### Exercises 4.3 (I alternated my new exercises with the old exercises)

1. A bag contains 3 gold marbles, 6 silver marbles, and 28 black marbles. Someone offers to play this game: You randomly select one marble from the bag. If it is gold, you win $3. If it is silver, you win $2. If it is black, you lose $1.
   1. Make a probability model for this game.
   2. What is your expected value if you play this game?
2. A bag contains 5 red marbles, 8 blue marbles, and 15 green marbles. Someone offers to play this game: You randomly select one marble from the bag. If it is blue, you win $3. If it is red, you win $2. If it is green, you lose $1. ADD

a. Make a probability model for this game.

b. What is your expected value if you play this game?

1. A friend devises a game that is played by rolling a single six-sided fair (each side has equal probability of landing face up, once rolled) die once. If you roll a 6, he pays you $3; if you roll a 5, he pays you nothing; if you roll a number less than 5, you pay him $1. EDIT
   1. Make a probability model for this game.
   2. Compute the expected value for this game.
   3. Should you play this game?

4. A friend devises a game that is played by rolling a single six-sided fair (each side has equal probability of landing face up, once rolled) die once. If you roll a 1, he pays you $5; if you roll a 2, he pays you nothing; if you roll a number more than 2, you pay him $2. ADD

1. Make a probability model for this game.

b. Compute the expected value for this game.

c. Should you play this game?

5. A company wants to offer a 2-year extended warranty in case their product fails after the original warranty period but within 2 years of the purchase. They estimate that 0.7% of their products will fail during that time, and it will cost them $350 to replace a failed product. If they charge $48 for the extended warranty, what is the company's expected profit or loss on each warranty sold?

6. A company wants to offer a 3-year extended warranty in case their product fails after the original warranty period but within 3 years of the purchase. They estimate that 0.5% of their products will fail during that time, and it will cost them $400 to replace a failed product. If they charge $60 for the extended warranty, what is the company's expected profit or loss on each warranty sold? ADD

7. An insurance company estimates the probability of an earthquake in the next year to be 0.0013. The average damage done by an earthquake it estimates to be $60,000. If the company offers earthquake insurance for $100, what is their expected value of the policy?

8. An insurance company estimates the probability of a flood in the next year to be 0.0002. The average damage done by a flood is estimated to be $70,000. If the company offers flood insurance for $3000, what is their expected value of the policy? ADD

9. You purchase a raffle ticket to help out a charity. The raffle ticket costs $5. The charity is selling 2000 tickets. One of them will be drawn and the person holding the ticket will be given a prize worth $4000. Compute the expected value for this raffle.

10. You purchase a raffle ticket to help out a charity. The raffle ticket costs $10. The charity is selling 1000 tickets. One of them will be drawn and the person holding the ticket will be given a prize worth $3000. Compute the expected value for this raffle. ADD

11. At the local fair there is a game in which folks are betting where a chicken will poop on a 5 by 5-foot grid. (There are 25, 1 by 1 squares to choose from) You can buy a 1 by 1-foot square for $10 and if the chicken poops on your square you win $100. Find the expected value for this game.

12. At the local fair there is a game in which folks are betting where a chicken will poop on a 4 by 4-foot grid. (There are 16, 1 by 1 squares to choose from) You can buy a 1 by 1-foot square for $15 and if the chicken poops on your square you win $125. Find the expected value for this game. ADD

13. Create a problem using the concept of expected value. Possible topics include insurance policies, financial decisions, gambling and lotteries. Determine the expected value of the situation you created.

Answers to Exercises

1a.

|  |  |  |  |
| --- | --- | --- | --- |
| Marble color | Gold | Silver | black |
| Probability | 3/37 | 6/37 | 15/37 |

b. The expected value is approximately - $0.19. That is, you would lose about $0.19 on average each time you pick a marble.

2a.

|  |  |  |  |
| --- | --- | --- | --- |
| Marble color | Red | Blue | Green |
| Probability | 5/28 | 8/28 | 15/28 |

b. The expected value is approximately $0.57. That is, you would win about $0.57 on average each time you pick a marble.

3a.

|  |  |  |  |
| --- | --- | --- | --- |
| Die roll outcome | 1, 2, 3, or 4 | 5 | 6 |
| Probability | 4/6 | 1/6 | 1/6 |

b. The expected value is about - $0.50 which means you would lose 50 cents on average each time you roll the die.

c. No, you should not play this game (unless you want to give your friend your money).

4a.

|  |  |  |  |
| --- | --- | --- | --- |
| Die roll outcome | 1 | 2 | 3, 4, 5, or 6 |
| Probability | 1/6 | 1/6 | 4/6 |

b. The expected value is - $0.17 which means you would lose 17 cents on average each time you roll the die.

c. No, you should not play this game (unless you want to give your friend your money).

5. The company’s expected profit is $45.55 per warranty sold.

6. The company’s expected profit is $58 per warranty sold.

7. The company’s expected value on each policy is $22 which means they will make $22, on average, per policy sold.

8. The company’s expected value on each policy is $2,986 which means they will make $2,986, on average, per policy sold.

9. The expected value for this raffle is - $3.

10. The expected value for this raffle is - $7.

11. The expected value for this game is approximately - $6.

12. The expected value for this game is approximately - $7.19.

13. Answers will vary since you are making up your own problem.