

Math 321

How to Count

Countable: \rightarrow (1) Finite
 \rightarrow (2) infinite, bijection to \mathbb{Z}^+

How many? e_1, e_2, e_3, \dots

$$P(e_n) = \underline{\underline{\text{"cost"}}}$$

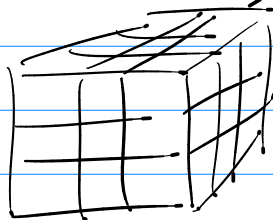
ex a_1, a_2, \dots, a_n operators like $a \cdot b, a + b, a - b, \dots$

$$a_1 \circ a_2 \circ a_3 \circ \dots \circ a_n$$

$$((A \wedge B \cup C) \wedge D) \cup E$$

$$(A \wedge ((B \cup C) \wedge D)) \cup E$$

ex Rubik's cube



519,024,039,293,878,272,000 \uparrow

43,252,003,274,489,856,000

ex

5 kids \rightarrow each get 204 pieces each

Basics

process to do and you use words

like "and", "or"

Example

How many shirts to make if you have 3 styles and 15 colors?

$$S = \{s_1, s_2, s_3\}$$

$$C = \{c_1, c_2, \dots, c_{15}\}$$

$$\rightarrow (s_i, c_j)$$

$$|S \times C| = |S| \cdot |C| = 3 \cdot 15 = 45$$

Product Rule

A_1, A_2, \dots, A_n

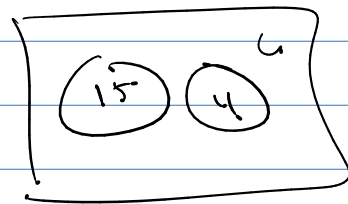
task is take from A_1 and A_2 and \dots and A_n

$$|A_1 \times A_2 \times \dots \times A_n| = |A_1| |A_2| \dots |A_n|$$

Ex) take 1 candy from box 1 or box 2 (disjoint)

$$|\text{box 1}| = 15$$

$$|\text{box 2}| = 4$$



$$\rightarrow \text{total ways} = 15 + 4 = 19$$

Sum Rule

task is to take one from Set 1 or Set 2 or \dots or Set n &

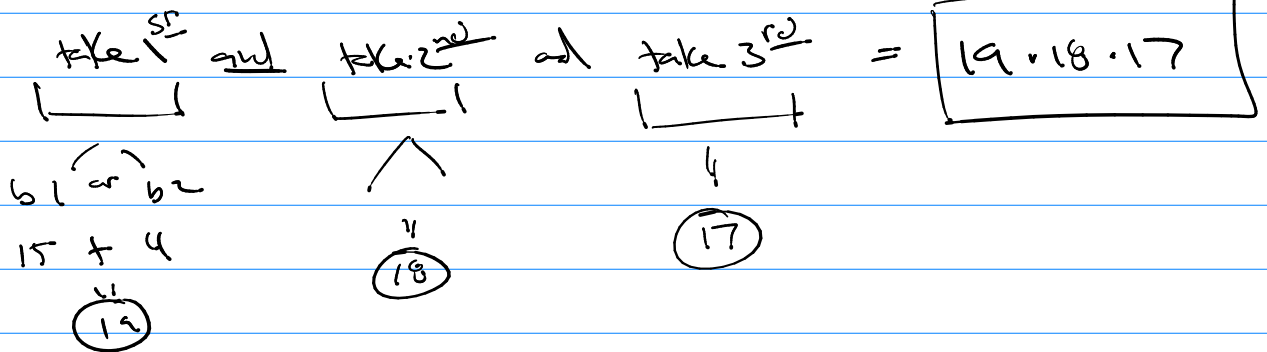
$$|A_1 \cup A_2 \cup \dots \cup A_n| = |A_1| + |A_2| + \dots + |A_n|$$

disjoint

advanced example

(box 1) = 15 (box 2) = 4 disjoint

task: ways to get 3 toys?



How many passwords that Capital, Special, number
length = 8

task: type 8 characters

