

KEY

Instructions: Fill in the table and use that information to calculate the expected value of each scenario.

1. In a Pick 4 game you can win \$100 if you pick all 4 numbers correctly, and \$5 if you get three of the numbers correct. You earn nothing otherwise, but have to pay \$1 to play. What is the expected value of each ticket that you purchase?

	All 4 match	Three of 4 match	None Match
Value of Event (Winnings - \$1 to play)	100 - 1	5 - 1	0 - 1
Probability of Event	$(\frac{1}{10})^4 = \frac{1}{10000}$	$4(\frac{9}{10000}) = \frac{36}{10000}$	$1 - \frac{1}{10000} - \frac{36}{10000} = \frac{9963}{10000}$

$$99\left(\frac{1}{10,000}\right) + 4\left(\frac{36}{10,000}\right) + (-1)\left(\frac{9963}{10,000}\right) = -.972$$

2. In a raffle, 250 tickets are sold. The top prize is \$1000. The second prize is \$200. The third prize is \$50. There are 4 fourth prizes worth \$10 each. It costs \$10 to purchase a ticket. Complete the table below and use it to calculate the expected value of purchasing a raffle ticket.

	1 st prize	2 nd prize	3 rd prize	4 th prize	Win nothing
Value of Event (Winnings - \$10 to play)	1000 - 10 = 990	200 - 10 = 190	50 - 10 = 40	10 - 10 = 0	0 - 10 = -10
Probability of Event	$\frac{1}{250}$	$\frac{1}{250}$	$\frac{1}{250}$	$\frac{4}{250}$	$1 - \frac{7}{250} = \frac{243}{250}$

$$990\left(\frac{1}{250}\right) + 190\left(\frac{1}{250}\right) + 40\left(\frac{1}{250}\right) + 0\left(\frac{4}{250}\right) - 10\left(\frac{243}{250}\right) =$$

$$-4.84$$

3. An insurance company charges \$250 for a home-owner's policy. It expects to pay out \$100,000 to replace the house with probability 0.0001, it expects to pay out \$10,000 with probability 0.005, and it expects to pay out \$500 with probability 0.03. Find the expected value of the policy.

	Replace Home	Major Damage	Minor Damage	No Damage
Value of Event (Payout - \$250 for policy)	$100,000 - 250$ $= 99,750$	$10,000 - 250$ $= 9,750$	$500 - 250$ $= 250$	$0 - 250 =$ $- 250$
Probability of Event	.0001	.005	.03	$1 - .0001 -$ $.005 - .03 =$ $.9649$

$$99750(.0001) + 9750(.005) + 250(.03) - 250(.9649) =$$

$$= -175$$

4. Suppose you are playing a game with a friend according to the following rules: You flip a coin and roll a die at the same time. If the coin comes up heads at the same time the die comes up a 6, he'll pay you \$120. If the coin comes up a tail, and the die is odd then you pay him \$40. In all other scenarios, it's a draw. What is the expected value of this game? Is it fair?

	Heads + 6	Tails + Odd	Heads + (2 or 4)
Value of Event (Note the signs)	120	-40	0
Probability of Event	$\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$	$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$	$\frac{2}{3}$

$$120\left(\frac{1}{12}\right) - 40\left(\frac{1}{4}\right) + 0 = 0$$

Yes, this game is fair