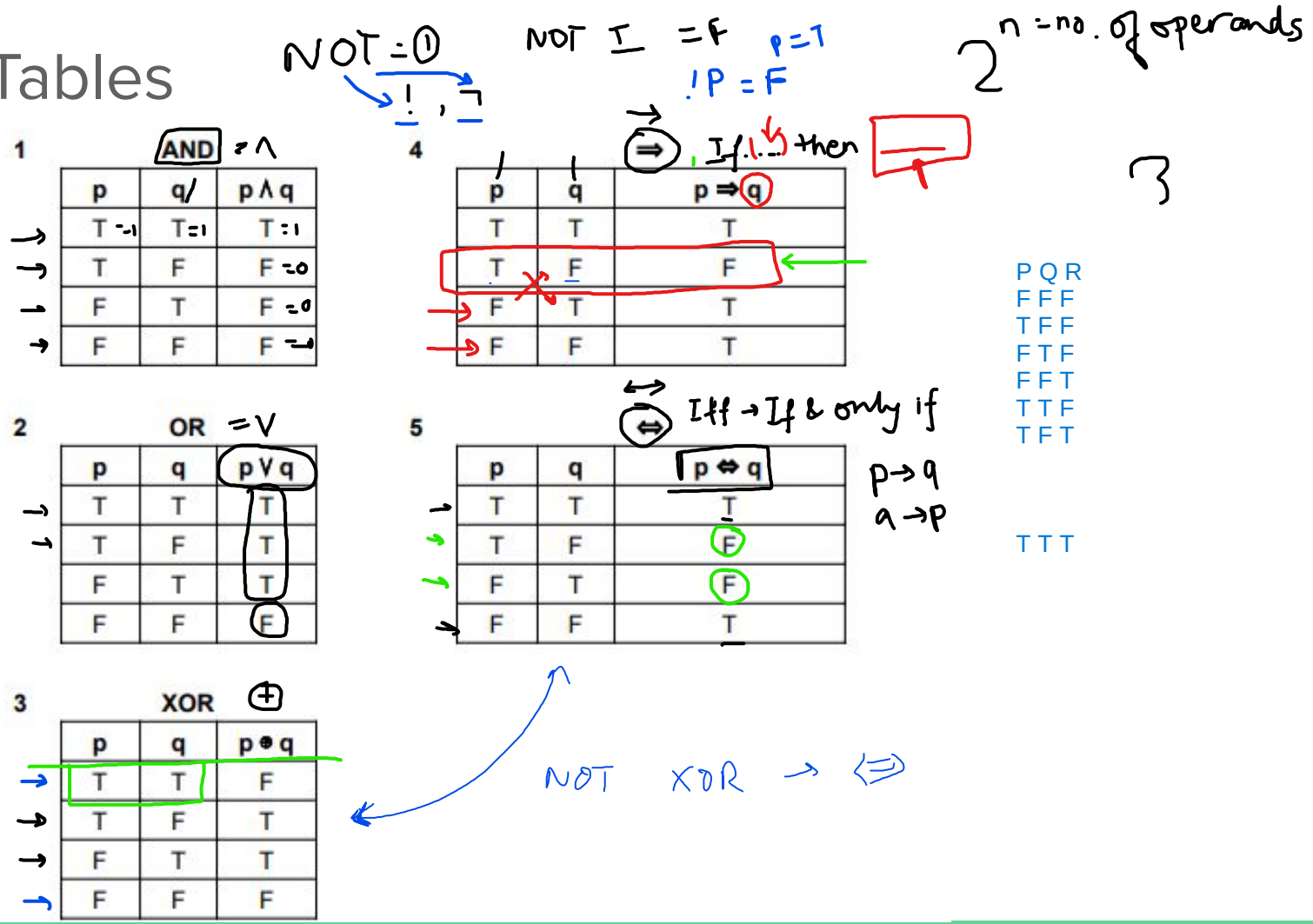
Topics for today

- Boolean Logic
- Sets

Boolean Logic

- is a branch of mathematics
- results can be true or false
- 1 = T = true
- 0 = F = false

Truth Tables



Truth Tables - Practice

!P AND (P -> Q) =

P	Q	!P	P-> Q	!P AND (P -> Q)
T	T	F	T	F
T	F	F	F	F
F	T	T	T	T
F	F	T	T	T

(P AND Q) XOR (P OR Q)

P	Q	P AND Q	P OR Q	(P AND Q) XOR (P OR Q)
T	T	T	T	F
T	F	F	T	T
F	T	F	T	T
F	F	F	F	F

Truth tables. Practice!

Not P Q

$(\neg p \wedge q) \Rightarrow (r \vee \neg t)$ is false when:

A = T ⇒ B = F

T

¬ P

P = F, Q = T, R = F, T = F

Q = T

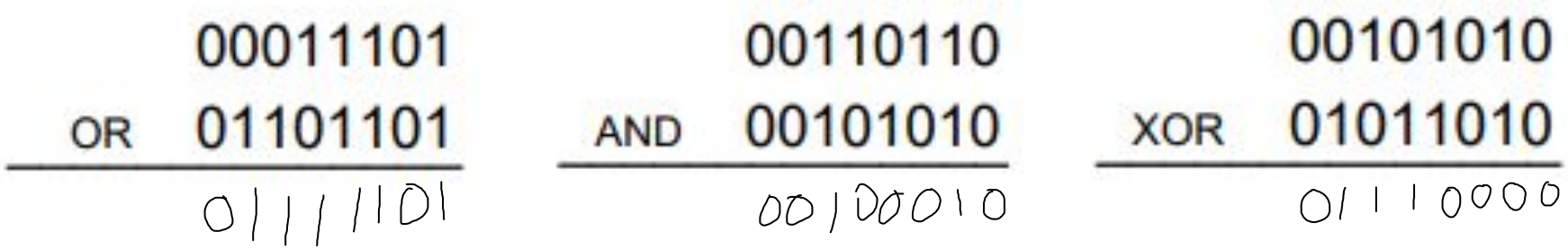
¬ t = F

t = T

¬ P = T

P = F

Bitwise operations.



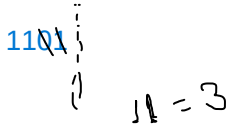
Bitwise operations.

19 AND 13

19 = 10011
13 = 01101

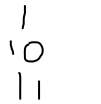
00001 = 1

13 >> 2



9 << 3

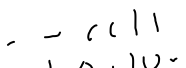
1001000 = 72



13 >> 2 XOR 9 << 3

3 XOR 72
0000011
1001000

1001011 → 75



Sets

Sets

- A set is a well-defined collection of distinct objects
- Represented using capital letters (S, A, B, U)
- The objects are called elements/members
- No duplicates in sets
- Examples:
  - A = {1, 10, 12, 15}
  - B = {5, 99, 2, 67, 12} = {2, 5, 12, 67, 99}
  - C = {} or Φ (phi - greek) or ∅ (miniscule - Danish/Norwegian)

Sets (contd...)

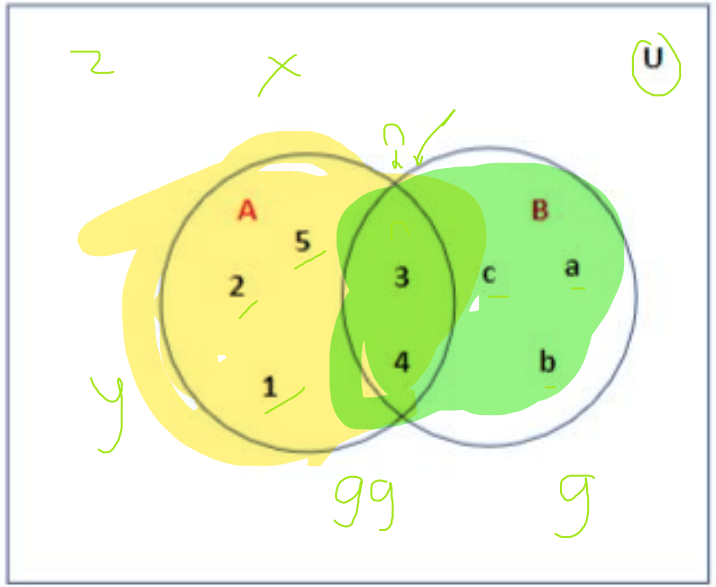
Universal set “U” is a set which consists of all the elements of the relevant

sets.

A = {1, 2, 3, 4, 5}

B = {3, 4, a, b, c}

U = {1, 2, 3, 4, 5, a, b, c}



Sets. Union.

The union of sets refers to the combination of all elements from the sets

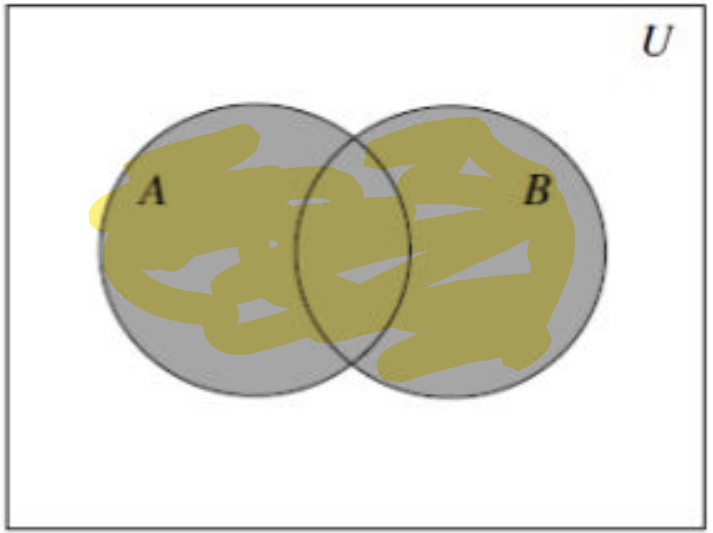
$$A \cup B = \{x : x \in A \text{ or } x \in B\}$$

example

$$A = \{1, 2, 3, 4\}$$
$$B = \{3, 4, 5, 6\}$$

$$A \cup B = \{1, 2, 3, 4, 5, 6\}$$

Venn-Diagram



Sets. Intersection.

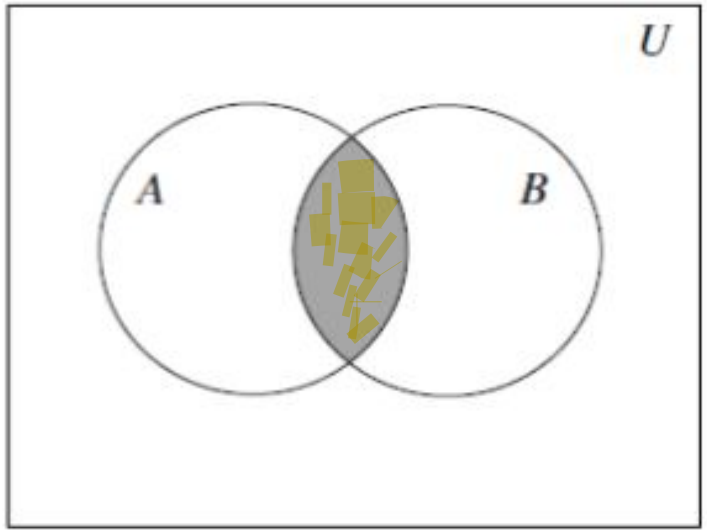
The intersection of sets refers to the common elements between the given sets

$$A \cap B = \{x : x \in A \text{ and } x \in B\}$$

example

$$A = \{1, 2, 3, 4\}$$
$$B = \{3, 4, 5, 6\}$$

$$A \cap B = \{3, 4\}$$



Sets. Relative complement.

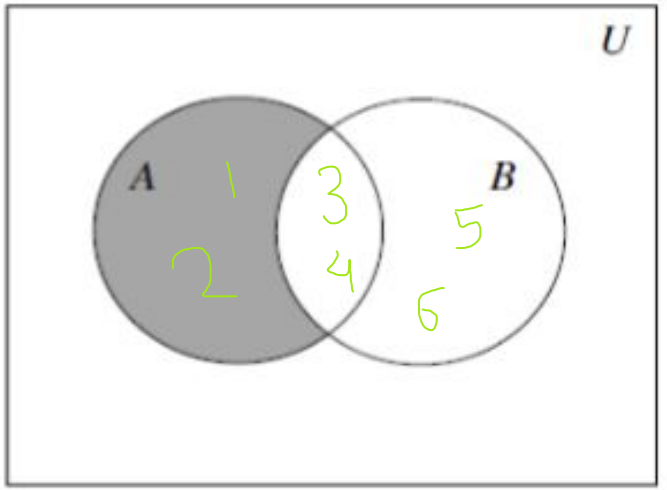
The relative complement also referred to as set difference of a set with respect to another set

$$A - B = \{x : x \in A \text{ and } x \notin B\}$$

example

$$A = \{1, 2, 3, 4\}$$
$$B = \{3, 4, 5, 6\}$$

$$A - B = \{1, 2\}$$



Sets. Complement.

$A' = U - A$

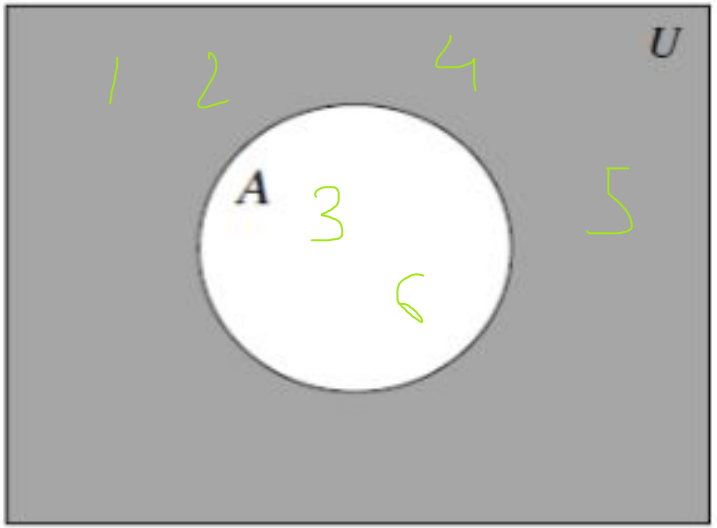
The complement of a set is the set of all elements in universal set U that is not in a given set.

$$A' = U - A = \{x : x \in U \text{ and } x \notin A\}$$

example

$$U = \{1, 2, 3, 4, 5, 6\}$$
$$A = \{3, 6\}$$

$$A' = \{1, 2, 4, 5\}$$



Sets. Practice!

N = {1,2,3,4,5,...n}

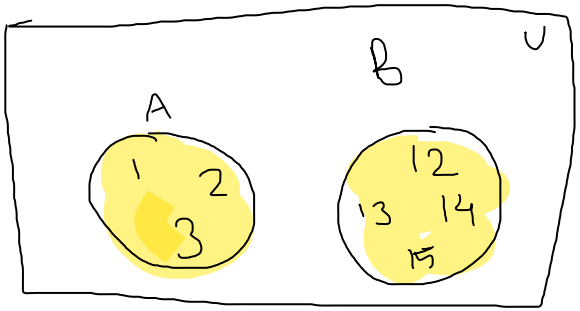
What are the elements of the set expressed as:

$A = \{ x \mid x \in N, x < 6, x \bmod 2 == 1\}$

N = {1,2,3,4,5,6,...}

A = {1, 3, 5}

Sets. Practice!



A = { x | x ∈ N, x < 4} A = {1,2,3}

B = { x | x ∈ N, x > 11, x <= 15 } B = {12,13,14,15}

What is A U B?

A U B = {1,2,3,12,13,14,15}

A - B = {1,2,3}

Sets. Practice!

What is A - B?

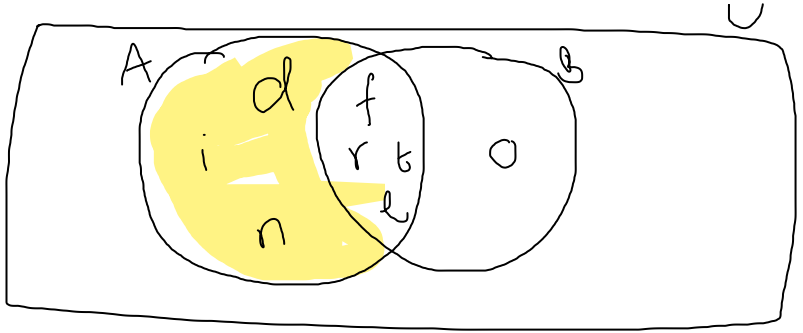
Let A = set of characters from “different”

A = {d, i, f, r, e, n, t}

Let B = set of characters from “effort”

B = {e, f, o, r, t}

A - B = {d, i, n}



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