

AFM Probability Unit
 HW 2 - Expected Value and Fair Game

Name key

1. A raffle is held by the FVHS student council to draw for a \$1000 plasma television. Two thousand tickets are sold at \$1.00 each. Find the expected value of one ticket.

$$EV = \frac{1}{2000}(999) + \frac{1999}{2000}(-1) = \boxed{\$-.50}$$

2. A game consists of rolling a colored die with three green sides, two red sides, and one blue side. A roll of a red loses. A roll of blue pays \$6.00. A roll of green pays \$2.00. What is a "fair" price to pay to play? GGGRRB

$$EV = \frac{2}{6}(0) + \frac{1}{6}(6) + \frac{3}{6}(2) = \boxed{\$2.00}$$

3. A game consists of rolling a colored die with four red sides, three green sides, and two blue sides. A roll of a red loses. A roll of green pays \$2.00. A roll of blue pays \$5.00. The charge to play the game is \$2.00. Would you play the game? Why or why not? RRRRGGGBB

$$EV = \frac{4}{9}(-2) + \frac{3}{9}(0) + \frac{2}{9}(3) = \boxed{\$-.22}$$

no! b/c I would be losing \$

4. Suppose you were given one of thirty free tickets at the beginning of this class period. Suppose at the end of this period (*just dreaming*) three tickets are drawn without replacement. The holder of the first ticket drawn wins \$100, the second ticket \$50, and the third ticket \$30.

(a) Determine your expected winnings.

(b) If your neighbor offered to buy your ticket before drawing, what would be a "fair price"?

$$\textcircled{a} EV = \frac{1}{30}(100) + \frac{1}{29}(50) + \frac{1}{28}(30) = \boxed{\$6.13}$$

\textcircled{b} the fair price is $\boxed{\$6.13}$ ☺

5. A company believes it has a 40% chance of being successful on bidding a contract that yields a profit of \$30,000. Assume it costs \$5,000 in consultant fees to prepare the bid. What is the expected gain or loss for the company if it decides to bid on the contract?

$$EV = .4(25000) + .6(-5000) = \boxed{\$7000 \text{ gain}}$$

6. A game consists of drawing a single card from a standard 52-card deck. A player receives \$40 for a heart and \$50 for an ace, but \$90 for the ace of hearts. If the cost of a draw is \$15, should a person play the game? Explain.

	Ace	Ace of ♡	other
prob.	$\frac{12}{52}$	$\frac{3}{52}$	$\frac{36}{52}$
net come	25	75	-15

$$EV = \frac{12}{52}(25) + \frac{3}{52}(75) + \frac{36}{52}(-15)$$

$$EV = \boxed{\$-1.15}$$

don't play!

lose ↙ win ↘ so the probability of success is $\frac{2}{7}$

7. Assume that the odds against a certain horse winning a race are 5 to 2. If a better wins \$14 when the horse wins, how much should the person bet to make the game "fair"?

$$EV = \frac{2}{7}(14) + \frac{5}{7}(0)$$

$EV = \$4$ ← also the "fair price"!

8. An airline is considering adding a route to the city of Austin, TX. There are many factors to consider before they decide. After research, the company estimates the following – there is a 70% chance of making an \$800,000 profit, a 10% chance of breaking even, and a 20% chance of losing \$1,200,000. Find the expected value and determine if the airline should add this new route.

$$EV = .7(800,000) + .1(0) + .2(-1,200,000)$$

$EV = \$320,000$ yes!

9. Sandra is taking a multiple choice test, and there are 5 possible answers for each question. The instructions indicate that 2 points will be awarded for each one she gets right, she'll lose 1/2 point for each she gets wrong, and no points if she leaves it blank.

a) If Sandra does not know the right answer, is it to her advantage or disadvantage to guess at an answer?

$$EV = \frac{1}{5}(2) + \frac{4}{5}(-\frac{1}{2}) = 0 \text{ doesn't matter!}$$

b) If she can eliminate one of the possible answer choices, is it to her advantage or disadvantage to guess?

$$EV = \frac{1}{4}(2) + \frac{3}{4}(-\frac{1}{2}) = .125 \text{ she should guess!}$$

10. Marina is playing a game in which she needs to throw a ball into a bucket. If she throws the ball into the bucket, she will win \$100; if not, she will pay \$25. The probability that Marina will throw the ball into the bucket is 0.2. If she plays the game five times, what is the expected value of Marina's winnings?

$$EV = .2(100) + .8(-25) = 0$$

$$5 \times 0 = 0$$

$\$0$