The Math Behind Bookmaking: Notes and Solutions

1. $30

2. Give those who have a less likely probability a higher payout.

3. \( P(A) = \frac{y}{x+y} \)

4. \( \frac{x}{y} \) odds = \( \frac{y}{x+y} \)

5. The odds form a contest.

6. 4.5, 22%, 1.25, 80%, 3.67, 27.3%

7. 11, 2.2, 1.87

8. Decimal odds, treat these as payout multipliers.

9. 7.32, 72.6

10. Maintain probability ratios but increase implied probabilities to decrease payouts.

11. \( \frac{1}{5}, \frac{2}{5}, \frac{6}{5} \)

12. Profit is $20.

13. 14.4%, 22.4%, 31.2%. Decimal odds are \((1.87)^n\), where \(n\) is the number of legs.

14. Convert multipliers to implied probabilities and use Problem 13. Straight bets are more profitable since the overround is less. A loss is what the books win, which is represented by overround.

15. Suppose \( x \) is the hit rate. Then set expected value to be greater than 0, and the expressions should be \( x > \sqrt[3]{\frac{1}{3}} \Rightarrow x \approx 57.7\% \) for 2-legs, \( x > \sqrt[5]{\frac{1}{5}} \Rightarrow x \approx 58.5\% \) for 3-legs, and \( x > \sqrt[10]{\frac{1}{10}} \Rightarrow x \approx 57.7\% \) for 4-legs.

16. 28

17. Approximately \( \frac{1}{276000} \). \((1.67)^{28} \times 2^4\) is the multiplier, which can be converted to implied probability.

18. Solve using the strategy from Problem 17 and consider the binomial theorem.

19. Decimal odds should be between \( \left(\begin{array}{c}28 \\ 4\end{array}\right)(2.5)^4(1.67)^{24}(2)^4\) and \( \left(\begin{array}{c}28 \\ 5\end{array}\right)(2.5)^5(1.67)^{23}(2)^4\).

20. It could help guarantee that the bets would be profitable, rather than risking the third leg for a loss.

21. Shifted lines, high probability of original bet hitting, etc.

