

Topics for today

- Boolean Logic
- Sets

Boolean Logic

- is a branch of mathematics
- results can be true or false
- $1 = T = \text{true}$
- $0 = F = \text{false}$

Truth Tables

1

AND

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

4

\Rightarrow

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

2

OR

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

5

\Leftrightarrow

p	q	$p \Leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

3

XOR

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

Truth Tables - Practice

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

(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	F			
F	T			
F	F			

Truth tables. Practice!

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

Bitwise operations.

$$\begin{array}{r} 00011101 \\ \text{OR } 01101101 \\ \hline \end{array}$$

$$\begin{array}{r} 00110110 \\ \text{AND } 00101010 \\ \hline \end{array}$$

$$\begin{array}{r} 00101010 \\ \text{XOR } 01011010 \\ \hline \end{array}$$

Bitwise operations.

19 AND 13

13 >> 2

9 << 3

13 >> 2 XOR 9 << 3

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 \emptyset (miniscule - Danish/Norwegian)

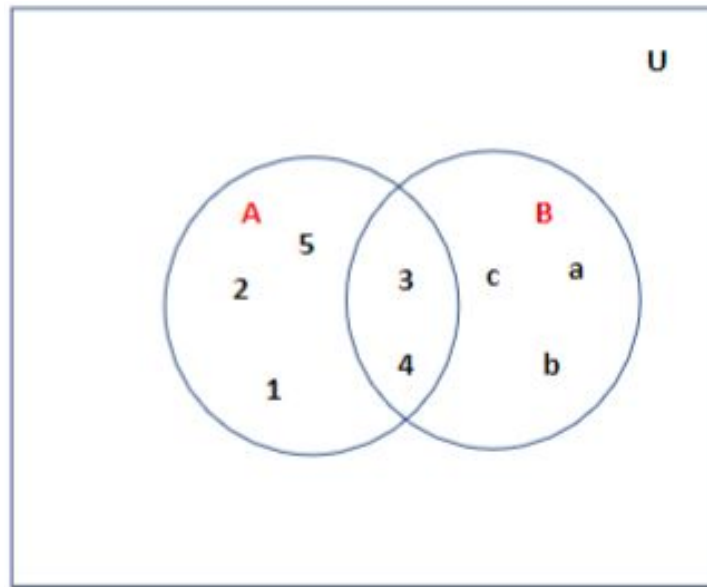
Sets (contd...)

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

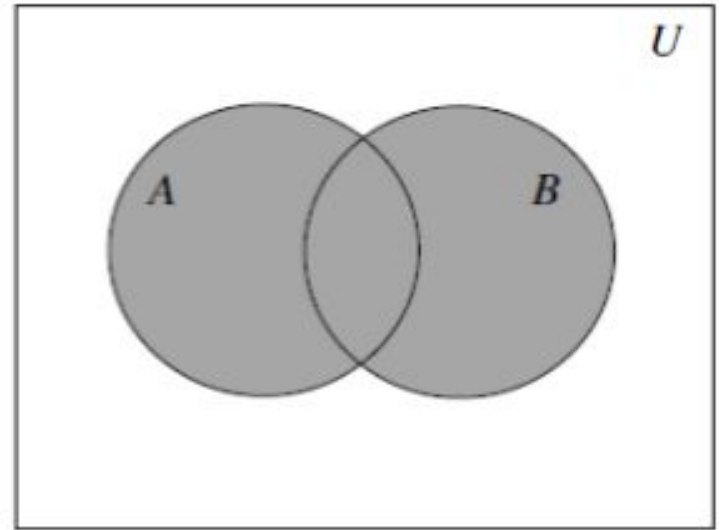
$$A \cup B = \{x : x \in A \text{ or } x \in B\}$$

example

$$A = \{1, 2, 3, 4\}$$

$$B = \{3, 4, 5, 6\}$$

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



Sets. Intersection.

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

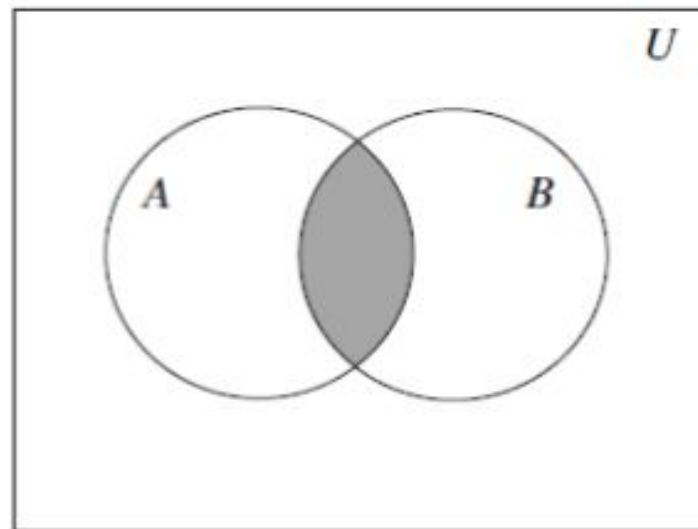
$$A \cap B = \{x : x \in A \text{ and } x \in B\}$$

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

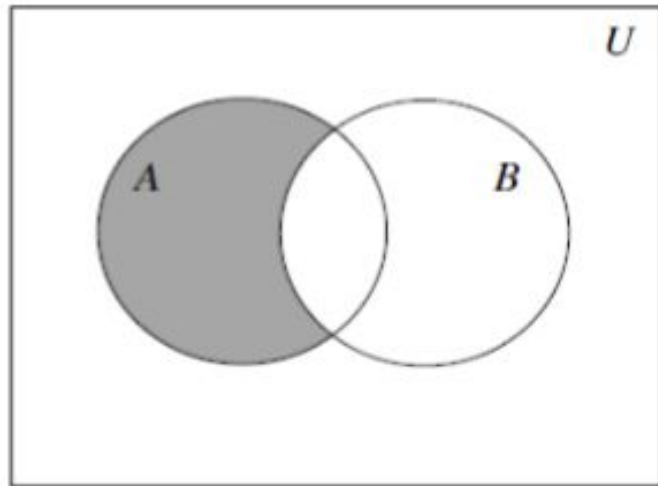
$$A - B = \{x : x \in A \text{ and } x \notin B\}$$

example

$$A = \{1, 2, 3, 4\}$$

$$B = \{3, 4, 5, 6\}$$

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



Sets. Complement.

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

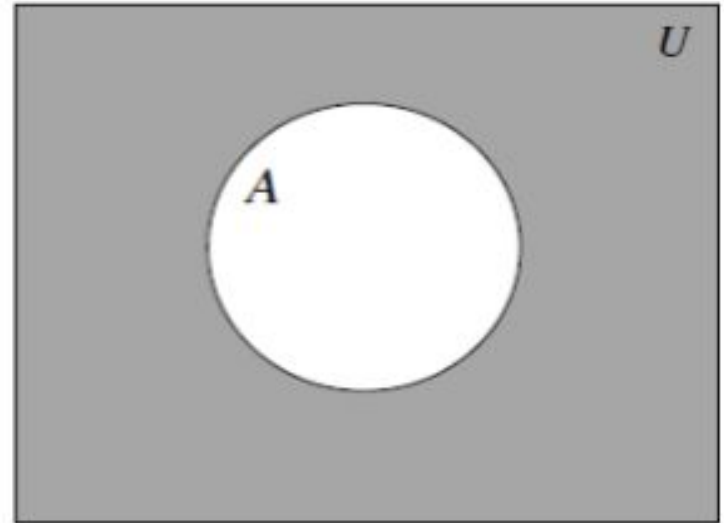
$$A' = U - A = \{x : x \in U \text{ and } x \notin A\}$$

example

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

$$A = \{3, 6\}$$

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



Sets. Practice!

What are the elements of the set expressed as:

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

Sets. Practice!

$$A = \{ x \mid x \in \mathbb{N}, x < 4 \}$$

$$B = \{ x \mid x \in \mathbb{N}, x > 11, x \leq 15 \}$$

What is $A \cup B$?

Sets. Practice!

What is $A - B$?

Let A = set of characters from “different”

Let B = set of characters from “effort”

THE END
