Probabilistic Misconception Project

General Information

Course: Math Academy I

Chapter: six

Assigned: Thursday, February 9

Due: Friday, February 24

Points: 30

Group Size: 1 to 3 people

Format: poster

Summary: Explain the fallacy of a common probabilistic misconception in a way that people not in this class would understand.

Bonus: For up to +4% per problem, do one or more of the problem b's listed above the one you chose for your project, explaining your reasoning for each.

Directions

1. Choose one of the pairs of probability problems on the back of this page.
2. Solve the first problem.
3. State the answer people would tend to believe is correct for the second problem.
4. Explain why the answer in #3 is incorrect.
5. Do the second problem correctly.

Scoring

[A] The explanation clearly explains the fallacy and the correct answers.

10	The explanation of the problem clearly illustrates the fallacy common to the problem, even to people not studying probability, and precisely uses mathematical terminology.
8-9	The explanation of the problem accurately explains the fallacy common to the problem, and makes use of mathematical terminology.
5-7	The problems are both solved correctly, but the explanation is inaccurate or incomplete, or use of mathematical terminology is lacking or superficial.
1-4	The problems are not both solved correctly, or the explanation is widely inaccurate or incomplete.

[X] All steps are completed.

10	All stated directions are followed.
1-9	One or more aspects of the project is omitted or incomplete.

[Y] The final product is attractive.

10	The poster is neat, colorful, and attractive.
1-9	The aesthetic quality of the poster is not superior.

Questions

1. Tom draws two cards.
   a) What is the probability that his first card is hearts?
   b) What is the probability that his second card is hearts?

2. Tom draws two cards.
   a) If his first card is hearts, what is the probability that his second card will be hearts?
   b) If his second card is hearts, what is the probability that his first card was hearts?

3. Tom flips four coins.
   a) What is the probability that they all land on heads?
   b) What is the probability that they all land the same?

4. Out of three cards, one is blue on both sides, one is green on both sides, and one is blue on one side and green on the other. Tom sees one side of one card.
   a) What is the probability that he sees a blue side?
   b) If he sees a blue side, what is the probability that the other side is also blue?

5. Forty percent of the students at Tom University are male. Twenty-five percent of the females and thirty-five percent of the males are science majors.
   a) What is the probability that a random male is a science major?
   b) What is the probability that a random science major is male?

6. Tom flips a nickel, a dime, and a quarter.
   a) If the quarter landed on heads, what is the probability that all three coins landed on heads?
   b) If at least one of the coins landed on heads, what is the probability that all three of the coins landed on heads?

7. Tom draws two cards.
   a) If the first card is hearts, what is the probability that the first card is an ace?
   b) If his first card is hearts, what is the probability that the second card is an ace?

8. Two jacks and an ace are shuffled face down. Tom guesses which card is the ace. Then Tim flips over another card, and it is a jack.
   a) What is the probability that the third card is the ace?
   b) What is the probability that the third card is an ace, given Tim knew which cards were jacks and chose one of them to flip?

9. Tom has two kids.
   a) If he has at least one daughter, what is the probability that he has two daughters?
   b) If at least one of his kids was born on a Sunday, what is the probability that both were born on a Sunday?

10. Tom draws four cards.
    a) What is the probability that the first card is an ace?
    b) What is the probability that one of the four cards is the ace of spades?

11. Tom and Tim are each rolling a 6-sided die. The first person to roll a 6 wins.
    a) If they roll at the same time and they reroll if there is a tie, what is the probability that Tom will win?
    b) If they take turns rolling and Tim goes first, what is the probability that Tom will win?

12. Tom has a bag with two marbles, each of which is equally likely to be black or white. He adds another marble, then pulls out two of the three marbles at random and they are both black.
    a) What is the probability the remaining marble is black if the marble he added was equally likely to be black or white?
    b) What is the probability that the remaining marble is black if the marble he added was black?