

Expected Value

p. 87

What is expected value? a predicted value on the return you can expect for some kind of action

When is it used?

decision-making (risk vs. reward)

gambling ; insurance

How do you find expected value?

mult. each possible outcome by prob. of that occurring + add them all together

$$x_1 \cdot P(x_1) + x_2 \cdot P(x_2) + \dots$$

- 1.) In a game, you are to roll a dice. If you roll an odd number, you win \$2. If you roll an even number, you lose \$3. What is the expected value of the game?

$$\begin{matrix} \text{win} \cdot \text{prob}(w) & \text{lose} \\ (2) \cdot \frac{1}{2} & + & -3 \cdot \frac{1}{2} = \end{matrix} \quad \text{you shouldn't play}$$

- 2.) You ask your parents for money. Being math minded people who want you to think, they each give you a mathematical answer. Your mom says for money you must flip a coin, if it is heads you get \$10 and if it is tails, you get \$5. Your dad on the other hand, says if you get heads, he will give you \$30, but if you get tails you must pay him \$20. Which should you choose?

mom: $10\left(\frac{1}{2}\right) + 5\left(\frac{1}{2}\right) = \7.50

dad: $30\left(\frac{1}{2}\right) + -20\left(\frac{1}{2}\right) = \5

mom

- 3.) A raffle has a grand prize of \$10,000. It also has 3 lower prizes of \$100 each. There are 20,000 tickets sold for \$5 each. What is your expected value.

$$\begin{matrix} \text{grand prize} & \text{lower prize} & \text{lose} \\ 9,995\left(\frac{1}{20,000}\right) & + & 95\left(\frac{3}{20,000}\right) & + & -5\left(\frac{19,996}{20,000}\right) = \end{matrix} \quad \text{shouldn't play}$$

bc you paid \$5

- 4.) At a particular game, you are to draw a card from a regular deck of cards (with no jokers). If it is a heart, you win \$10. If it is a face card of another suit, you win \$8. Any other card, you lose \$6. Should you play? Why?

$$\begin{matrix} \text{heart} & \text{face card} & \text{of another suit} \\ 10\left(\frac{13}{52}\right) & + & 8\left(\frac{9}{52}\right) & - & 6\left(\frac{30}{52}\right) = \end{matrix} \quad \text{you should play}$$

- 5.) A grab bag at a children's store has packages of toys in it. It has 12 toys worth 80 cents, 15 worth 40 cents, and 25 worth 30 cents. Is it worthwhile to buy a grab bag if it cost 50 cents to pick at random?

worth .80 worth .40 worth .30

$$.30\left(\frac{12}{52}\right) + -.10\left(\frac{15}{52}\right) + -.20\left(\frac{25}{52}\right) = \quad \text{6¢}$$