SMIT SIKKIM MANIPAL UNIVERSITY

SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

Engineering Mathematics III

Discrete Mathematics

Lecture 18

Mathematical Logic: Connectives, Truth Tables, Tautologies

This course is taught to Computer Science Engineering students in SMIT, India during Jun-Dec, 2019.

Today it is raining

Yes (True)

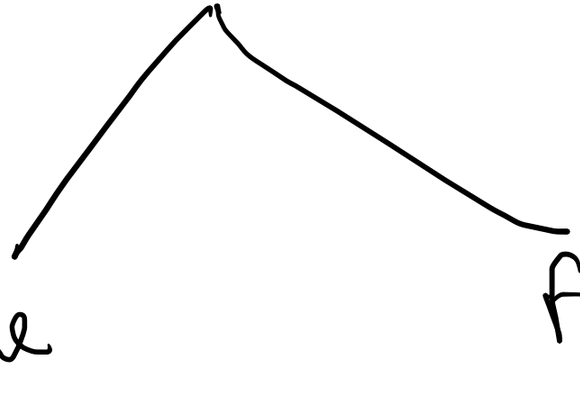
No (False)

Is it raining today? ⇒ not a statement

Statement or proposition

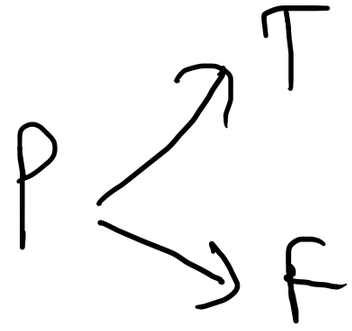
not a proposition

Statement (P)



P: Raja is a boy

q: Rani is a girl



Raja is a boy and Rani is a girl.

conjuctive

P and q

P or q

p — statement → atomic proposition

$p \wedge q$ — Compound proposition

$p \vee q$ — " "

$p \vee p$ — " "

$p \wedge p$ — " "

$p \vee (p \wedge q)$ — " "

Negation of a Statement:

p : My shirt is Red

$\sim p$, $\neg p$, $\bar{p}$: My Shirt is not Red.

p - proposition, q - proposition,

$p \wedge q$, $p \vee q$, $\sim p \wedge q$, $\sim p \vee q$,

$\sim(p \wedge q)$, $\sim(p \vee q)$ $\sim p \vee (p \vee q)$

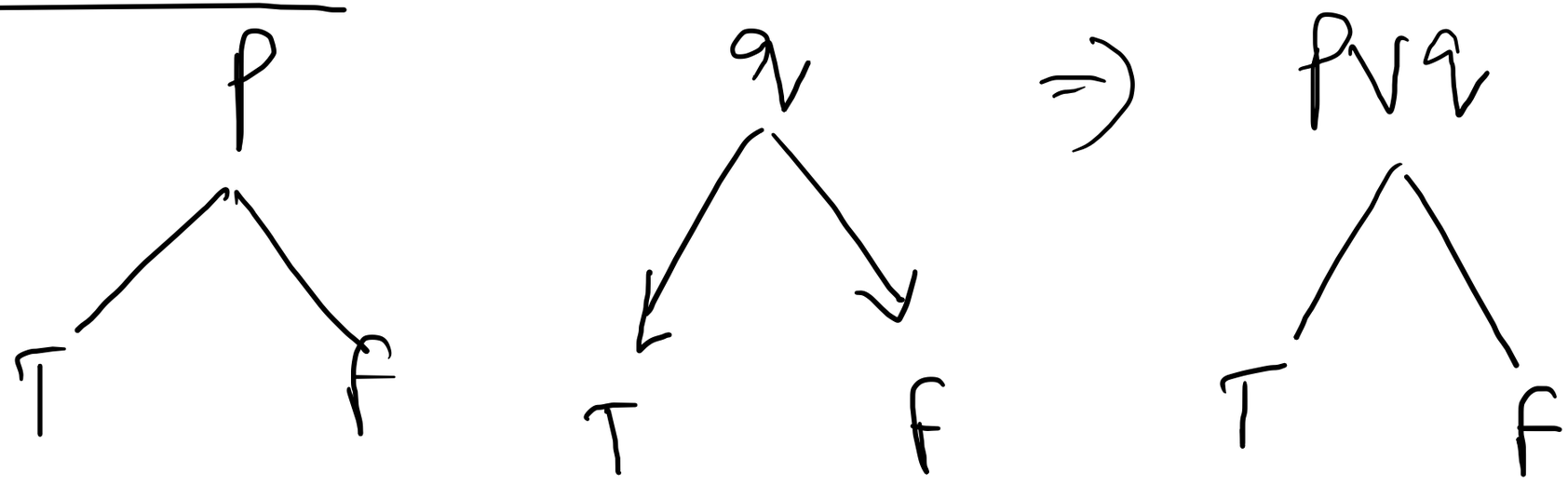
$\vee \rightarrow$ +, (or)

$\wedge \rightarrow$ ·, AND, and

$P \oplus q$ – Either P (or) q (but not both)

$P \dotplus q$ – Either P or q

Truth table:



p	q	p ∨ q
T		

Truth table of $p \vee q$

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

Truth table of $p \wedge q$:-

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

$\sim p$:-

p	$\sim p$
T	F
F	T

find the truth table of

$\overline{(p \vee q)}$

p	q	$p \vee q$	$\overline{p \vee q}$
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

$P \wedge (\sim P \vee Q)$ → Contra

P	Q	~P	~P ∨ Q	P ∧ (~P ∨ Q)
T	T	F	T	T
T	F	F	F	F
F	T	T	T	F
F	F	T	T	F

Neither tautology nor Contradiction.

$p \vee (\sim p)$

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

↓

Tautology

$p \wedge (\sim p)$

p	$\sim p$	$p \wedge (\sim p)$
T	f	f
f	T	f

↓

Contradiction.