

School of Computing Science and Engineering

Course Code : MATH2007

Course Name: Discrete Mathematics

Conditional Operators, Converse, Inverse and Contrapositive

By

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In this presentation we will discuss following things:

- Conditional Operator
- Biconditional Operator
- Converse ,Inverse and Contrapositive

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Implication /Conditional Operator

The *implication* $p \rightarrow q$ states that p implies q .
I.e., If p is true, then q is true; but if p is not true, then q could be either true or false.

E.g., let $p =$ “You study hard.”

$q =$ “You will get a good grade.”

$p \rightarrow q =$ “If you study hard, then you will get a good grade.”



$p \rightarrow q$ is **false** only when
 p is true but q is **not** true.

$p \rightarrow q$ does **not** say
that p causes q !

$p \rightarrow q$ does **not** require
that p or q are ever true!

E.g. “ $(1=0) \rightarrow$ pigs can fly” is TRUE!

p	q	$p \rightarrow q$
F	F	T
F	T	T
T	F	F
T	T	T

The
only
False
case!



Examples

“If this lecture ends, then the sun will rise tomorrow.” *True or False?*

“If Tuesday is a day of the week, then I am a penguin.” *True or False?*

“If $1+1=6$, then Bush is president.”
True or False?

“If the moon is made of green cheese, then I am richer than Bill Gates.” *True or False?*

Biconditional Operator

The *biconditional* $p \leftrightarrow q$ states that p is true *if and only if* (IFF) q is true.

p = “Trump wins the 2020 election.”

q = “Trump will be president for all of 2021.”

$p \leftrightarrow q$ = “If, and only if, Trump wins the 2020 election, Trump will be president for all of 2021.”

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Biconditional truth table

$p \leftrightarrow q$ means that p and q have the **same** truth value. Note this truth table is the exact **opposite** of \oplus 's!

$p \leftrightarrow q$ means $\neg(p \oplus q)$

$p \leftrightarrow q$ does **not** imply p and q are true, or cause each other.

p	q	$p \leftrightarrow q$
F	F	T
F	T	F
T	F	F
T	T	T

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Converse, Inverse, Contrapositive

Some terminology, for an implication $p \rightarrow q$:

Its *converse* is: $q \rightarrow p$.

Its *inverse* is: $\neg p \rightarrow \neg q$.

Its *contrapositive*: $\neg q \rightarrow \neg p$.

One of these three has the *same meaning* (same truth table

as $p \rightarrow q$. Can you figure out which?

Contrapositive

Assignment

- 1.State the converse,contapositive and inverse of conditional statement "If it snows today,I will ski tomorrow".
2. Determine whether following biconditional are true or false
 - a) $1 + 1$ if and only if monkeys can fly.
 - b) $0 > 1$ if and only if $2 > 1$.

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Video link:1.<https://www.youtube.com/watch?v=F3544ZyO-eU&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=16>

2.<https://www.youtube.com/watch?v=BNhp6LXncI0&list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS&index=20>

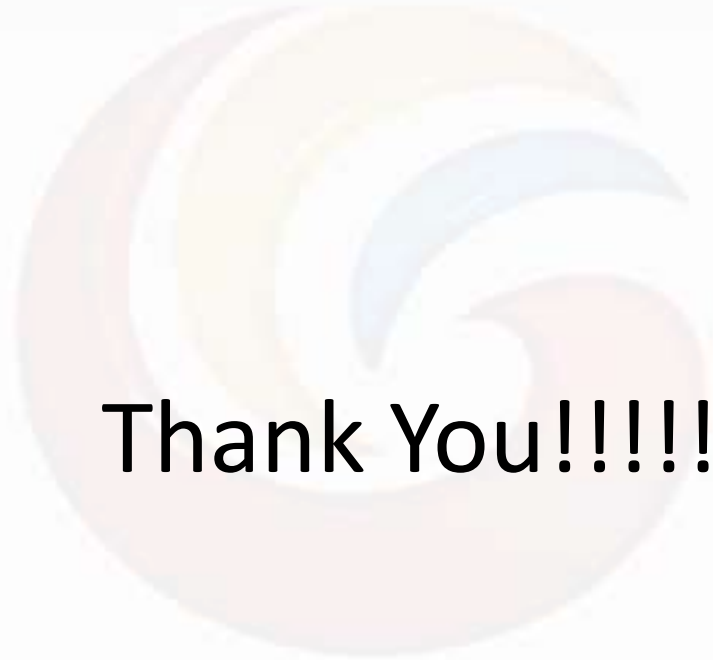
References: Discrete Mathematics and its application by Kenneth H Rosen

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Thank You!!!!

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