Reading Questions 13

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1. The number of ways in which precisely one of a collection of mutually exclusive events can occur is the sum of the numbers of ways in which each event can occur. T
2. If the intersection of any pair of sets among the sets $A_1, A_2, \ldots, A_n$ are empty then the sets are pairwise disjoint. T
3. If $|A| = |B| = 5$, $|C| = 6$ and A, B, C are pairwise disjoint sets what is $|A \cup B \cup C|$? $= 16$

Section 6.2 The Addition and Multiplication Rules (Part 1)

Counting

P 1. If the sets A and B are mutually exclusive what can you say about $A \cap B$?

P 2. How many ways can a password of length 5 be created using only 3 letters x, y, z?

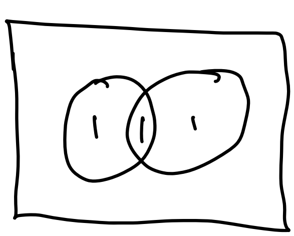
P 3. From a group of 14 dogs, 5 cats, and 3 monkeys how many ways can a dog, a cat, and a monkey be selected?

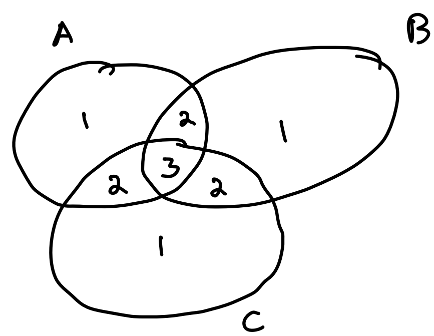
P 4. How many three-digit numbers contain the digits 2 and 5?

P 5. Let $A = \{1, 2, \ldots, n\}$ and $B = \{1, 2\}$. Show that there are 2^n functions from A to B.

Last time

$$|A \cup B| = |A| + |B| - |A \cap B|$$





$$|A \cup B \cup C| = |A| + |B| - |A \cap B| + |C| - |A \cap C| - |C \cap B| + |A \cap B \cap C|$$

Def: $n \in \mathbb{N}$

$$[n] = \{1, 2, \ldots, n\}$$

Ex: How many integers in $[100]$ are not divisible by 2, 3, or 5?

Let A_2 be the numbers divisible by 2

A_3 be the numbers divisible by 3

A_5 be the numbers divisible by 5.

$$100 - |A_2 \cup A_3 \cup A_5|$$

$$|A_2 \cup A_3 \cup A_5| = |A_2| + |A_3| + |A_5| - |A_2 \cap A_3| - |A_2 \cap A_5| - |A_3 \cap A_5| + |A_2 \cap A_3 \cap A_5|$$

$$|A_2| = \left\lfloor \frac{100}{2} \right\rfloor = 50 \qquad |A_3| = \left\lfloor \frac{100}{3} \right\rfloor = 33$$

$$|A_5| = \left\lfloor \frac{100}{5} \right\rfloor = 20 \qquad |A_2 \cap A_3| = |A_6| = \left\lfloor \frac{100}{6} \right\rfloor = 16$$

$$|A_2 \cap A_5| = |A_{10}| = \left\lfloor \frac{100}{10} \right\rfloor = 10$$

$$|A_3 \cap A_5| = |A_{15}| = \left\lfloor \frac{100}{15} \right\rfloor = 6$$

$$|A_2 \cap A_3 \cap A_5| = |A_{30}| = 3$$

$$100 - |A_2 \cup A_3 \cup A_5| = 100 - (50 + 33 + 20 - 16 - 10 - 6 + 3)$$

6.2

Addition Principle If $A_1, A_2, \ldots, A_n$ are pair disjoint then

$$|A_1 \cup A_2 \cup A_3 \cup \cdots \cup A_n| = |A_1| + |A_2| + \cdots + |A_n|$$

<u>Ex:</u> How many ways can you get a total of 6 when rolling 2 dice?

⚀ appears first $= A_1$ ⠀⠀⠀⠀ ⚅ appears first A_6

$$|A_1 \cup A_2 \cup A_3 \cup A_4 \cup A_5 \cup A_6| = |A_1| + |A_2| + |A_3| + |A_4| + |A_5| + |A_6|$$

$$=$$