

Counting 1

Lesson 3 Probability

What is probability?

- Probability is the likelihood of something happening. For example, what is the probability that you get heads when you flip a coin? What is the probability that you will win first place in a competition?
- Probability is commonly expressed as a fraction.

Ex: What is the probability that you flip two heads in a row? Assume that the coin is not rigged.

- Think about a coin, it has two sides: heads and tails. So when you flip the coin you will either get heads or tails. So if you just want heads, you want 1 option out of 2, or $\frac{1}{2}$. Thus, the probability of getting a single head is $\frac{1}{2}$. However, we must remember that we are searching for the probability of getting two heads in a row. The probability of the second head is also $\frac{1}{2}$. So, the probability of getting two heads in a row is $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$.

Ex: What is the probability that the sum of two dice rolls is four?

- Let's think of the total number of ways to make four with 2 dice. You could have (1,4) (2,2) and (3,3). Thus there are 3 ways to make a four. The total number of outcomes would be $6 \times 6 = 36$. Thus, the probability would be $\frac{3}{36} = \frac{1}{12}$.

What about the probability of drawing a card?

- There are 52 cards in a deck
- 13 cards of each suit
- 4 cards of each number/letter
- The probability is the number of ways you can draw this card divided by the total number of ways you can draw that number of cards.

Ex: How many ways can you draw a 5 card out of a deck of 52 cards?

- There are 4 ways you can draw a 5 card, the 5 of spades, 5 of diamonds, 5 of hearts, and 5 of clovers. So you have 4 ways to draw the 5, and 52 cards that you could draw in total. Thus, the probability you draw a 5 is $\frac{4}{52} = \frac{1}{13}$.

What is independent and dependent probability?

- During independent probability, the outcome is not affected by other events.
- During dependent probability, the outcome is affected by other events.

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Examples:

1. (MOEMS Set 1 3E) Two standard dice are rolled. One is red and one is green. What is the probability that the product of the two numbers on top is divisible by 3?
2. (MOEMS Set 2 4C) The room numbers on one side of a hotel hall are odd. They are numbered from 11 through 59 inclusive. Kristen is in one of these rooms. Express as a fraction the probability that Kristen's room number is divisible by 5.
3. Suppose we roll a standard fair 6-sided dice. What is the probability that:
 - a. A 3 is rolled
 - b. An odd number is rolled
 - c. A perfect square is rolled
4. A number is selected at random from 1-50 inclusive, what is the probability that the number is a perfect square?
5. (AMC 8 2016 Problem 13) Two different numbers are randomly selected from the set $-2, -1, 0, 3, 4, 5$, and multiplied together. What is the probability that the product is 0?

Homework:

1. (MOEMS Set 13 3C) Chloe and Jack play 3 games. The probability that Chloe wins any game is $\frac{3}{5}$. What is the probability that Chloe wins for the first time in the third game?
2. A standard dice is rolled. What is the probability that a 2, 4, OR 6 is rolled?
3. In a class of 9 boys and 7 girls, the teacher gives out a prize. What is the probability that the prize goes to a girl?
4. What is the probability of getting heads if you throw a coin 6 times? Assume that the coin is fair. (You may express your answer with an exponent)
5. If two dice are rolled, find the probability that the sum of the two numbers rolled is 12.