

# PROBABILITY

You have 3 cards. One is red on both sides, one is black on both sides, and one has a red side and a black side. You pick one card randomly and put it on the table. Its top side is red. What is the probability the other side is red?

# PROBABILITY

What is the probability that...

a) A flipped coin comes up heads?

b) A rolled die comes up 3?

c) A rolled pair of dice comes up 4?

## MORE EXAMPLES

1. You toss a coin 5 times. What is the probability of getting 4 heads?
2. What is the probability of correctly guessing the winners in a 64-team single elimination tournament?  
(Assume every team has a 50% chance of winning each game)

## MORE EXAMPLES

3. An urn has 4 red balls, 3 green balls. You pull one ball at random. What is the probability of pulling a green ball?

Suppose you pull one ball, replace it, then pull another ball. What is the probability of pulling two balls of the same color?

## MORE EXAMPLES

Same urn (4 red, 3 green). Now suppose you pull one ball, don't replace it, and pull another ball. What is the probability of getting two balls of the same color?

## MORE EXAMPLES

4. In poker, what is the probability of dealing a 4-of-a-kind?

What about a full house?

# APPLYING PROBABILITY RULES

**EXAMPLE:** A number from 1 to 100 is chosen at random.

What is the probability it is...

a) divisible by 2, 3, or 5?

b) divisible by 2 and 3, but not 5?

c) divisible by 3 but not 2 or 5?

d) divisible by at most two of 2, 3, and 5?

# MUTUAL EXCLUSIVITY

Two events  $A$  and  $B$  are mutually exclusive if  $A \cap B = \emptyset$

Events  $A_1, \dots, A_n$  are pairwise mutually exclusive if  $A_i \cap A_j = \emptyset$  whenever  $i \neq j$ .

If  $A_1, \dots, A_n$  are pairwise mutually exclusive events, then  
 $P(A_1 \cup \dots \cup A_n) = P(A_1) + \dots + P(A_n)$  (addition rule)

**EXAMPLE:** A number from 1 to 100 is chosen at random. What is the probability that the number is divisible by 7 or 30?



# APPLYING PROBABILITY RULES

1. What is the probability that a length 10 bit string (chosen at random) has at least one zero? at least two zeros?
2. What is the probability that a poker hand (dealt at random) is a flush? a straight? royal flush?

Note: A,2,3,4,5 and 10,J,Q,K,A  
are both straights.