

## Last Time

### Sample Space

A sample space  $\Omega$  is the set of all possible outcomes of an experiment.

### Event

An event  $E \subseteq \Omega$  is a subset of possible outcomes (i.e. a subset of  $\Omega$ )

### Probability

A probability is a number between 0 and 1 describing how likely a particular outcome is.

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## Another Example

Suppose you shuffle a deck of cards so any arrangement is equally likely. What is the probability that the top two cards have the same value?

Sample Space

Probability Measure

Event

Probability

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## Conditional Probability

### Conditional Probability

For an event  $B$ , with  $\mathbb{P}(B) > 0$ ,  
the "Probability of  $A$  conditioned on  $B$ " is

$$\mathbb{P}(A|B) = \frac{\mathbb{P}(A \cap B)}{\mathbb{P}(B)}$$

Just like with the formal definition of probability, this is pretty abstract. It does accurately reflect what happens in the real world.

If  $\mathbb{P}(B) = 0$ , we can't condition on it (it can't happen! There's no point in defining probabilities where we know  $B$  has not happened) –  $\mathbb{P}(A|B)$  is **undefined** when  $\mathbb{P}(B) = 0$ .

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## Conditioning Practice

Red die 6  
conditioned on  
sum 7

Red die 6  
conditioned on  
sum 9

Sum 7 conditioned  
on red die 6

	D2=1	D2=2	D2=3	D2=4	D2=5	D2=6
D1=1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
D1=2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
D1=3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
D1=4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
D1=5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
D1=6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

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