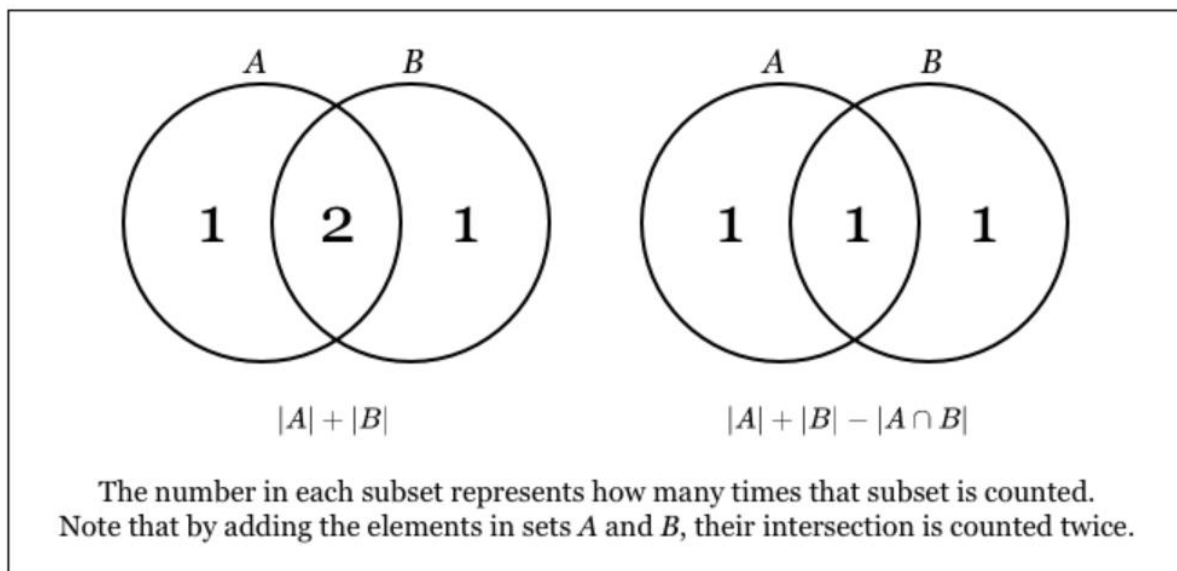


**Principles of Inclusion and Exclusion:** counting technique that computes the number of elements that satisfy at least one of several properties while guaranteeing that elements satisfying more than one property are not counted twice.

- Ex. the number of people that have at least one cat or at least one dog can be found by taking the number of people who own a cat, adding the number of people that have a dog, then subtracting the number of people who have both.
- $|A \cup B| = |A| + |B| - |A \cap B|$
- Basically that says the size of the union of sets A & B (how many elements are in A or B or both, but distinct):  $|A \cup B|$
- Is equal to:
  - o Adding the size of set A and set B (this counts elements that are shared by both twice):  $|A| + |B|$
  - o Then subtracting the size of the intersection of A and B (the number or numbers that are in both A and B. (so that these numbers are only counted once)
  - o Basically this tells you how many unique numbers are in either A or B or both A & B, if you didnt subtract the amount of numbers that are in both from the sum of the size and A and B the numbers that are in both will be counted twice.



**IF statements:** An if statement will execute the code after only if the if statement is true. Can also specify a second case with an else statement that will run if the original if statement is false.

- **IF** *condition*: code will execute if condition is true
- **ELIF** *another\_condition*: code will execute if first condition is false but *another\_condition* is true.
- **ELSE**: code will execute if all conditions are false
- Can use an **elif** to specify multiple other cases, an elif will only run if the if statement directly preceding it evaluates to false. You may not always want to use this for multiple cases, for example when you have a condition in multiple if statements that could return true and you want the code following both to execute. In which situation you would want to use multiple if statements. (**see question 4 non extra credit solution & question 5**)

## Loops

**For Loop:** used to iterate over a sequence (list, tuple, string, range)

**While Loop:** used when you want to repeat code as long as a condition is True.

## Calculating perfect squares

- If user inputs a positive integer, can calculate that to the power of  $\frac{1}{2}$  to get the square root
- Can then use modulo operator and divide by 1 to see if there is any remainder.
- $(\text{sqrt} \% 1 == 0) \wedge$