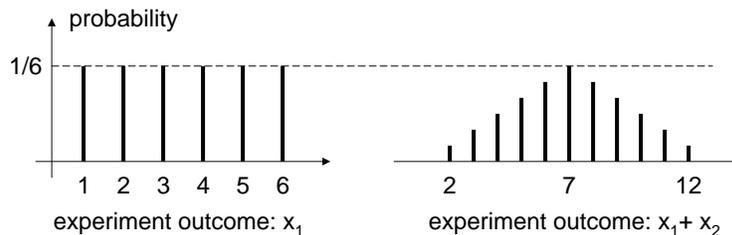


## 8 Probability Primer with Dice

You are given two fair dice.

1. Make a plot of the possible outcomes of one toss of one die, versus the likelihood (probability) of that outcome. Clearly there are six possible outcomes, with equal likelihoods of occurring. We call this graph a probability mass function, or pmf.



2. Make a similar plot for a throw of both dice, where the outcome is the *sum* of the two values, i.e., the outcome of a toss giving  $[3,4]$  is seven. Your pmf should account for the fact that there are more ways to roll a three ( $[1+2],[2+1]$ ) than to roll a two ( $[1,1]$ ).

*Solution:* As shown in the figure, the pmf for the two-throw case has a nice linear structure. The height of each spike follows the possible number of ways the additions can occur: 2 is achieved only by rolling  $[1,1]$ , 3:  $[1,2]$  or  $[2,1]$ , 4:  $[1,3]$  or  $[2,2]$  or  $[3,1]$ , 5:  $[1,4]$  or  $[2,3]$  or  $[3,2]$  or  $[4,1]$ , and so on.

3. For the case of throwing both dice, what is the most likely outcome, and what is its probability on any given toss?

*Solution:* the most likely outcome is seven, and it occurs one-sixth of the time.

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