Discrete Mathematics



DMS = Discrete Mathematic Structures

DS = Discrete Structures

D.M = D. Maths = Discrete maths

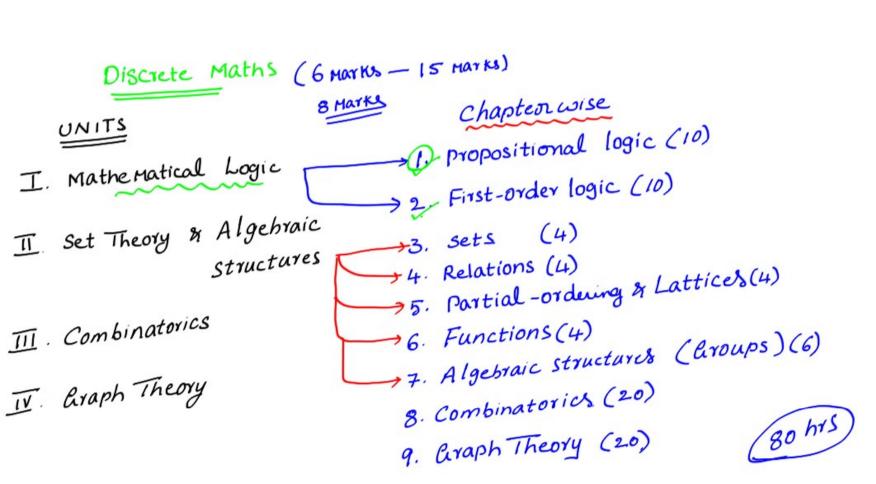
MFCS = Mathematical Foundations

for computer science

DS&T = Discrete Structures & Graph Theory

Discrete Maths	Engg. Maths
I. Mathematical Logic	1. Linear alg
II. Set theory & Algebra	2. calculus
III Combinatorics	3. Probability
IV Graph Theory	









Reference Books

- Discrete Mathematical Structure with Applications to Computer Science –
 Tremblay & Manohar
- 2/ Discrete Mathematics for Computer Scientist & Mathematicians Mott, Kandell & Baker.
- 3 Discrete Mathematics Kenneth Rosen
- 4/ Discrete Mathematics C.L.Liu

LOGIC



Logic is the basis of all mathematical reasoning, and of all automated reasoning.

It has the practical applications

- To the design of computing machines
- To the specification of systems
- > To artificial intelligence
- > To programming languages and to other areas of computer science.



Propositions:-

A proposition is a declarative sentence (that is, a sentence that declares a fact) that is either true or false, But not both.

Eg:-





- 1. Washington D.C. is the capital of the united states of America. (T)
- 2. Bombay is the capital of India. (F)

$$3.1 + 1 = 2$$
 (T)

$$4.2 + 2 = 3$$
 (F)

Eg:-

- 1. What time is it? NOT proposition
- 2. Read this carefully

3.
$$x + 1 = 2$$

4.
$$x + y = z$$

Propositional Variables

: p, q, r, s,

No. of Drop.

No. of bossy

Truth Values

: True \rightarrow T

2 --- 4

False \rightarrow F

 $3 \longrightarrow 8$

Propositional Calculus

: The area of logic that deals with propositions is called as

propositional logic (or) propositional calculus.

Compound Propositions: Many Mathematical statements are constructed by combining one or propositions by using logical operators, known as compound propositions.

Logical Operators:

 \wedge (and)

Conjunction

∨ (or)

Disjunction

 \rightarrow (Implies)

Implication

 \leftrightarrow (Bi-implies)

Bi-conditional

Negation:

p Mumbai is the capital of Maharashtra

~p): Mumbai is NOT the capital of Maharashtra

Simple propositions are combined with

logically connective "and (1)" then

the obtaine new proposition is

Known as conjunction

Р	9	PA9
I	T	T
T	F	F
F	T	F
F	F	F



Truth Table: Truth table for compound proposition

utuu	uth Table: Truth tooks jor								
						//	NOP	NAI	Boolean Sun
		2					THOL	La.	
P	2	PA9	pra	P->9	P+>9	/ 9→F	P19	Pla	P P 9
T.	T	T	T	T	T	T	F	F	F
T	-	E	T	F	F	T	F	T	T
1	7	<i>y</i> .		,	E	_	,	T	T
F	T	F	T	T	7	F	F	,	
r	E	E	E	T	T	T	T	T	F
	1		1	,	,	,	,		



Construct Truth Tables of the following compound proposition:

$$(5) \sim (\sim P) = TF$$

$$(6) \sim (\sim P \land \sim 9) \lor (P \land 9) = TFFT$$

$$(7) \sim (\sim P \lor 9) \land (P \lor \sim 9) = TFFT$$

$$(7) \sim (\sim P \lor 9) \land (P \lor \sim 9) = TFFT$$

$$(9)$$
 $PV \sim P = TT = always True$
 (9) $PV \sim P = FF = always False$

$$\sim (PVQ) \cong \sim PN\sim Q.$$

$$P\rightarrow Q \cong \sim PVQ$$

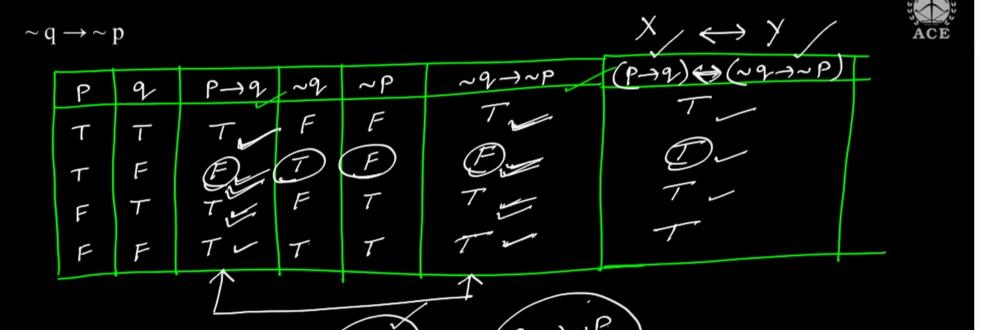
$$\sim (\sim P) \cong P$$

$$P \leftrightarrow Q \equiv (\sim PN\sim Q) \vee (PNQ) \equiv (\sim PVQ) \wedge (PV\sim Q)$$

(B) Pv(2→51)

P	12	/ n	9-) or	pv(9→1)
T	T	T		
T	T	F		
T	F	T		
T	F	F		
F	T	T		
F	T	F		
F	F	F	/	



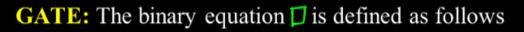




Logical Equivalence: Compound propositions that have the same truth values in all possible cases are called logically equivalent.

The compound propositions 'p' and 'q' are called logically is a Tautology equivalent if $p \leftrightarrow q$ is a tautology

 $X \cong Y$ if and only if $P \rightleftharpoons q$ Tautology



s poq poq p*q



p	q	p□q	
T	T	T	
T	F	T	
(F)/	(T)-/	(F)~	
F	F	T	

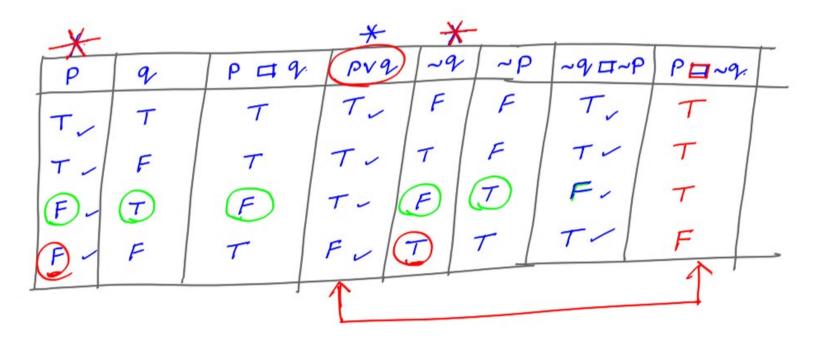
Then compound proposition $(p \lor q) \Leftrightarrow \cong$

$$a) \sim q \; \square \sim p$$



$$c) \sim q \ \Box \ p$$

$$pvq \cong a$$





PV9 = P = ~2



Tautology, Contradiction, Contingency, Satisfiable and Unsatisfiable:

Always TRUE = Tautology

Always False = Contradiction

Neither Tautology = Contingency
Nor contradiction

at least one TRUE = Satisfiable

NOT Satisfiable = un satisfiable.

* Every contingency is satisfiable, But converse need not be TRUE



Eg: Which of the following is NOT a Tautology



a)
$$\sim (p \to q) \to p$$
 c) $[\sim p \land (p \lor q)] \to q$

$$b) \sim (p \to q) \to \sim q \qquad \qquad d) \; (p \to q) \wedge q \to p$$

d)
$$(p \rightarrow q) \land q \rightarrow p$$

I. Touth table

II. Logical Approach

III. Ропореттіев (or) laws

