Gambling Probability Worksheet

Instructions: This worksheet provides practice with calculating probabilities and expected values in gambling scenarios. Show all work and explanations in the provided spaces. Keep this worksheet for reference during Day 2 activities.

Key Formulas:

Probability = Number of favorable outcomes / Total number of possible outcomes

Expected Value (EV) = Σ(Outcome × Probability of that outcome)

House Edge = |Expected Value| / Wager Amount × 100%

Part 1: Basic Probability Calculations

1. Dice Probability: In a game of craps, what is the probability of rolling a 7 with two fair dice? Show your calculation and express the answer as a fraction, decimal, and percentage.

2. Card Probability: If you draw one card from a standard 52-card deck, what is the probability of drawing:

a) An ace

b) A face card (Jack, Queen, or King)

c) A red card (hearts or diamonds)

3. Roulette Probability: On an American roulette wheel (numbers 1-36, plus 0 and 00):

a) What is the probability of the ball landing on a red number?

b) What is the probability of the ball landing on an even number?

c) Why are these probabilities different from 1/2, even though there are 18 red numbers and 18 even numbers?

Part 2: Independent vs. Dependent Events

4. Independent Events: If a roulette wheel has landed on black for the last 10 spins in a row, what is the probability it will land on red on the next spin? Explain your answer with reference to the concept of independent events.

5. Dependent Events: In a game of blackjack, if an ace has already been dealt from a single deck, what is the probability that the next card dealt will be an ace? How is this different from independent events like roulette spins?

Part 3: Expected Value Calculations

6. Simple Expected Value: In a carnival game, you pay $5 to roll a die. If you roll a 6, you win $25. If you roll any other number, you win nothing. Calculate the expected value of this game and determine if it's fair, favorable to the player, or favorable to the carnival.

7. Lottery Expected Value: A lottery ticket costs $2. The jackpot is $10,000,000 with a 1 in 20,000,000 chance of winning. There are also smaller prizes: $100 (1 in 1,000 chance) and $5 (1 in 50 chance). Calculate the expected value of buying one ticket.

8. Roulette Expected Value: In American roulette, a "straight up" bet on a single number pays 35 to 1 if you win. Calculate the expected value of a $10 bet on a single number. What is the house edge for this bet?

Part 4: Application Questions

9. The Gambler's Fallacy: Emily has been playing roulette and has seen red come up 7 times in a row. She decides to bet all her money on black because "it's due to come up." Explain why Emily's reasoning demonstrates the gambler's fallacy. Use probability concepts in your explanation.

10. Entertainment Cost Analysis: James enjoys playing slot machines. He typically bets $1 per spin and plays about 300 spins per hour. If the slot machine has a house edge of 8%, calculate James's expected loss per hour. Compare this cost to other forms of entertainment (movies, concerts, etc.) and discuss whether the entertainment value might justify this cost.