Practice with Expected Value

1. You draw one card from a standard deck of playing cards. If you pick a heart, you will win $10. If you pick a face card, which is not a heart, you win $8. If you pick any other card, you lose $6. Do you want to play? Explain.

$$EV = \frac{13}{52}(10) + \frac{9}{52}(8) + \frac{30}{52}(-6)$$

$EV = \$0.42$ → Yes, definitely play!

2. The world famous gambler from Philadelphia, Señor Rick, proposes the following game of chance. You roll a fair die. If you roll a 1, then Señor Rick pays you $25. If you roll a 2, Señor Rick pays you $5. If you roll a 3, you win nothing. If you roll a 4 or a 5, you must pay Señor Rick $10, and if you roll a 6, you must pay Señor Rick $15. Is Señor Rick crazy for proposing such a game? Explain.

$$EV = \frac{1}{6}(25) + \frac{1}{6}(5) + \frac{1}{6}(0) + \frac{2}{6}(-10) + \frac{1}{6}(-15)$$

$EV = -\$0.83$ → No, are you crazy!

3. You pay $10 to play the following game of chance. There is a bag containing 12 balls, five are red, three are green and the rest are yellow. You are to draw one ball from the bag. You will win $14 if you draw a red ball and you will win $12 is you draw a yellow ball. How much do you expect to win or loss if you play this game 100 times?

$$EV = \frac{5}{12}(14) + \frac{4}{12}(12) + \frac{3}{12}(0) - 10$$

$EV = -\$0.1667$ → $100 \times -\$0.1667 = -\$16.67$ after 100 times

4. A detective figures that he has a one in nine chance of recovering stolen property. His out-of-pocket expenses for the investigation are $9,000. If he is paid his fee only if he recovers the stolen property, what should he charge clients in order to breakeven?

$$\frac{1}{9}x - 9{,}000 = 0$$

$$\frac{1}{9}x = 9000$$

$$x = \$81{,}000$$

5. At Tucson Raceway Park, your horse, Soon-to-be-Glue, has a probability of 1/20 of coming in first place, a probability of 1/10 of coming in second place, and a probability of ¼ of coming in third place. First place pays $4,500 to the winner, second place $3,500 and third place $1,500. Is it worthwhile to enter the race if it costs $1,000?

$EV = 4500\left(\frac{1}{20}\right) + 3500\left(\frac{1}{10}\right) + 1500\left(\frac{1}{4}\right) - 1000$

$EV = -\$50$ → Soon-to-be-Glue is soon to be glue.

6. Your company plans to invest in a particular project. There is a 35% chance that you will lose $30,000, a 40% chance that you will break even, and a 25% chance that you will make $55,000. Based solely on this information, what should you do?

$EV = 0.35(-30{,}000) + 0.40(0) + 0.25(55{,}000)$

$EV = \$3{,}250$ → Proceed with the project.

7. A manufacturer is considering the manufacture of a new and better mousetrap. She estimates the probability that the new mousetrap is successful is 0.75. If it is successful it would generate profits of $120,000. The development costs for the mousetrap are $98,000. Should the manufacturer proceed with plans for the new mousetrap? Why or why not?

$EV = 120{,}000(0.75) - 98000(0.25)$

$EV = \$65{,}500$ → Proceed with the project.

8. A grab bag contains 12 packages worth 80 cents apiece, 15 packages worth 40 cents each and 25 packages worth 30 cents apiece. Is it worthwhile to pay 50 cents for the privilege of picking one of the packages at random?

$EV = 12(0.80) + 15(0.40) + 25(0.30)$

$EV = 23.1¢$ → Absolutely not!