Same Game Parlay - Impossible vs Improbable

Overcoming the Challenges of Fully Combinable SGP

A Case Study of Huddle
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INTRODUCTION

A previously published whitepaper from Huddle explored the technical foundations of implementing a **Same Game Parlay (SGP) product using Monte Carlo simulations in conjunction with an OLAP database.** The paper outlined how Monte Carlo simulations were employed to estimate probabilities for correlated outcomes in sports betting, addressing the challenge of capturing and combining these probabilities efficiently at scale.

The approach described in the publication detailed a shift from in-memory search of simulation data to a data retrieval model, where market features were encoded directly into the simulation dataset. An OLAP database was utilized to enable rapid querying and analysis of the large datasets generated during simulations, providing the foundation for a composable and scalable SGP API. This architecture made it possible to translate user selections into conditions applied to the simulation space, facilitating the retrieval of correlated probabilities that could be seamlessly combined with other market offerings.

Additionally, the whitepaper discussed strategies for addressing scalability and performance concerns, such as leveraging columnar storage, vectorized processing, and sharding mechanisms. These optimizations ensured the solution could handle large-scale data requirements while supporting advanced features like cashout and void markets. The paper underscored the importance of collaboration between product design, quantitative analysis, and engineering teams in delivering a flexible, high-performing SGP product.

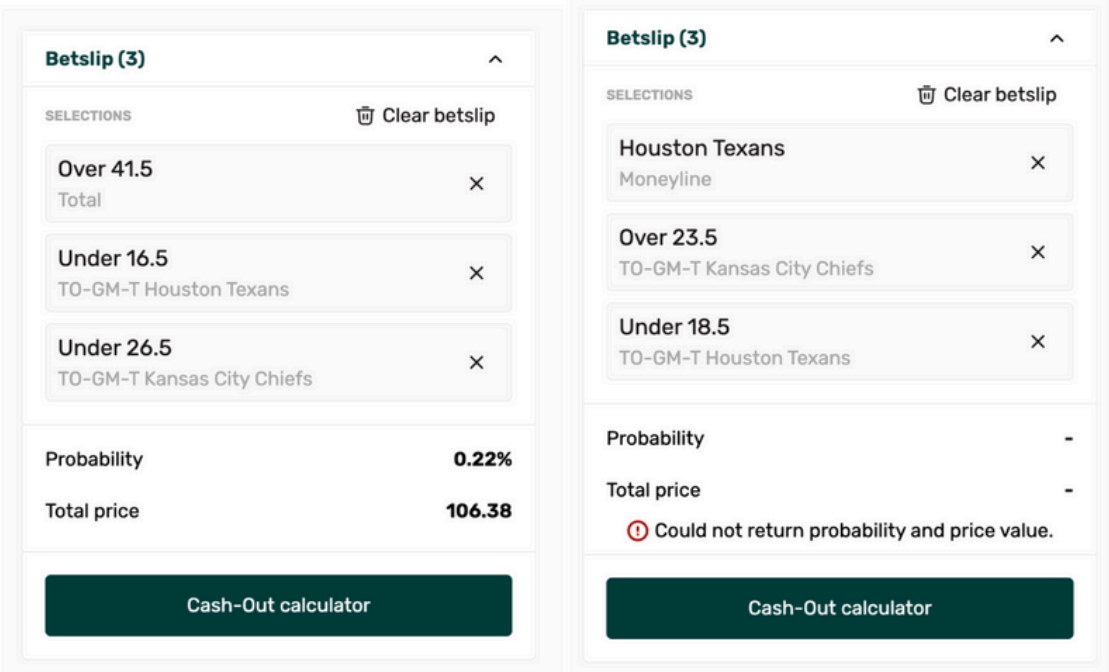
In the context of sports betting, the distinction between impossible and improbable outcomes is critical for ensuring accuracy and reliability in probability calculations. An **impossible outcome** refers to an event that cannot occur under any circumstances within the rules of the game or its underlying mechanics. For example, a quarterback throwing for negative touchdowns in a game or a team scoring points during halftime would represent impossible scenarios, as they violate the fundamental structure and rules of the sport.

In contrast, an **improbable outcome** describes an event that, while unlikely, remains within the realm of possibility. These are outcomes with extremely low probabilities that sit on the far edges of the probability distribution. For instance, a baseball game ending with a score of 30–0 or a batter hitting six home runs in a single game would be highly improbable, yet they are technically feasible under the rules of the sport.

The complexity increases significantly when it comes to **parlay betting**, particularly in Same Game Parlays (SGPs), where multiple outcomes from the same game are combined into a single bet. For example, consider an **improbable parlay** in a basketball game: a bettor selects a star player to score over 50 points and the same team to win by more than 30 points. While highly unlikely, these outcomes remain possible within the game's structure, as a player can have an extraordinary performance, and the team can dominate their opponent.

In contrast, an **impossible parlay** might involve selecting a player to score more points than the entire opposing team combined and simultaneously selecting that same opposing team to win the game. These outcomes directly contradict one another and cannot coexist within the same game. Without systems in place to block such impossible combinations, the operator risks accepting invalid bets that undermine both compliance and user trust.

This whitepaper explores how the “impossible vs improbable” distinction impacts both operators and their end customers, including bettors and punters. It further examines how HuddleOS addresses this challenge through a specialized API that dynamically identifies and blocks selections that cannot be added to an SGP bet based on the selections previously added to the bet slip.



Source: Huddle Demo; SGP Bet Slip showcasing improbable (left) and impossible (right) SGP

DIFFERENT PERSPECTIVES

Differentiating between the impossible and the improbable is essential in sports betting, as it directly influences the accuracy of modeled probabilities and their representation to bettors. Including impossible outcomes in calculations would distort probability estimates, potentially misleading users. Conversely, accounting for improbable outcomes ensures that even rare events are properly reflected, providing a comprehensive and realistic view of the range of possible scenarios.
The challenge lies in designing systems that can efficiently and accurately distinguish between impossible and improbable outcomes, particularly in complex betting scenarios such as Same Game Parlays. By addressing this challenge, betting products can maintain both mathematical rigor and practical relevance, offering users greater confidence in the underlying data.
From the perspective of end users, the distinction between impossible and improbable outcomes has significant implications for the betting experience, which varies depending on the type of bettor.

End User Perspective

For **new bettors**, the process of building a Same Game Parlay (SGP) can be intimidating, especially if they are unfamiliar with the rules governing which selections can or cannot be combined. These users may spend considerable time navigating the interface, trying to understand why certain selections are invalid, or experimenting with combinations that ultimately fail. This confusion can lead to frustration, as the user journey becomes unnecessarily complicated. A betting platform that seamlessly guides these users and dynamically prevents invalid combinations from being selectable can dramatically improve the user experience, reducing friction and encouraging engagement.

For **experienced bettors** — often referred to as "sharp" bettors — the distinction between impossible and improbable outcomes represents both a challenge and an opportunity. These users are likely to have a deep understanding of betting mechanics and may actively seek edge cases to exploit the system. Without robust safeguards, a sharp bettor could construct a parlay that includes improbable yet highly favorable combinations that were not adequately accounted for in the system's pricing. This can lead to significant financial risk for operators. A dynamic system that accurately distinguishes between impossible and improbable outcomes and preemptively blocks invalid combinations ensures fairness and protects the integrity of the betting platform.

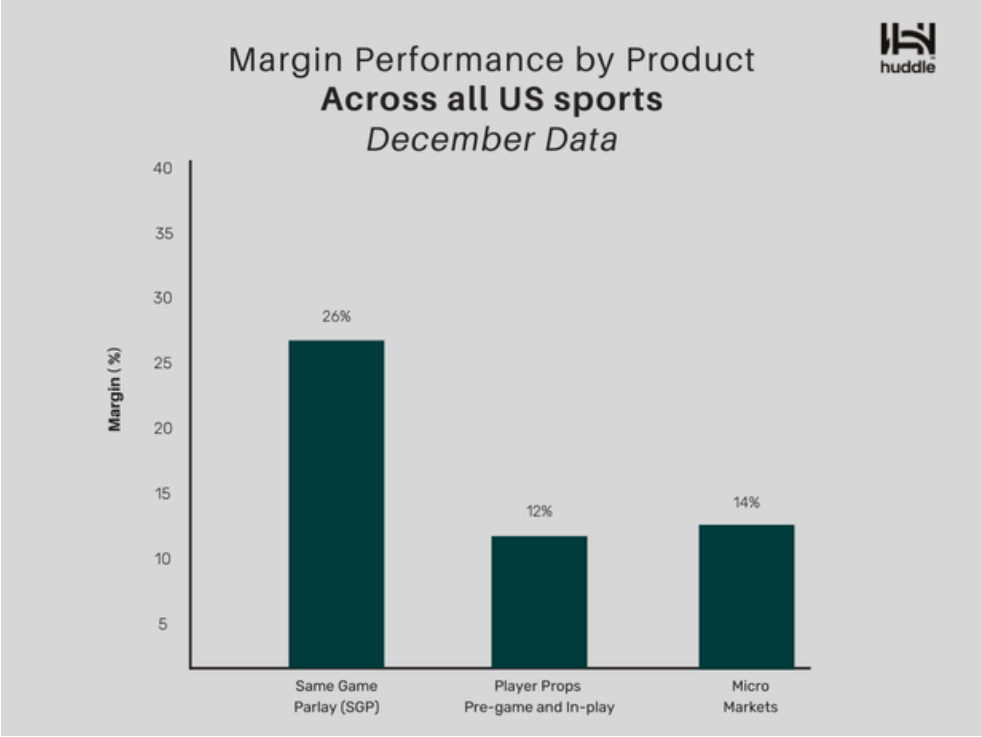
For **recreational bettors**, the priority is a fast, simple, and enjoyable betting experience. These users are often less concerned with the technicalities of which outcomes can or cannot be combined and simply want to place a parlay bet quickly and confidently. They expect the platform to handle any complexity in the background, allowing them to select and place bets in just a few clicks. If the system prevents impossible combinations and ensures the validity of

their selections without requiring the user to think about the details, it creates a frictionless experience that enhances satisfaction and drives retention.

By catering to these varied user needs, a well-designed system can strike a balance between usability, fairness, and efficiency. Whether a user is new to betting, highly experienced, or purely recreational, ensuring that the platform dynamically manages impossible and improbable outcomes is essential for delivering a seamless and trustworthy betting experience.

Sportsbook Operator Perspective

From the perspective of sportsbook operators, the distinction between impossible and improbable outcomes plays a critical role in maintaining profitability, regulatory compliance, and operational integrity. Same Game Parlays (SGPs) have emerged as one of the primary drivers of operator profitability, with **margins averaging around 26% in the case of Huddle's SGP product in December 2024**. However, this profitability is contingent on the system's ability to manage risks associated with both impossible and improbable bets.



Source: Margin Performance by Product Across all US sports, December 2024

One of the key challenges lies in the realm of **regulations and compliance**. Sportsbook operators are required to adhere to strict rules designed to protect consumers and ensure fair play. Accepting impossible bets—those that cannot occur under any circumstances—presents a significant compliance risk. Regulators often scrutinize cases where operators knowingly accept bets that cannot win, as this could be interpreted as exploiting users or accepting "stupid money." For example, if a user mistakenly selects contradictory outcomes, such as a baseball team both winning and losing in the same game, the operator risks reputational damage and potential regulatory penalties if these bets are not blocked at the outset. Implementing a robust system that dynamically recognizes and prevents such combinations is essential for safeguarding compliance while also maintaining the trust of bettors.

On the other hand, **accepting highly improbable parlays** presents a different challenge. While these bets can be considered "free money" from the operator's perspective due to their low likelihood of success, they still carry an element of risk. Sportsbooks must be confident that even the most unlikely scenarios included in an SGP are theoretically possible within the rules of the game. Failure to account for this could result in large payouts for rare but valid outcomes, jeopardizing the operator's profitability. For example, a parlay involving a baseball team scoring 15 runs in a single inning or a pitcher throwing a perfect game might be improbable but must remain within the realm of possibility. The operator's system must, therefore, be capable of evaluating these edge cases with precision, ensuring they are priced appropriately while maintaining a manageable level of risk.

Additionally, the **high profitability of SGPs** makes it imperative for operators to balance risk and user engagement. SGPs attract a diverse range of bettors, from recreational users to sharp bettors, all of whom contribute to the overall margin. By distinguishing between impossible and improbable outcomes, operators can ensure their systems are both compliant and optimized for profitability. This allows operators to confidently offer SGPs that enhance the betting experience while maintaining the integrity of their margins.

Ultimately, addressing the **impossible vs. improbable** distinction is not just a matter of technical accuracy but a strategic imperative for sportsbook operators. A well-implemented solution not only ensures compliance with regulatory standards but also mitigates risks, preserves profitability, and enhances user trust—key factors in sustaining long-term success in the competitive sports betting market.

TECHNICAL CHALLENGES

Calculating the odds for a Same Game Parlay (SGP) bet in real-time is inherently a complex task, requiring the efficient evaluation of multiple probabilities and their correlations. This complexity arises from the need to accurately model the relationships between various outcomes within the same game, such as the impact of a star forward's scoring performance on the team's likelihood of winning. These calculations demand sophisticated algorithms and significant computational power to ensure precision and speed, particularly in the dynamic environment of live sports betting.

This challenge becomes even more intricate when extending this functionality to determine which selections are impossible to add to an existing SGP bet. For instance, in the case of an ice hockey game, identifying impossible selections requires the system to dynamically evaluate not just individual probabilities but also the logical relationships between multiple outcomes. An example might include a bettor attempting to combine a selection where a player records zero points with a selection for that same player to achieve a hat trick in the same game—an outcome that is fundamentally contradictory and therefore impossible.

Adding to this complexity is the need to perform these evaluations in real time, as users interact with the platform. The system must be capable of instantly assessing the feasibility of each new selection while maintaining seamless performance, ensuring a smooth user experience even under high traffic conditions. This involves integrating advanced data processing techniques and decision-making algorithms capable of distinguishing between improbable and impossible outcomes without introducing delays or computational bottlenecks.

In essence, the technical challenges associated with SGP betting extend far beyond traditional odds modeling. They demand a robust and agile infrastructure capable of addressing not only probabilistic calculations but also logical consistency in a dynamic and user-driven context.

Algorithm for Blocking Selections in SGP Betting

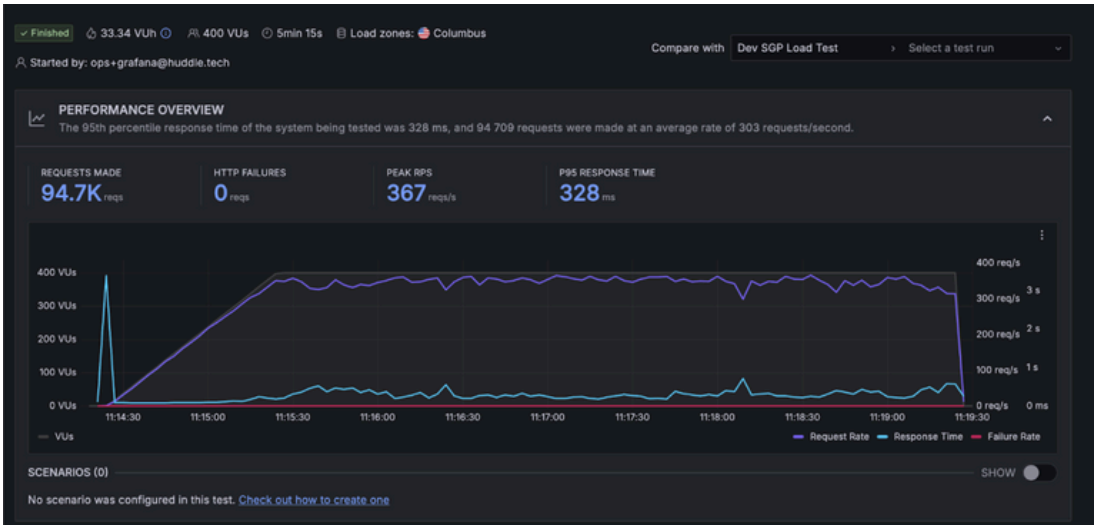
Huddle's approach to blocking invalid selections in Same Game Parlay (SGP) betting is grounded in determining when a set of selections results in an impossible outcome. At its core, this involves checking whether a system of inequalities — representing the user's selected outcomes — is unsolvable, meaning it has no valid solution. To achieve this, a system of equations is defined for each available selection.

Given the complexity of covering all possible selections in a game, the algorithm focuses specifically on markets tied to the home and away team scores. By narrowing the scope to score-based selections, we balance computational efficiency with accuracy.

Extending Beyond a Single Algorithm

To ensure scalability and responsiveness in the context of Same Game Parlay (SGP) selection validation, HuddleOS employs not just a single algorithm but a chain of multiple algorithms, complemented by various heuristics. This layered approach enables the platform to efficiently handle the inherent complexity of the problem, which belongs to the class of NP-complex problems. Without the application of heuristics, solving such problems in real-time would demand significantly more computational resources and time, rendering the solution impractical for high-traffic betting scenarios.

By leveraging heuristics, the system reduces the computational overhead, ensuring that it remains capable of serving over 350 requests per second for a single game. This level of performance is achieved using a horizontally scaled architecture comprising six application instances, which distribute the load effectively while maintaining low latency.



Source: Grafana Cloud; Load test results for a SGP blocking API

To validate and optimize the system under realistic traffic conditions, the team employed **Grafana Cloud** for real-time monitoring and performance insights, alongside the load-testing tool k6. These tools were instrumental in emulating real user traffic across both staging and production environments, allowing for rigorous testing and ensuring that the system could reliably handle peak demand. This robust testing framework was critical for fine-tuning the algorithms and heuristics to meet the performance and reliability requirements of modern sports betting platforms.

CONCLUSION

In conclusion, the development and optimization of systems to manage Same Game Parlay (SGP) betting have presented significant technical challenges. These challenges span from the core task of calculating real-time odds for multiple, correlated outcomes in a dynamic sports environment to the complex process of identifying and blocking impossible combinations. Whether dealing with the inherent complexity of modeling diverse outcomes or addressing the need to scale the platform for high-volume betting scenarios, Huddle has leveraged sophisticated algorithms and heuristics to ensure both accuracy and efficiency.

The distinction between impossible and improbable outcomes is pivotal in safeguarding the integrity of the betting experience, ensuring that both users and operators benefit from a transparent, fair, and reliable system. Implementing a robust algorithm to block invalid combinations based on a logical analysis of user selections is crucial, as is addressing the broader technical challenge of scaling this solution to handle high traffic in real-time. The combination of intelligent algorithms, advanced heuristics, and a horizontally scaled infrastructure is what enables HuddleOS to meet the demanding performance standards of the modern sports betting landscape.

However, the work doesn’t end here. As Huddle continues to expand its offerings, the need for more sophisticated algorithms and heuristics becomes even more pressing. The addition of new sports and markets will require constant refinement and adaptation to ensure the system can handle an ever-expanding set of scenarios. This ongoing work will involve the continuous enhancement of existing algorithms, the development of new techniques to handle previously unaddressed complexities, and the integration of additional data sources to improve the accuracy and responsiveness of the platform.

Ultimately, the pursuit of innovation and optimization in the SGP betting domain is a never-ending process. By continually refining and expanding the technical infrastructure and algorithms, Huddle ensures that it remains at the forefront of providing a seamless, user-friendly, and trustworthy sports betting experience. As the landscape evolves, so too will the technologies that power it, and Huddle will continue to lead the way in making Same Game Parlays more accessible, accurate, and engaging for bettors around the world.