Design and Analysis of QUIZ-Gambling model

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Abstract

We aim to the design a sustainable house edge quiz gambling model while ensuring fairness and an enjoyable quizzing experience. Through Monte Carlo simulations, we evaluate various probability distribution models (Tambola, Uniform, Exponential, Real-world data) to assess their viability. The "Beat the ChatGPT Challenge" makes the gameplay interesting. The project also details the development of a quizzing platform.

Introduction

Online gambling is booming, but needs innovation to keep users engaged. Quiz-based gambling combines the thrill of gambling with trivia, potentially appealing to a wider audience. Studies show people gamble more when they see a skill element involved. This format might be particularly interesting for those who enjoy intellectual challenges. However, for the gambling company to make money, they need a house edge.

Objectives

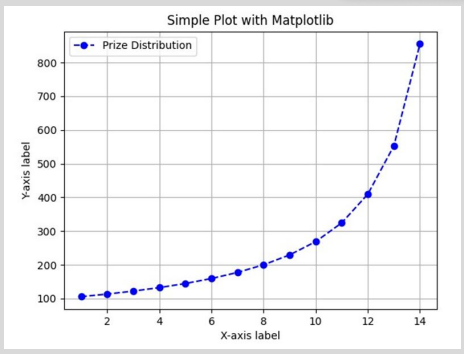
The objective of this project is to design, evaluate, and develop quiz-based gambling models that merge gambling excitement with intellectual challenges. Using Monte Carlo simulations, the project ensures a sustainable house edge and player engagement. It also features an online quizzing platform with a "Beat the ChatGPT Challenge," aiming to create an innovative, engaging, and profitable gambling experience.

Tambola Model

The Tambola model offers a straightforward approach to quiz-based gambling with a predetermined number of winners and corresponding fixed prize amounts. We studied the effectiveness of the time limit factor in regulating winners and winning amounts within this model.

We employed Monte Carlo simulations to evaluate the Tambola model's behavior under varying time constraints. By simulating numerous games with different time limits, we observed how the time factor influences the number of players who successfully answer within the allotted time and ultimately become winners. Overall, the Tambola model demonstrates the feasibility of a controlled quiz-based gambling environment with a fixed number of winners.

Uniform Probability



Game Level vs Prize distribution Graph for Uniform Probability Distribution

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This is the probability distribution of the game -->

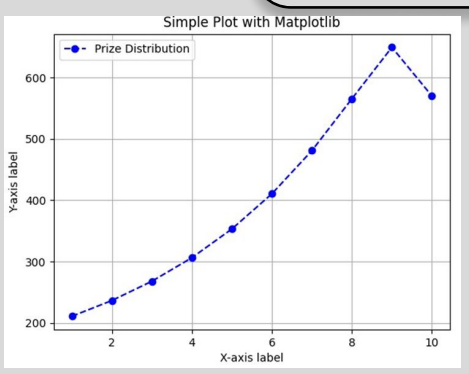
[0.9, 0.8392857142857143, 0.7785714285714286, 0.7178571428571429, 0.6571428571428571, 0.5964285714285715, 0.53
75000000000003, 0.4142857142857143, 0.3535714285742865, 0.2928571428571429, 0.2321428571428572, 0.1714285714
8571428577, 0.05000000000000044]
```

Round	Participants	Amount per Head	Amount Given	House Earning
1	1000000	106	106	5000000.0
2	900000	126	113	9500000.0
3	755357	162	122	13276785.0
4	588099	225	132	16217280.0
5	422171	342	145	18328135.0
6	277427	574	159	19715270.0
7	165465	1072	177	20542595.0
8	88642	2256	200	20985805.0
9	42105	5446	229	21196330.0
10	17444	15402	269	21283550.0
11	6168	52602	324	21314390.0
12	1806	226730	409	21323420.0
13	419	1319444	553	21325515.0
14	72	11875000	855	21325875.0

Prize distribution for Uniform Probability Distribution

$$P_e = \frac{\text{Total number of rounds} - \text{current round}}{(\text{Number of Rounds})} = \frac{14}{15} (for\ 1st\ round)$$

Exponential Probability



Game Level vs Prize distribution Graph for Exponential Probability Distribution

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This is the probability distribution of the game -->

[0.4501660026875221, 0.401312339887548, 0.35434369377420455, 0.3100255188723875 5, 0.2689414213699951, 0.231475
1611144141828, 0.16798161486607552, 0.14185106490048782, 0.11920292202211755, 0.09975048911968513, 0.083172696
034334682, 0.05732417589886877, 0.04742587317756678]
```
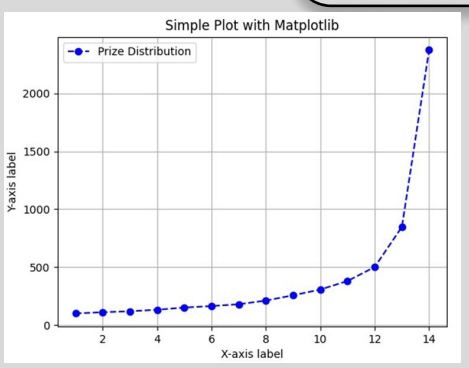

Round	Participants	Amount per Head	Amount Given	House Earning
1	1000000	211	211	5000000.0
2	450166	526	237	7250830.0
3	180657	1484	268	8154115.0
4	64015	4787	306	8474190.0
5	19846	17800	353	8573420.0
6	5337	76923	411	8600105.0
7	1235	389344	481	8606280.0
8	244	2317073	565	8607500.0
9	41	15833333	649	8607705.0
10	6	95000000	570	8607735.0

Prize distribution for Exponential Probability Distribution

$$P = \frac{e^{-\frac{t}{\tau}}}{1 + e^{-\frac{t}{\tau}}}$$

Real world data



Game Level vs Prize distribution Graph for Real Probability Distribution

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This is the probability distribution of the game -->

[0.9, 0.8392857142857143, 0.7785714285714286, 0.7178571428571429, 0.6571428571428571, 0.5964285714285715, 0.5357
75000000000003, 0.4142857142857143, 0.3535714285742865, 0.2928571428571429, 0.2321428571428572, 0.1714285714
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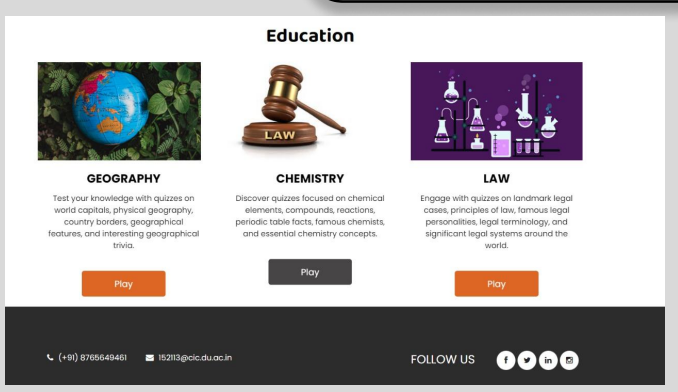
12	1806	226730	409	21323420.0
13	419	1319444	553	21325515.0

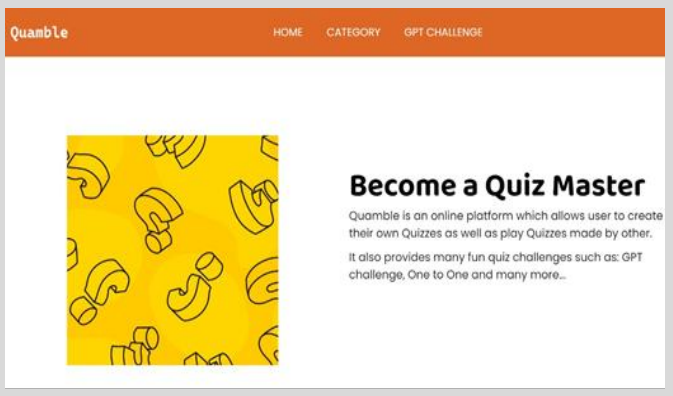
Prize distribution for Real World Probability Distribution

Quizzing Platform

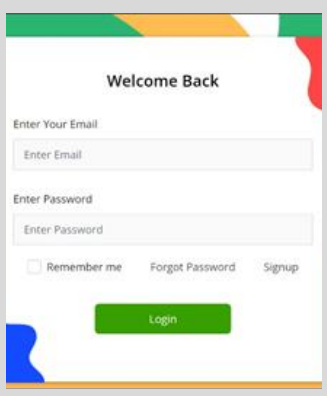


Category wise Quizzes

Register Page



Home Page

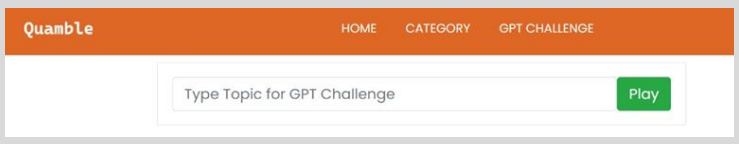


Login Page

ChatGPT Challenge

The time of response from ChatGPT was recorded and the analysis was carried out. The average time taken by ChatGPT to answer any question was 1.177 seconds. The highest time taken by ChatGPT was 11.054 seconds on the question “Which of the American states below does not have part of the Yellow Stone National Park in it?” ChatGPT was able to answer it correctly. This might be an outlier or there might be some issue with the api response server that causes the delay of the response time.

The next highest time is 3.598 seconds on the question “The ghost of the Roman Emperor Caligula was said to haunt this place.” The answer given by ChatGPT was incorrect as ChatGPT provided with a more generalized answer and could not give the correct answer. This shows that the ChatGPT is unable to answer questions that involve high precision and in depth analysis of facts.



Beat ChatGPT Challenge

Conclusion & Future Scope

This project explored quiz-based gambling, evaluating models for a fun and profitable online experience. Simulations assessed house edge and player engagement for various probability models (Tambola, Uniform, etc.). An "AI Challenge" concept explored user interaction with AI. We also built a quizzing platform for further development and testing.

Future work includes refining models for engagement, exploring advanced question design, and implementing platform features like leaderboards and live events. User testing will be crucial for finalizing the platform's design.