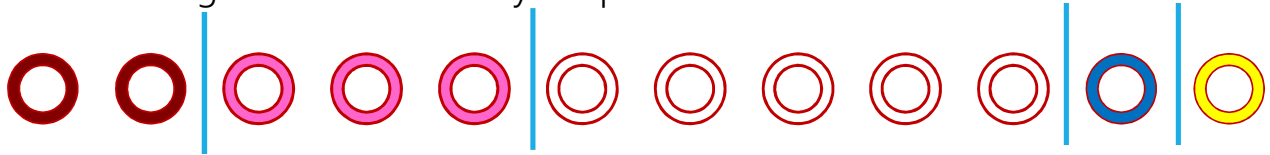# One More Counting Rule

You're going to buy one-dozen donuts (i.e., 12 donuts)

There are chocolate, strawberry, coconut, blueberry, and lemon (i.e. five types)

Put donuts in order by type, then put dividers between the types.

Counting the number of ways to place dividers instead.

We've seen lots of ways to count

Sum rule (split into disjoint sets)

Product rule (use a sequential process)

Combinations (order doesn't matter)

Permutations (order does matter)

Principle of Inclusion-Exclusion

Complementary Counting

"Stars and Bars" $\binom{n+k-1}{k-1}$

Niche Rules (useful in very specific circumstances)
Binomial Theorem
Pigeonhole Principle

A Solution with a Problem

You wish to count the number of 5-card hands with at least 3 aces.

There are 4 Aces (and 48 non aces)

$$\binom{4}{3} \cdot \binom{49}{2}$$

Choose the three aces. Then of the 49 remaining cards (the last ace is allowed as well, because we're allowed to have all 4)

What's wrong with this calculation?

What's the right answer?

Fill out the poll everywhere so Robbie knows how long to explain
Go to pollev.com/robbie

Another Problem

You have to choose 8 pieces of fruit. There are apples, oranges, and bananas.

You need to pick at most 2 apples and at least 1 banana. How many sets of fruit can you choose?