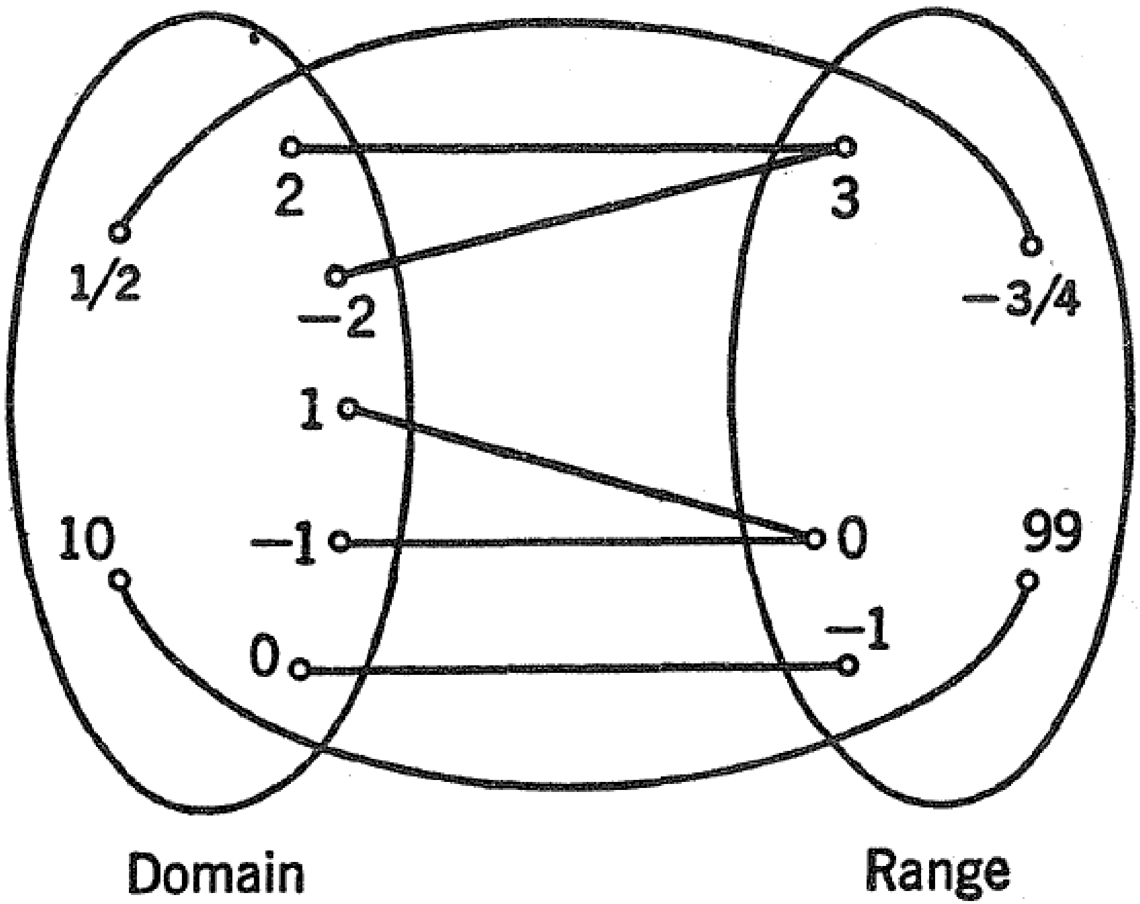
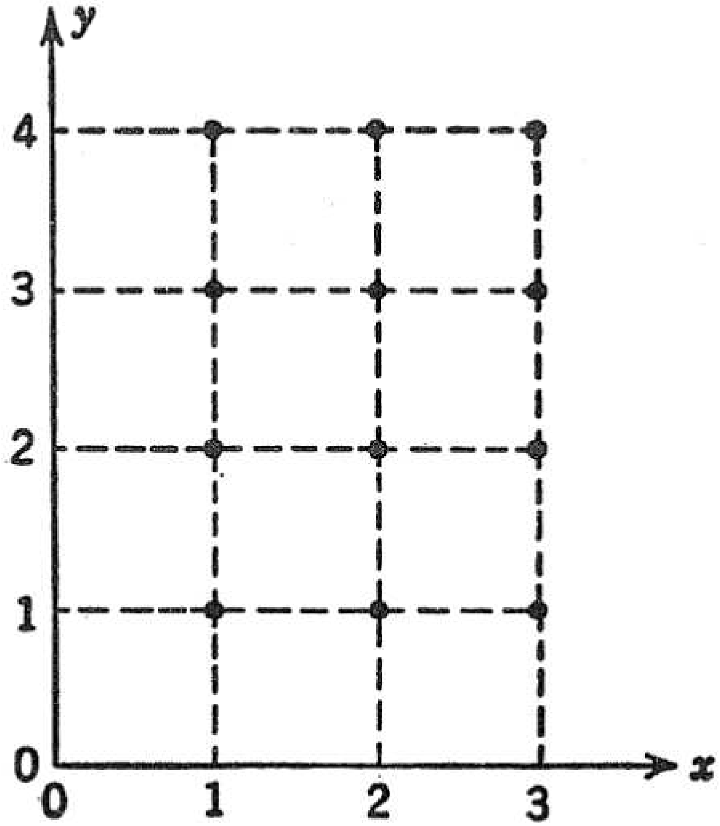
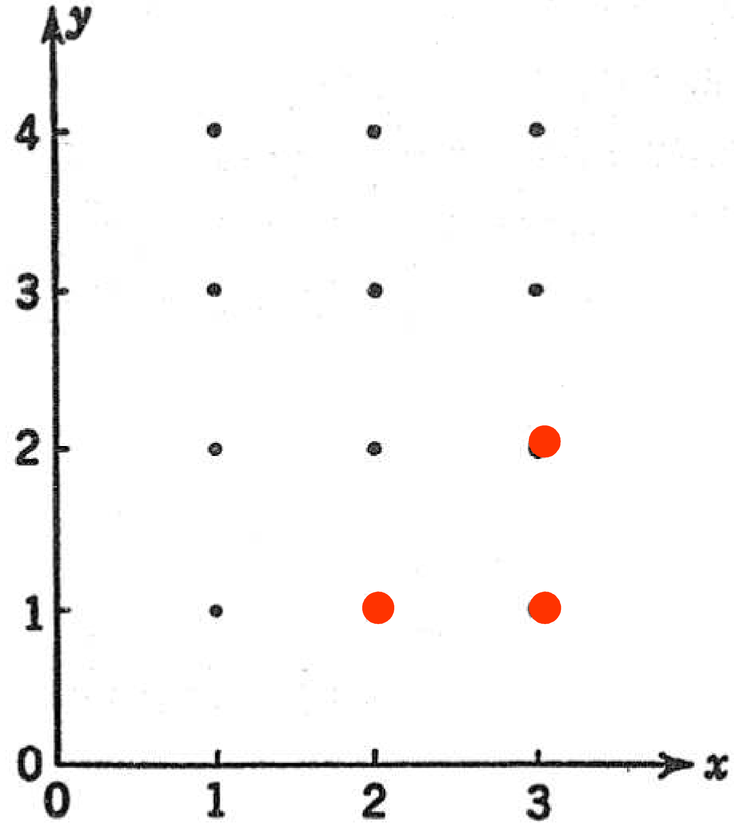
Set Theory - Basics

Domain and Range



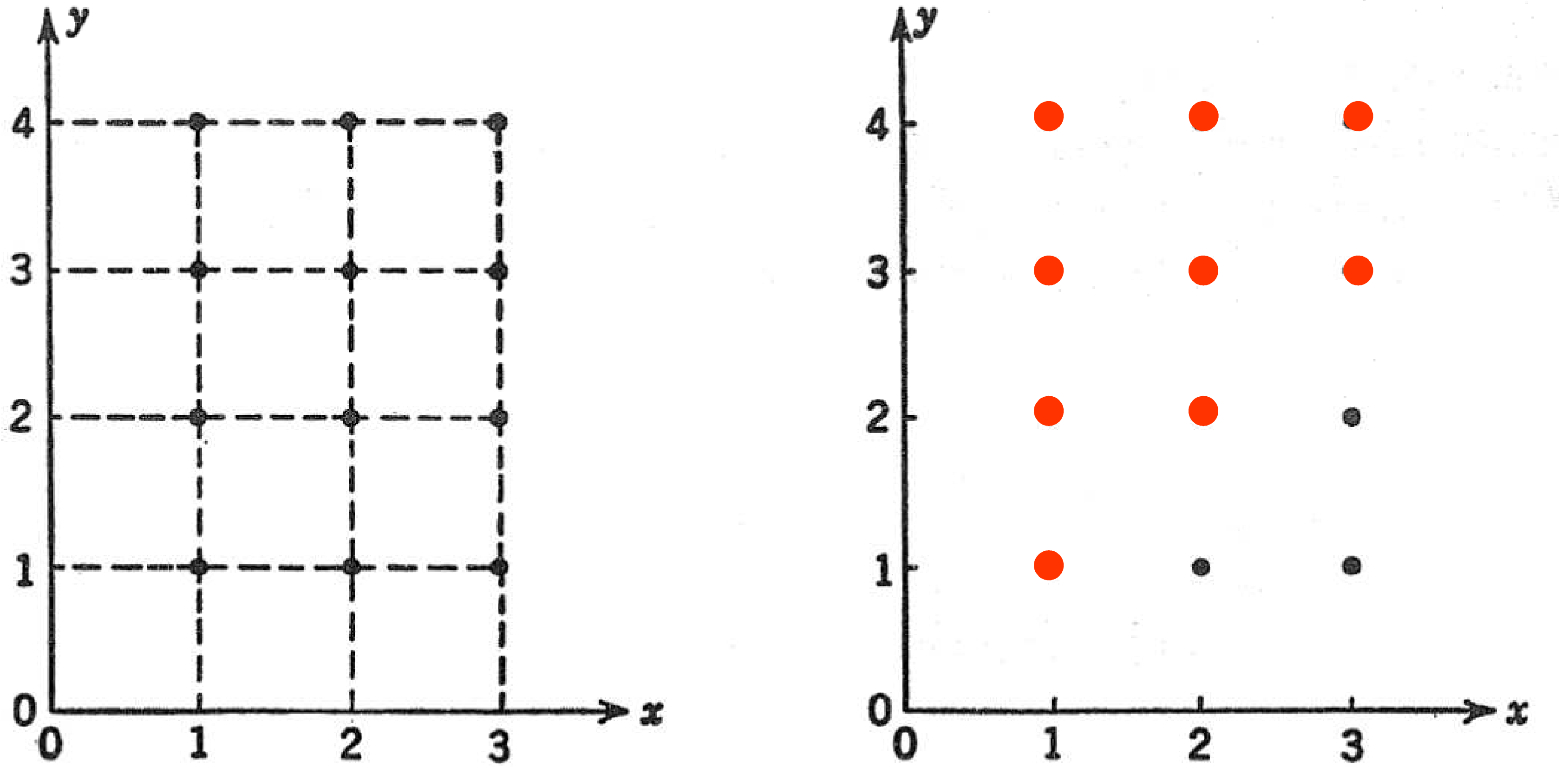
Describe the elements of the subset $a = \{(x,y) \mid y < x\}$





$$a = \{(x,y) \mid y > x\}$$

Describe the elements of the subset b=s-a



Infinite sets

A = set of natural numbers

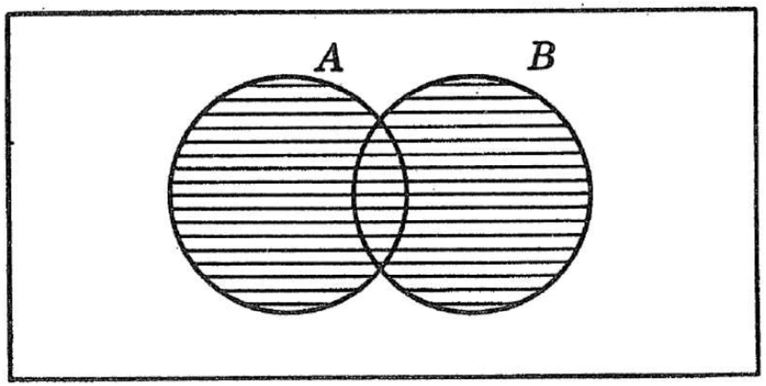
B = set of integers

C = set of even numbers

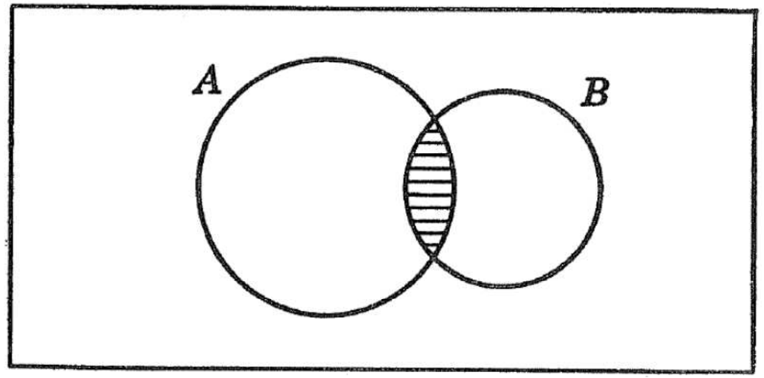
....

Operations

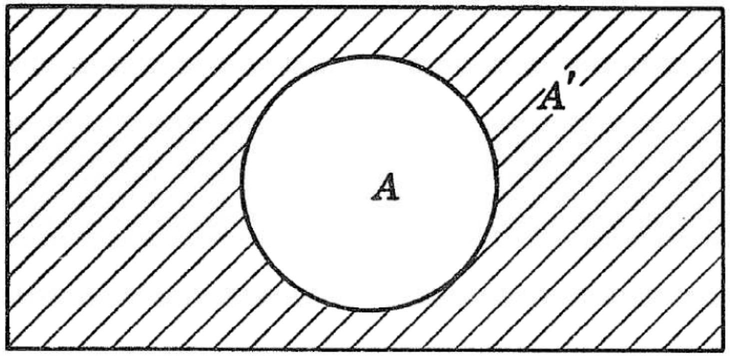
- Union
  - $A = \{1, 2, 3\}$ and $B = \{3, 4\}$
  - $A \cup B = \{1, 2, 3, 4\}$
- Intersection
  - $A = \{1, 2, 3\}$ and $B = \{3, 4\}$
  - $A \cap B = \{3\}$
- Disjoint : $A \cap B = \{\} =$ null set



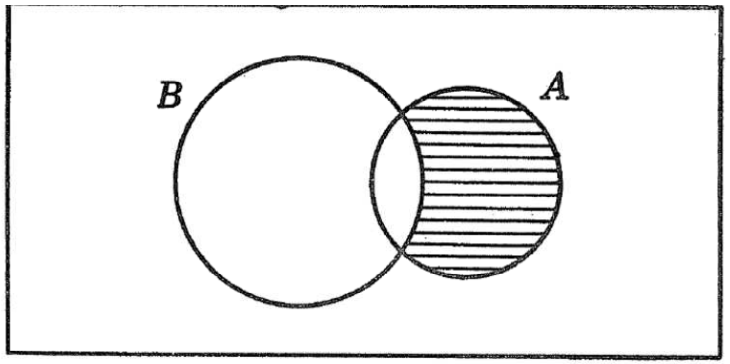
Sum or union $A + B$.



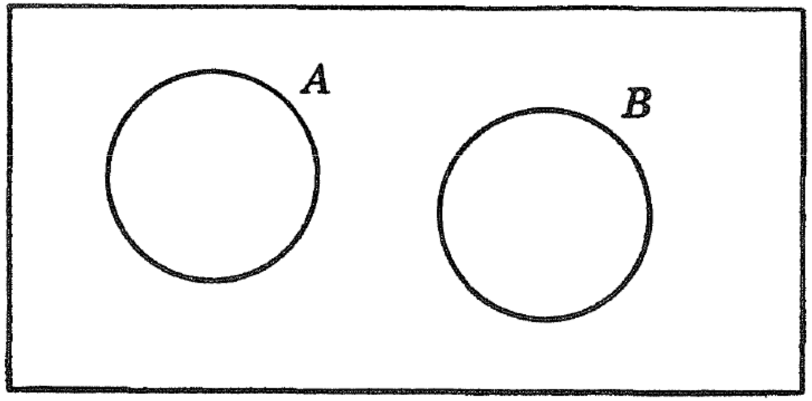
Intersection or product $A \cdot B$.



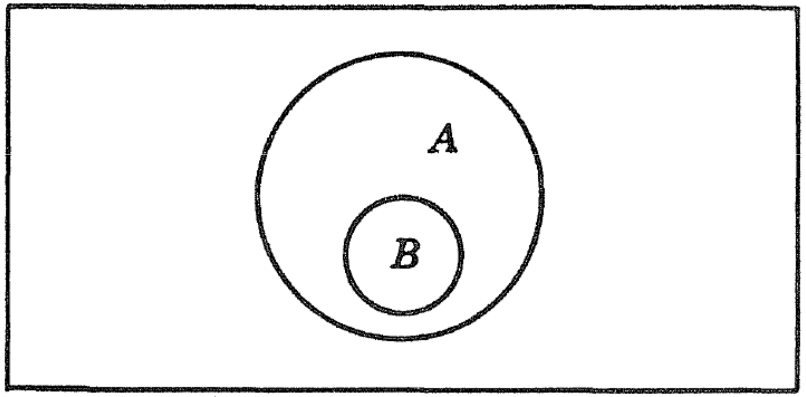
Complement.



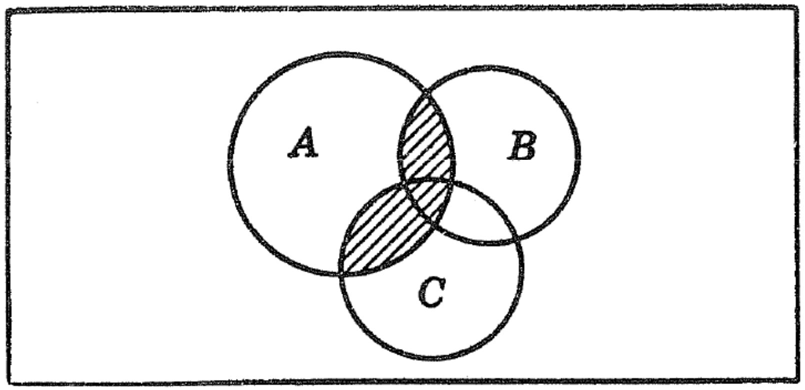
Difference $A - B$.



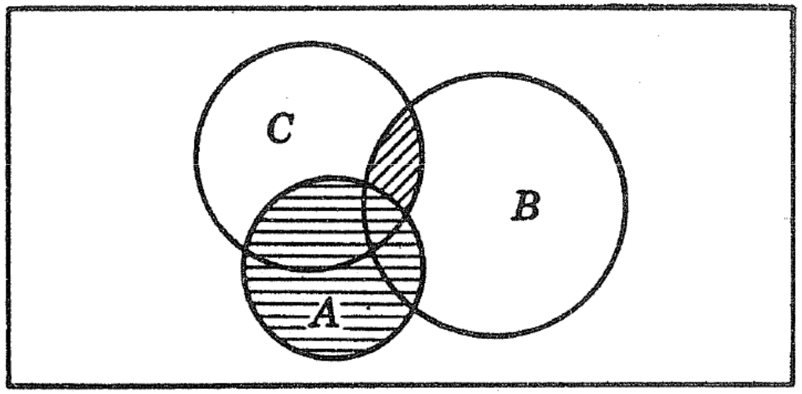
. Mutually exclusive sets. $AB = 0$.



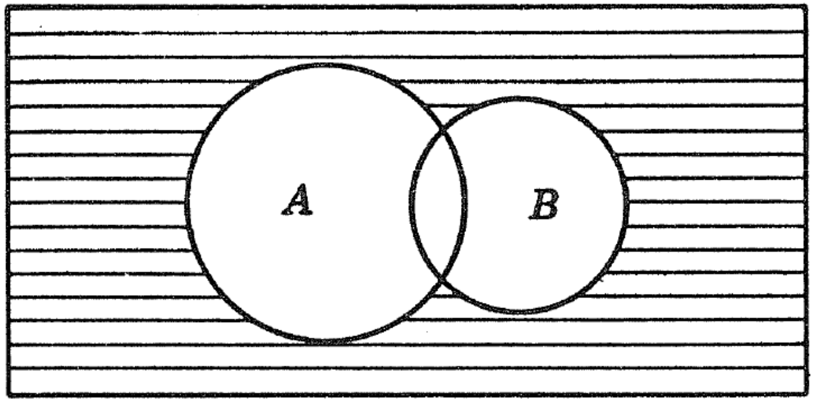
Subset $B \subset A$. $AB = B$.



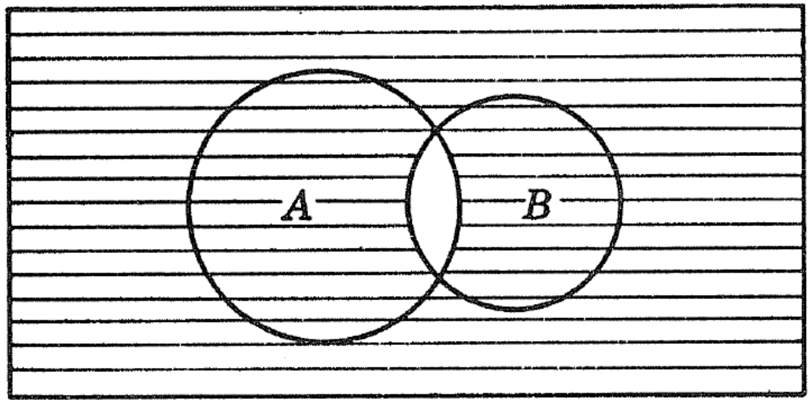
Distributive law. $A(B + C) = AB + AC$.



Distributive law. $A + BC = (A + B)(A + C)$.



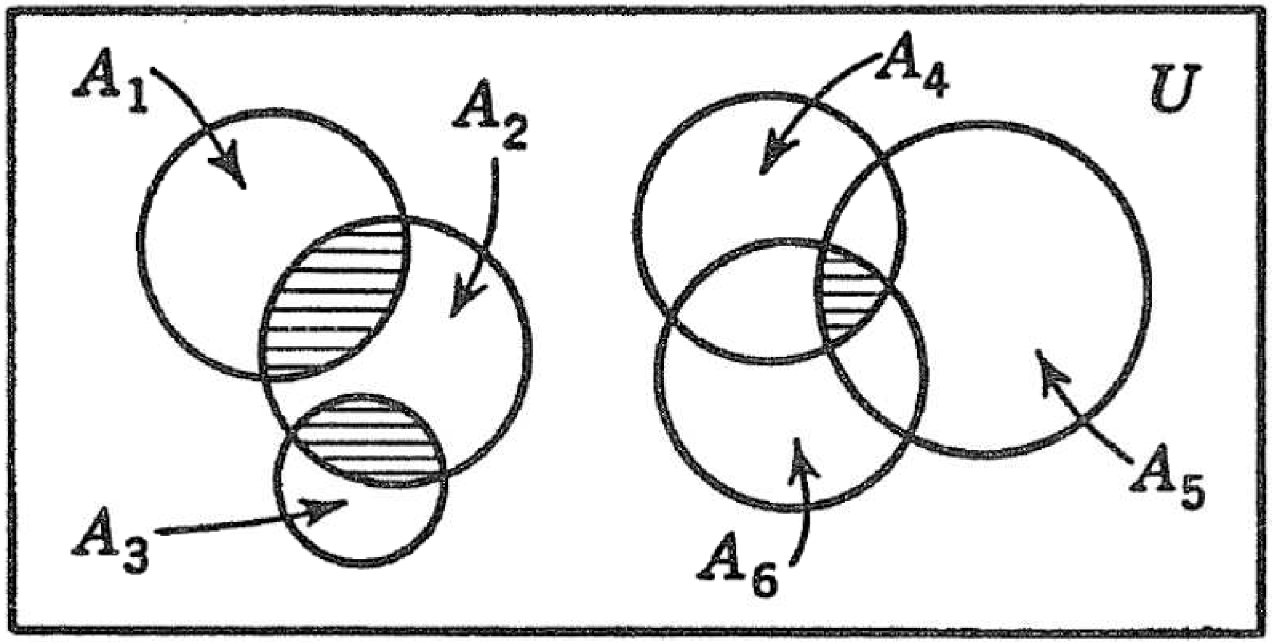
Dualization. $(A + B)' = A'B'$.

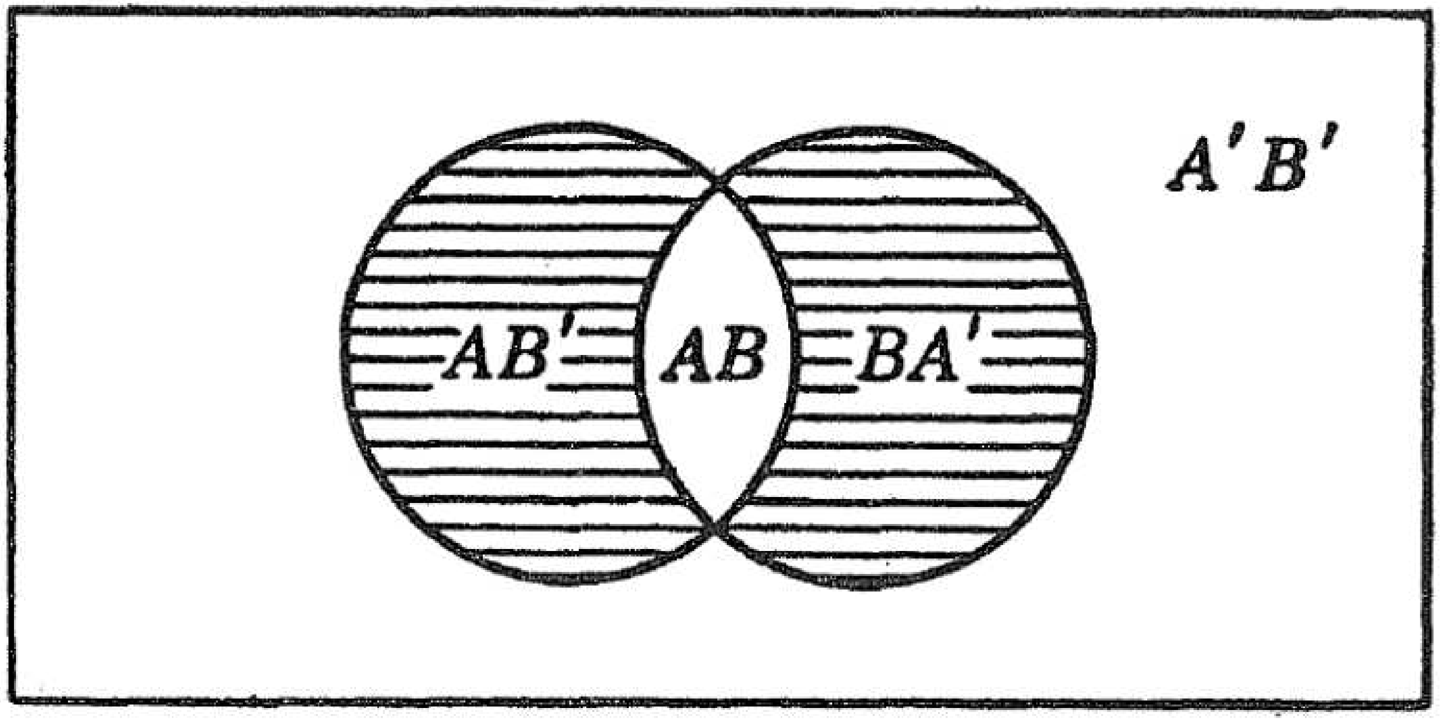


Dualization. $(AB)' = A' + B'$.

Example

$$A = A_1A_2 + A_2A_3 + A_4A_5A_6$$





Probability space of two events.

Problems

In a class of 100 students, 50 students passed in English, 60 students passed in Tamil, and 30 students passed in both English and Tamil.

How many students failed in both?

Solution

<u>Students passed in at least one subject</u>

- Students passed in English + students passed in Tamil – Students passed in both

  = 50 + 60 -30 = 80

<u>Students NOT passed in at least one subject</u>

- Total students – students passed in at least one subject

  = 100 – 80 = 20

Example

There are three radio stations *A, B,* and *C* which can be received in a town of 3,000 families.

The following data are given:

(a) 1,800 families listen to station *A.*

(b) 1,700 families listen to station *B.*

(c) 1,200 families listen to station *C.*

(d) 1,250 families listen to stations *A* and *B.*

(e) 700 families listen to stations *A* and *C.*

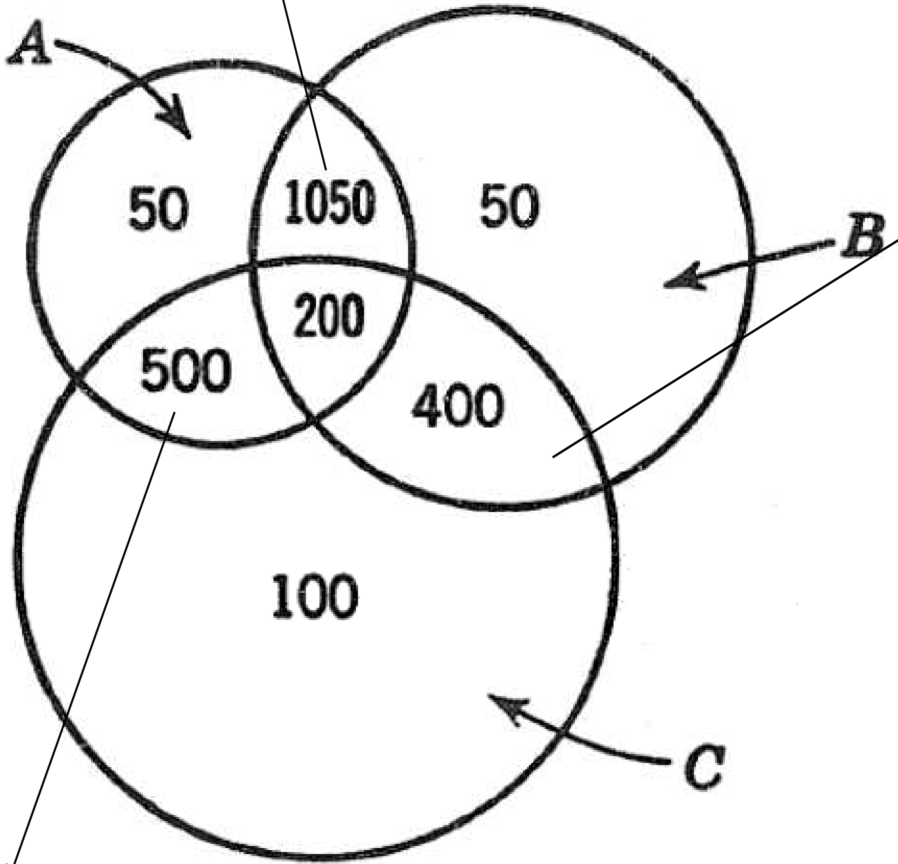
(*f*) 600 families listen to stations Band *C.*

(g) 200 families listen to stations *A, B,* and C.

Find the number of families who are not listening to any station

$n(BCA') = n(BC) - n(BCA) = 600 - 200 = 400$

$n(ABC') = n(AB) - n(BCA) = 1250 - 200 = 1050$



$n(A \cup B \cup C)$ = add all

$= 50+1050+500+50$

$+400+100+200$

$= 2350$

$n(ACB') = n(AC) - n(BCA) = 700 - 200 = 500$

$n(A \cup B \cup C) = n(A) + n(B) + n(C) - \{n(A \cap B) + n(B \cap C) + n(C \cap A)\} + n(A \cap B \cap C)$

$= 1800 + 1700 + 1200 – (1250+700+600) + 200$

$= 4700 – 2550 + 200$

$= 2350$

$\Rightarrow$ Not listening to any station = 3000 - 2350 = 650