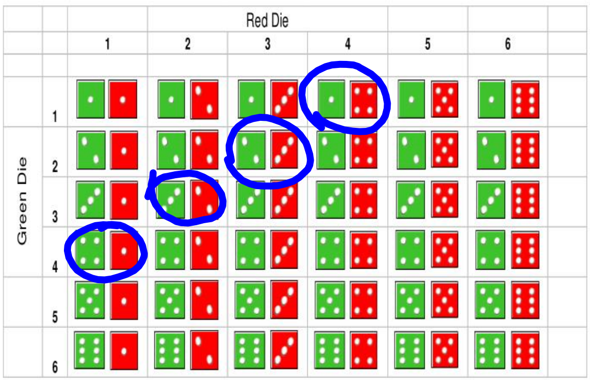
4.2 Basic Probability Rules: Probability Models

In Lesson 4.1, we used simulation to imitate chance behavior. Do we always have to repeat a chance process (rolling two dice, flipping a coin, or drawing a name from a hat) many times to determine the probability of a particular outcome? Fortunately, the answer is no.

Many board games involve rolling dice. Imagine rolling two fair, six-sided dice (one that's red and one that's green). How do we develop a **probability model** for this chance process? This figure displays the **sample space**. Because the dice are fair, each of these 36 outcomes will be equally likely and have probability 1/36.



Sample Space-1 Red Die, 1 Green Die - 36 Total Outcomes

A **probability model** is a description of some chance process that consists of two parts: a list of all possible outcomes & the probability for each outcome.

The list of all possible outcomes is called the **sample space**.

A probability model does more than just assign a probability to each outcome. It allows us to find the probability of an event.
An **event** is any collection of outcomes from some chance process.

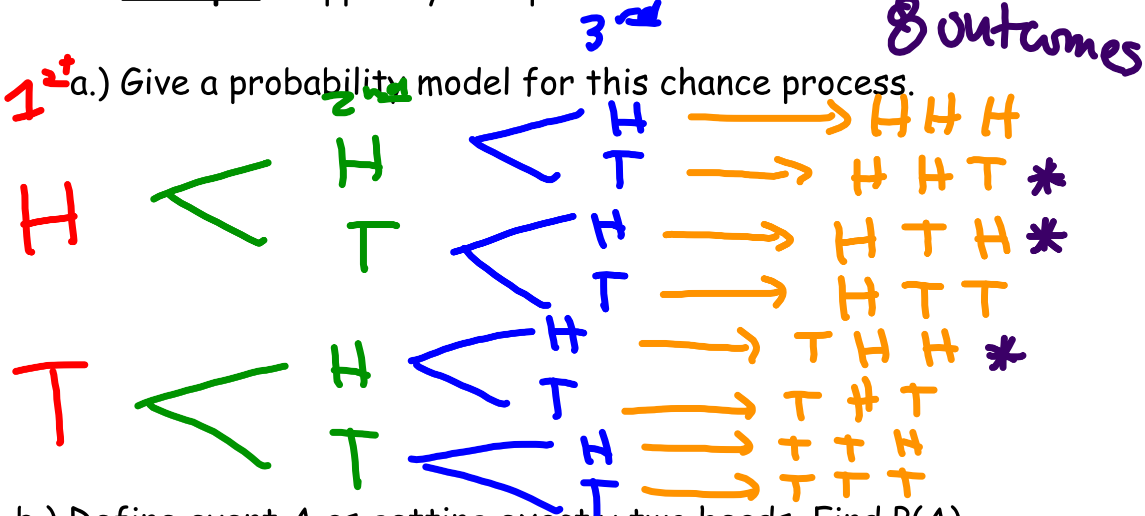
Events are usually designated by capital letters, like A, B, C, and so on. For rolling two 6-sided dice,we can define event A as getting a sum of 5. We write the probability of event A as P(A) or P(sum of 5).
It is fairly easy to find the probability of an event in the case of equally likely outcomes. There are 4 outcomes in event A. The probability that event A occurs is therefore:

$$P(A) = \frac{\text{number of outcomes in event } A}{\text{total number of outcomes in sample space}} = \frac{4}{36} = 0.111$$

Example: Suppose you flip a fair coin 3 times.

8 outcomes

a.) Give a probability model for this chance process.



b.) Define event A as getting exactly two heads. Find P(A).

$$P(A) = \frac{3}{8}$$