

Conditional Statements

If... then...

Given statements P and Q, we can form a new statement "If P, then Q".

- ▶ If (it is raining), then (it is cloudy).
- ▶ If (a number is divisible by 6), then (it is even).

These are called **conditional statements**.

Symbolically

$$P \Rightarrow Q$$

$$P \Rightarrow Q$$

"If P, then Q".

If... then..

Truth of the first statement forces truth of the second statement.

If it is raining then it is cloudy

P: It is Raining @ P true force

Q: It is Cloudy Q to be true

P	Q	$P \Rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

If is a number
is divisible by 6
then it is divisible
by 12.

Alternatives

- ▶ If P, then Q ← if you pass the final then you pass the course
- ▶ Q if P you pass the course if you pass the final.
- ▶ Q whenever P you pass the course whenever you pass the final.
- ▶ Q, provided that P you pass the course provided that you pass the final.
- ▶ Whenever P, then also Q whenever you pass the final then also you pass the course.
- ▶ P is a sufficient condition for Q

Passing the final is a sufficient condition for passing the course.

It's enough to pass the final to pass the course.

P	Q	$P \Rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

more alternatives

- ▶ For Q, it is sufficient that P *to pass the course it is enough to pass the final.*
- ▶ Q is a necessary condition for P
- ▶ For P, it is necessary that Q *→*
- ▶ P only if Q *→ passed final only if passed course.*

→ passing the course is necessary to passing the final. ★

P (final)	Q (course)	$P \Rightarrow Q$
T	<u>T</u>	T
T	F	F
F	T	T
F	<u>F</u>	T

Example

A matrix is invertible provided that its determinant is non-zero.

Q

P

$$P \Rightarrow Q$$

If determinant non-zero then matrix is invertible.

Example

An integer is divisible by 8 only if it is divisible by 4.

P

Q

If an integer is divisible by 8 then it is divisible by 4

Example

Being a native born citizen over the age of 35 is sufficient to be eligible to be elected president of the US.

Being native born and over 35 \Rightarrow eligible to be elected.

Example

Being over the age of 35 is necessary to be elected president of the US.

If you are elected president, then you are over age 35.