

Subtraction Rule / Principle of Inclusion-Exclusion

The subtraction rule: If a task can be done in either n_1 ways or n_2 ways then the number of ways to do the task is $n_1 + n_2$ minus the number of ways to do the task that are common to the two different ways.

$$A_1 = \{a_1, a_2, a_3, a_4\}$$

$$|A_1| = 4$$

$$A_2 = \{a_2, a_5, a_3, a_6, a_7\}$$

$$|A_2| = 5$$

$$A_1 \cap A_2 = \{a_2, a_3\}$$

$$|A_1 \cup A_2|$$

$$|A_1 \cup A_2| = 4 + 5 - 2 \quad \text{Because 2 elements are common in both}$$

$$\left\{ |A_1 \cup A_2| = |A_1| + |A_2| - |A_1 \cap A_2| \right\}$$