Benford's Law in Stars Dataset

Presented by Team: Neural Theorems

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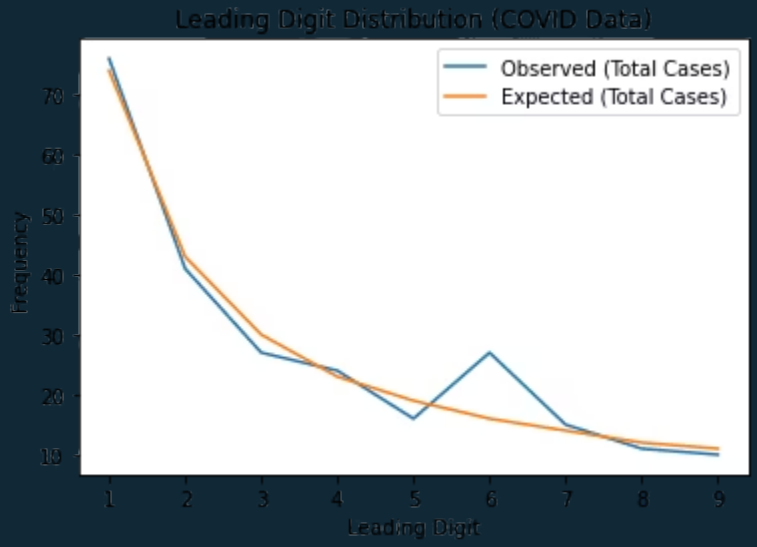

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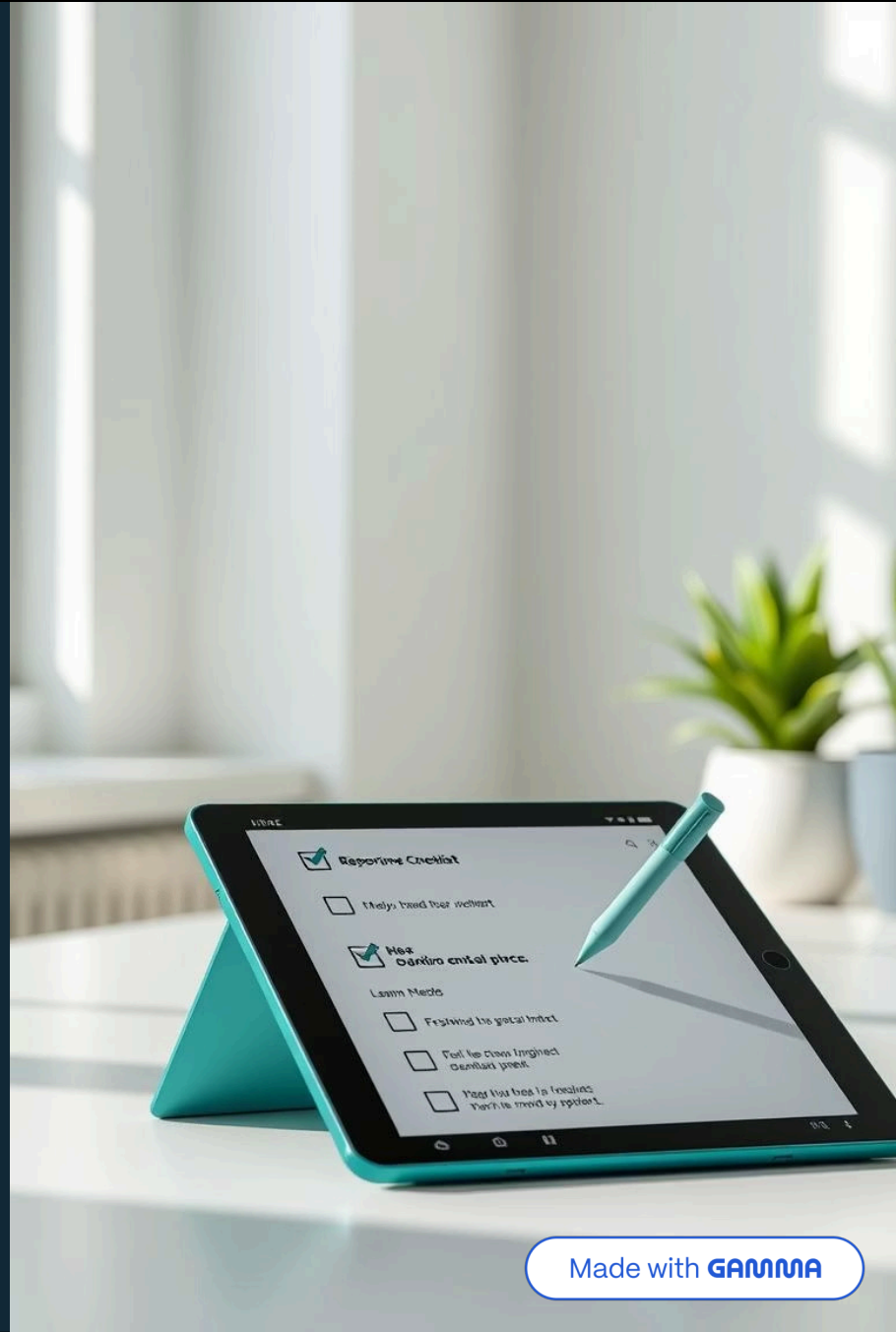


What is Benford's Law?

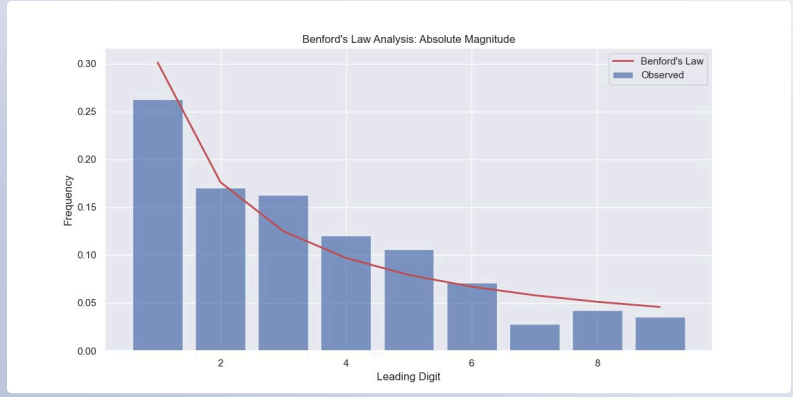
Benford's Law explains the frequency distribution of leading digits.

Digit 1 appears about 30% of the time, decreasing as digits increase.

Formula: p(d) = log10(1 + 1/d)

Applications

- Fraud detection in finance and accounting
- Scientific data validation
- Election and census anomaly detection



Dataset Description

Source

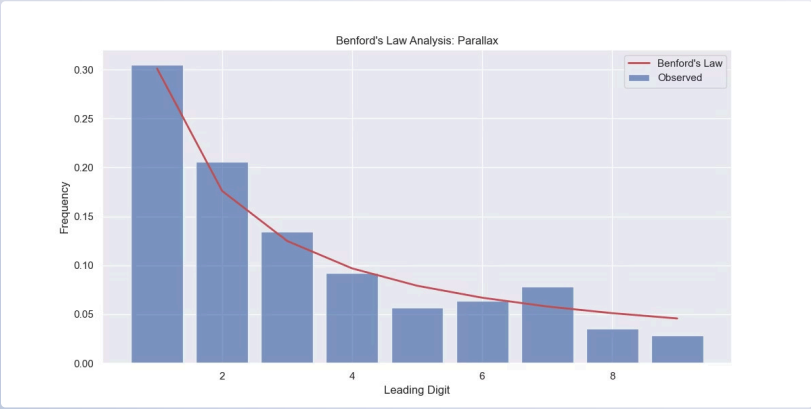
Stars Dataset CSV, extracted from Google Sheets.

Key Columns

Visual Magnitude, Absolute Magnitude, Parallax, Distance (light years).

Data Scope

Contains detailed star properties for analysis.



Data Cleaning & Preparation

1

Clean Column Names

Removed extra spaces for consistency.

2

Numeric Conversion

Converted key columns to numeric types.

3

Error Handling

Coerced errors during conversion to manage invalid data.

4

Missing Data Removal

Dropped rows missing critical values for analysis.

Benford's Law Analysis

Digit Extraction

Leading digits extracted from numeric star data.

Observed frequencies calculated per digit.

Comparison

Expected Benford frequencies contrasted with observed.

Visualized differences using combined bar and line charts.

Chi-Square Test

Goodness-of-Fit Test

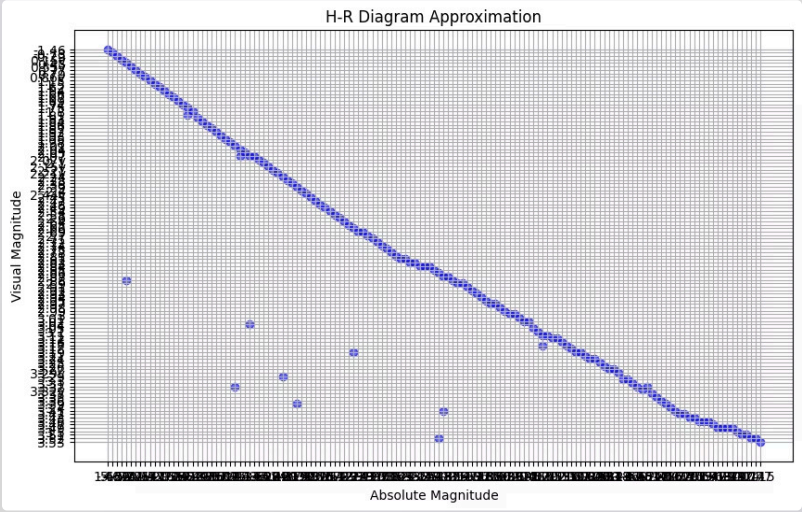
Chi-square test compared observed with expected frequencies.

Test Results

Chi-square value low, p-value high.

Conclusion

Data conforms closely to Benford's Law distribution.



H-R Diagram Approximation

1

Axes Plotted

Visual Magnitude vs Absolute Magnitude.

2

Y-Axis Inverted

Matches convention of HR diagrams.

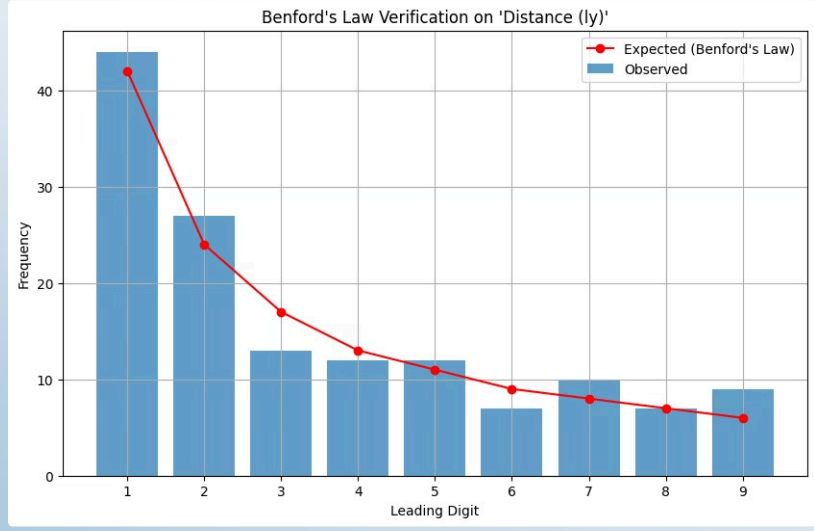
3

Stellar Insights

Diagram reveals star types and luminosity classes.

Individual Contributions

Name	Contribution
Akash Dhar Dubey	Data Cleaning, Digit Extraction, Benford Analysis
Yash Kishor Mali	Chi-Square Test Implementation
Himanshu Gulhane	H-R Diagram Creation, Expected Frequency Computation
Ayush Kumar	Data Processing, Final Frequency Comparison



Thank You 🙏

We appreciate your attention and welcome any questions or feedback.