

Announcements:

- Office Hours 2-3PM on Mon/Fri
in LSK 300 (next to MLC)
- Email: ksankar@math.ubc.ca.

Reminder: Last time,

if P, Q statements $\leadsto$

- $P \wedge Q$ "P and Q"
- $P \vee Q$ "P or Q"
- $\neg P$ "not P"

Now Can form compound statements
like $\neg(\neg P \wedge (P \vee (\neg Q)))$

Exercise: Compute truth tables for $\neg(P \wedge Q)$
and $(\neg P) \vee (\neg Q)$

P	Q	$P \wedge Q$	$\neg(P \wedge Q)$	$\neg P$	$\neg Q$	$(\neg P) \vee (\neg Q)$
T	T	T	F	F	F	F
T	F	F	T	F	T	T
F	T	F	T	T	F	T
F	F	F	T	T	T	T

Definition: Two compound statements are logically equivalent when they have the same truth table.
(Written $\equiv$)

De Morgan's Law: $\sim(P \wedge Q) \equiv (\sim P) \vee (\sim Q)$

"not (P and Q) is equivalent to (not P) or (not Q)"

we showed this.

$\longrightarrow \sim(P \wedge Q) \equiv (\sim P) \vee (\sim Q)$
"-----"

Exercise: Negate the following

• 5 is even and 3 is prime
P ^ Q

• At least one of my friends is here.

$\exists$ friend here $\leftarrow$ will appear later in course.

Exercise: Construct a truth table for $(P \vee Q) \wedge$

At least one is true

$\sim(P \wedge Q)$

But not both

Answers: • $\sim(P \wedge Q) \equiv (\sim P) \vee (\sim Q)$

"5 is odd or 3 is not prime"

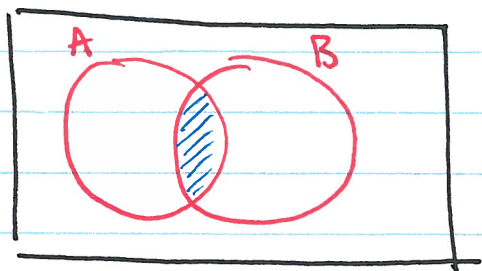
- None of my friends are here

P	Q	$(P \vee Q) \wedge \sim(P \wedge Q)$	"exclusive or"
T	T	F	
T	F	T	
F	T	T	
F	F	F	"xor"

Connection to

Sets:

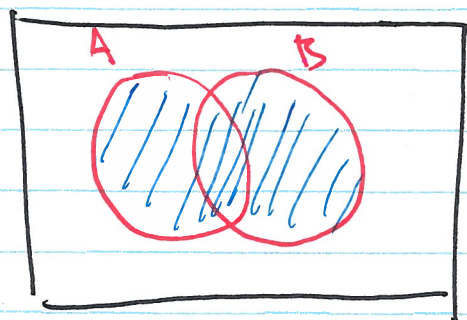
Given sets A & B ,



Intersection: $A \cap B$

$$= \{x \mid (x \in A) \wedge (x \in B)\}$$

"The set of x such that
 x is in A and x is in B "



Union: $A \cup B = \{x \mid (x \in A) \vee (x \in B)\}$

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

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

Implies: Given P and Q, can form
(Conditional) $P \Rightarrow Q$

"If P then Q"

"P implies Q"

Ex: P = "It is cloudy today"

Q = "It is raining today"

$(P \Rightarrow Q)$ = "If it's cloudy today, then it's raining today."

Ex: "If n is a multiple of 6 then n is even." } Always true!
these depend on n

P	Q	$P \Rightarrow Q$
T	T	T } the good case
T	F	F } "broken promise"
F	T	T } it's not false, so it's true.
F	F	T

Exercise: Can you find a compound statement using $\wedge, \vee, \neg$ equivalent to $P \Rightarrow Q$?