect the county's demographics and that some factor other than random variation is affecting jury composition. While this does not prove intentional bias, it raises concerns that should be investigated.

Some potential explanations for these results are that some demographic groups might be less likely to respond to jury duty summons than others. Another possibility is that some groups might be disproportionately excused due to outside factors.

To investigate this further, we could compare jury pools prior to final selection, to see if differences are already present there. Additionally, we could examine this pattern under other judges to see if it still holds. This will help us understand if it is judge-specific, or a wider systemic issue.

Problem 4

Part A

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	4.689	17.643	23.255	26.950	31.381	199.242

Part B: Checking for a Watermark

	Sentence	P_Value
She opened the book and started to read the first chapter, eagerly anticipating what might come next.	She opened the book and started to read the first chapter, eagerly anticipating what might come next.	0.513
Despite the heavy rain, they decided to go for a long walk in the park, crossing the main avenue by the fountain in the center.	Despite the heavy rain, they decided to go for a long walk in the park, crossing the main avenue by the fountain in the center.	0.926
The museums new exhibit features ancient artifacts from various civilizations around the world.	The museums new exhibit features ancient artifacts from various civilizations around the world.	0.076
He carefully examined the document, looking for any clues that might help solve the mystery.	He carefully examined the document, looking for any clues that might help solve the mystery.	0.489
The students gathered in the auditorium to listen to the guest speakers inspiring lecture.	The students gathered in the auditorium to listen to the guest speakers inspiring lecture.	0.484
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.	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.	0.009
The chef demonstrated how to prepare a delicious meal using only locally sourced ingredients, focusing mainly on some excellent dinner recipes from Spain.	The chef demonstrated how to prepare a delicious meal using only locally sourced ingredients, focusing mainly on some excellent dinner recipes from Spain.	0.328

	Sentence	P_Value
They watched the sunset from the hilltop, marveling at the beautiful array of colors in the sky.	They watched the sunset from the hilltop, marveling at the beautiful array of colors in the sky.	0.988
The committee reviewed the proposal and provided many points of useful feedback to improve the projects effectiveness.	The committee reviewed the proposal and provided many points of useful feedback to improve the projects effectiveness.	0.084
Despite the challenges faced during the project, the team worked tirelessly to ensure its successful completion, resulting in a product that exceeded everyones expectations.	Despite the challenges faced during the project, the team worked tirelessly to ensure its successful completion, resulting in a product that exceeded everyones expectations.	0.059

The sentence that was written by a LLM is:

“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.”

This is because of the abnormally low P-value of 0.009.