Goverment Engineering College Jhalawar

Model Question Paper - 1

Subject : Discrete mathematical Structure

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Branch - CS and IT

Semester - 2nd

Max Marks - 10

Do any four questions : Each question carry equal Marks.

Q-1 Show that the $(P \wedge q) \rightarrow (P \vee q)$ is a tautology.

Q-2 Make a truth table for each of the following

(i) $(P \vee q) \wedge r$ (ii) $(\sim P \vee q) \vee \sim r$

Q-3 Write contrapositive, converse and inverse of the statement

" The home team wins whenever it is raining.

Q-4 Show that the following argument is valid.

" If I try hard and have talent then I will become a musician. If I become a musician then I will be happy Therefore I will not be happy then either I do not try hard or have no talent.

Q-5 Verify the distributive laws by use of truth tabl

$$P \vee (q \wedge r) \equiv (P \vee q) \wedge (P \vee r)$$

Answer key

Ans→1 $(P \wedge q) \rightarrow (P \vee q) \equiv \sim(P \wedge q) \vee (P \vee q)$ [$\because P \rightarrow q \equiv \sim P \vee$

$\equiv (\sim P \vee \sim q) \vee (P \vee q)$ [Demorgan law

$\equiv [(\sim P \vee \sim q) \vee P] \vee q$ [by associative la

$\equiv [\sim P \vee (\sim q \vee P)] \vee q$ [by associative law

$\equiv [\sim P \vee (P \vee \sim q)] \vee q$ [by commutative la

$\equiv [(\sim P \vee P) \vee (\sim q \vee q)]$

$\equiv T \vee T$

$\equiv T$

Ans→2 Truth table of $(P \vee q) \wedge r$

P	q	r	P ∨ q	(P ∨ q) ∧ r
T	T	T	T	T
T	T	F	T	F
T	F	T	T	T
F	T	T	T	T
T	F	F	T	F
F	T	F	T	F
F	F	T	F	F
F	F	F	F	F

(ii) Truth table of $(\sim P \vee q) \wedge \sim r$

P	q	r	$\sim P$	$\sim P \vee q$	$\sim r$	$(\sim P \vee q) \wedge \sim r$
T	T	T	F	T	F	F
T	T	F	F	T	T	T
T	F	T	F	F	F	F
F	T	T	T	T	F	F
T	F	F	F	F	T	F
F	T	F	T	T	T	T
F	F	T	T	T	F	F
F	F	F	T	T	T	T

Ans-3: The given statement can be rewritten as

" If it is raining then the home team wins."

Let P: It is raining

q: The home team wins

Then the statement is of the form $P \to q$

(a) Its contrapositive is $\sim q \to \sim p$ i.e

"If the home team does not win then it is not raining."

(b) Its converse is $q \to p$ i.e

" If the home team wins then it is raining"

(c) Its inverse is $\sim p \to \sim q$ i.e

" If it is not raining then the home team does not win.

Ans 4: Let p: I try hard

q: I have talent

r: I become a musician

s: I will be happy

Premises → $p \wedge q \rightarrow r$

$r \rightarrow s$

conclusion → $\therefore \sim s \rightarrow \sim p \vee \sim q$

S.No.	Step	Reason
1	$p \wedge q \rightarrow r$	hypothesis
2	$r \rightarrow s$	hypothesis
3.	$p \wedge q \rightarrow s$	by hypothetical Syllogisms
4.	$\sim s \rightarrow \sim (p \wedge q)$	by contrapositive
5.	$\sim s \rightarrow \sim p \vee \sim q$	by demorgan law

Hence the argument is valid.

Ans - 5

p	q	r	$q \wedge r$	$p \vee (q \wedge r)$	$p \vee q$	$p \vee r$	$(p \vee q) \wedge (p \vee r)$
T	T	T	T	T	T	T	T
T	T	F	F	T	T	T	T
T	F	T	F	T	T	T	T
F	T	T	T	T	T	T	T
T	F	F	F	T	T	T	T
F	T	F	F	F	T	F	F
F	F	T	F	F	F	T	F
F	F	F	F	F	F	F	F