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Dear Casino Owner,

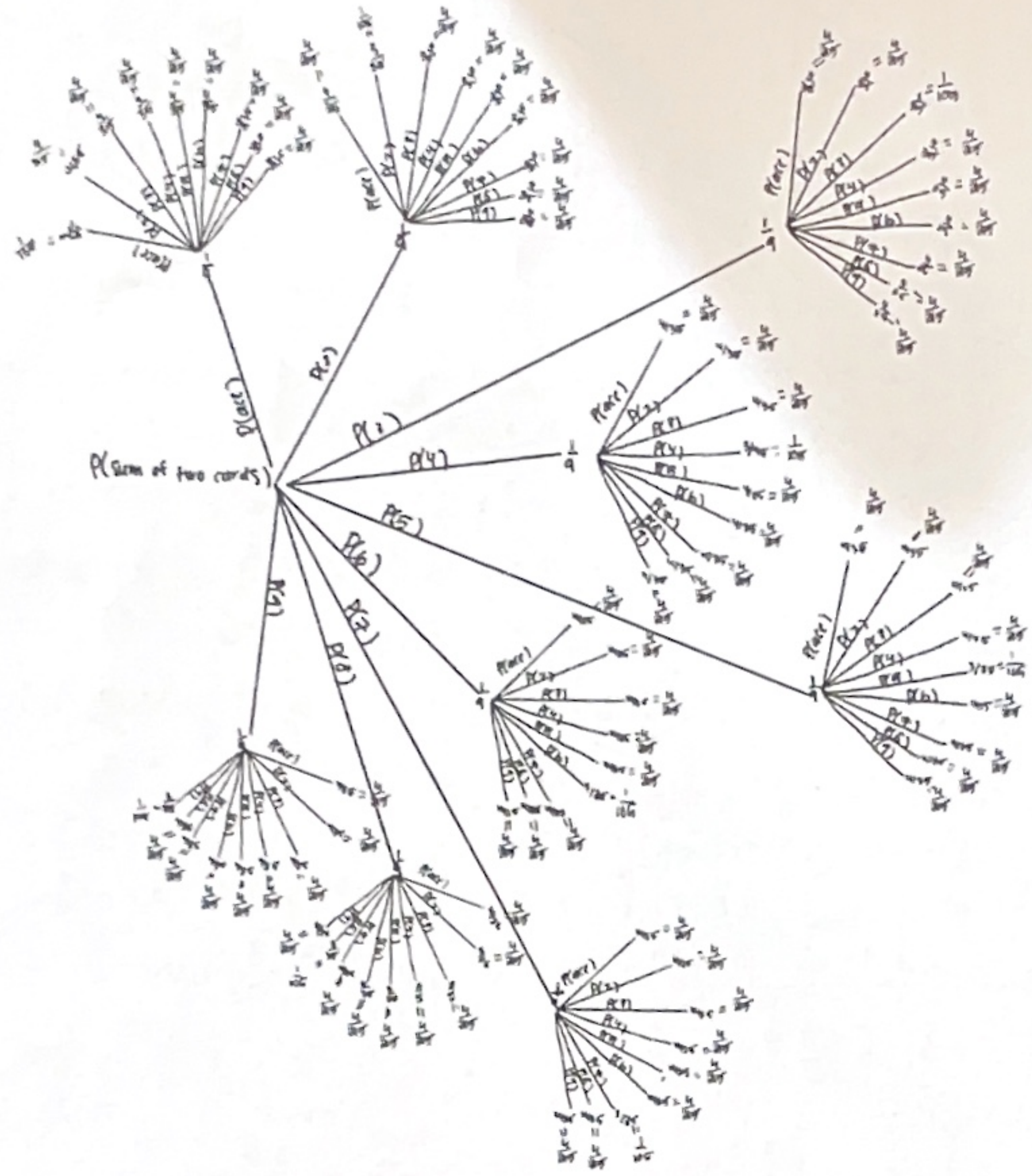
We would love for you to consider our game, *Guardian's Gamble* for your casino. The intuitive design of adding or multiplying dice values to get a score higher than the sum of the dealer's cards allows for a game that is easy to understand, yet unique. Guardians gamble has a one to one payout and gives the Casino only a slight statistical advantage. The probability the house wins is just over 50%, sitting at 51.0%. This makes it appeal to potential players because it gives them a solid chance of winning, yet still generates revenue for the casino in the long run. We know this because the law of large numbers states that the average of results obtained from many trials will equal the expected value for cards drawn. Since the expected score for the house is E(x)=10 and the expected score for the player is E(x)=9.625, we can guarantee that we will make money for your casino. These expected values were found using the tree diagrams below to show each possible outcome and its probability.

Aside from the cunning statistics, our witty theme and interactive components entice gamblers to check out and stay at our game. The sound effects of the baby crying when you lose and laughing when you win enhances the child-based theme. The attractive sign and childs toys surrounding the stand also catch the eyes of passers by.

Thank you for your consideration,

-The creators of *Guardian's Gamble*

House Probability Tree Diagram



House Expected Value Calculation

$$E(x)=2\left[\tfrac{1}{105}\right]+3\left[\tfrac{4}{315}+\tfrac{4}{315}\right]+4\left[\tfrac{4}{315}+\tfrac{1}{105}+\tfrac{4}{315}\right]+5\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+6\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{1}{105}+\tfrac{4}{315}+\tfrac{4}{315}\right]$$

$$+7\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+8\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{1}{105}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+9\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right.$$

$$\left.+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+10\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+11\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right.$$

$$\left.\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+12\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{1}{105}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+13\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]$$

$$+14\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{1}{105}+\tfrac{4}{315}+\tfrac{4}{315}\right]+15\left[\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}+\tfrac{4}{315}\right]+16\left[\tfrac{4}{315}+\tfrac{1}{105}\tfrac{4}{315}\right]+17\left[\tfrac{4}{315}+\tfrac{4}{315}\right]+18\left[\tfrac{1}{105}\right]$$

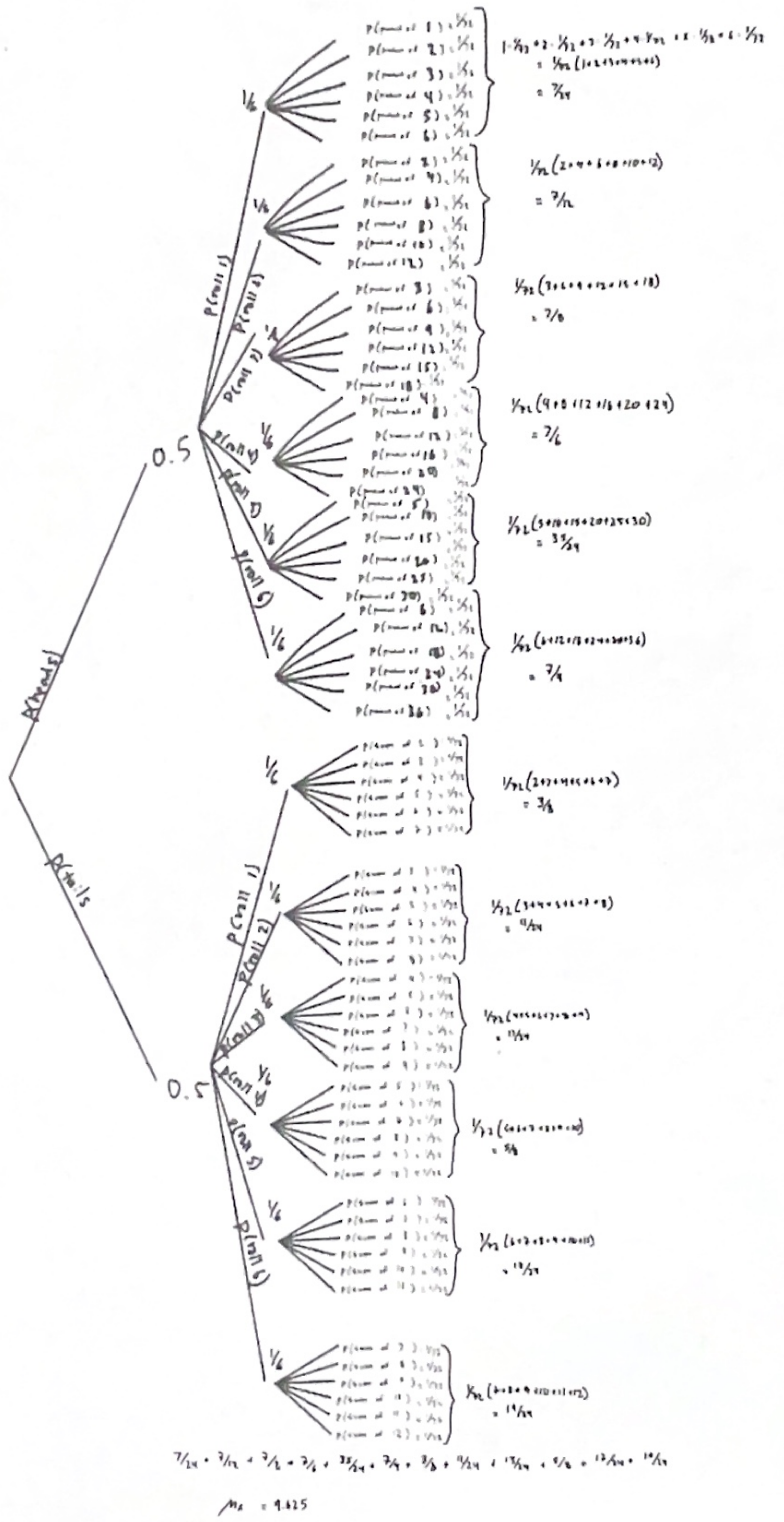
$$\boxed{=10}$$

E(x) = 2(1/105) + 3(4/315+4/315)+ 4(4/315+1/105+4/315) + 5(4/315+4/315+4/315+4/315) + 6(4/315+4/315+1/105+4/315+4/315) + 7(4/315+4/315+4/315+4/315+4/315) + 8(4/315+4/315+4/315+1/105+4/315+4/315+4/315) + 9(4/315+4/315+4/315+4/315+4/315+4/315+4/315+4/315+4/315) + 10(4/315+4/315+4/315+4/315+1/105+4/315+4/315+4/315+4/315) + 11(4/315+4/315+4/315+4/315+4/315+4/315+4/315+4/315) +12(4/315+4/315+4/315+1/105+4/315+4/315+4/315) +

13(4/315+4/315+4/315+4/315+4/315+4/315) + 14(4/315+4/315+1/105+4/315+4/315) +
15(4/315+4/315+4/315+4/315) + 16(4/315+1/105+4/315) + 17(4/315+4/315) + 18(1/105) = 10

E(x)=10

Player probability tree diagram/calculations:



1/72(1+2+3+4+5+6) = 7/42
1/72(2+4+6+8+10+12) = 7/12
1/72(3+6+9+12+15+18) = 7/8
1/72(4+8+12+16+20+24) = 7/6

Guardian's Gamble
Turn child support into trillions

"biased towards the parents"
- Our World in Data

"The #1 most efficient technique to fund your midlife crisis"
- The Times

"I [won] thousands of dollars"
- Leo Duvarney's mother

Materials needed:
two decks of playing cards (cards ace-10), pair of 6 sided die, random number generator, coin.

Directions:

The irresponsible parent must roll a pair of dice simultaneously, then flip a coin. If the coin shows tails then the numbers presented on the die will be added to get the parent's score. If the coin shows heads, multiply the two values on the die to get the parent's score. After the parent's score has been calculated, the dealer will draw a card randomly from each of the two decks of cards and add the two cards' values together (face cards and 10 are not included in the decks) to get the dealer's score. The value of the cards goes in sequential order with an ace being worth 1, a 2 being worth 2, and so forth with the 9 card being with a 9.

If the scores are the same, the coin dictates the winner, Heads means the parent wins and tails means the house wins. If the parent's score is higher than that of the house, the parent wins the bet. If the house's score is more than the parent's score, then the house wins. But as a last resort to recover from their loss, a parent has the opportunity to guess a random number between 1-100. if the parent guesses correctly, they win the bet. Our game has a one to one payout meaning if the player wins, he profits by whatever amount he wagered, but if the house wins, the house profits by whatever the player wagered. There is no cost to play, rather the player must bet at least a dollar.

Examples:

1. **Player wins:**

If the coin shows heads and the die show 4 and 6, then the parent's score is 4•6=24. If the cards drawn are a 2 and a 10, the house has 12 points and the player would win the game since 12 is less than 24. Say the parent bets $10,000 on this game, he would profit $10,000.

2. **House wins:**

However, if the coin showed tails in the previous scenario, the player's score would be 4+6=10, which would be less than 12. Since the player's score is less than that of the house, he or she is given a chance to guess a randomly generated number between 1 and 100. If the player guessed 4 and the randomly generated number was 30, the player would lose. If the player bet $10, the house would profit $10.

3. **Equal points:**

If the coin flip shows heads and the die show 5 and 3, the players score is 5*3=15. If the cards drawn are a 10 and a 5, the house's score is 15 as well. In this scenario we look to the coin flip to determine who wins. Since the coin flip was heads, the player wins. Had it been tails, the player would have had the lower score and would be given the option to guess the randomly generated number, if he or she fails to guess correctly, the house would win.

Probabilities/expected values:

The expected value for the house when drawing two cards is E(x)=10. The expected value for the players, when rolling dice is E(x)=9.625. This means that the house has a probability of 0.51 (51%) to win the round while the players have a probability of 0.49 (49%) to win the round.