IQRA UNIVERSITY IU

FACULTY OF ENGINEERING SCIENCES AND TECHNOLOGY

Department: **Computer Science** Program: **BS**

DISCRETE STRUCTURES

Announced date: 15/8/2024 Due Date: 22/8/2024 Max Marks:05

ASSIGNMENT# 1			
Mapped CLO	**Mapped GA**	**Mapped Learning Level**	**SDG**
CLO1	GA 2 (Problem analysis)	C2 (Knowledge for solving computing problems)	4 & 9

ASSIGNMENT 1

1. Truth table questions.

a. $p \wedge \sim r \leftrightarrow q \vee r$

b. Show that the following statement forms are all logically equivalent:

$p \rightarrow q \vee r$, $p \wedge \sim q \rightarrow r$, and $p \wedge \sim r \rightarrow q$

2. Let the symbol $\oplus$ denote *exclusive or*; so $p \oplus q \equiv (p \vee q) \wedge \sim(p \wedge q)$. Hence the truth table for $p \oplus q$ is as follows:

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

a. Find simpler statement forms that are logically equivalent to $p \oplus p$ and $(p \oplus p) \oplus p$.

Is $(p \oplus q) \wedge r \equiv (p \wedge r) \oplus (q \wedge r)$? Justify your answer.

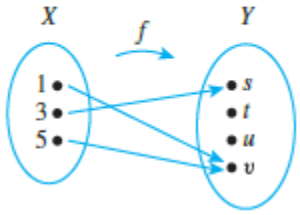
3.

Question: Proof by applying laws

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

4.

Let $X = \{1, 3, 5\}$ and $Y = \{s, t, u, v\}$. Define $f: X \to Y$ by the following arrow diagram.



a. Write the domain of f and the co-domain of f.
b. Find $f(1)$, $f(3)$, and $f(5)$.
c. What is the range of f?
d. Is 3 an inverse image of s? Is 1 an inverse image of u?
e. What is the inverse image of s? of u? of v?
f. Represent f as a set of ordered pairs.

5.

a. Define $f: \mathbf{Z} \to \mathbf{Z}$ by the rule $f(n) = 2n$, for every integer n.
(i) Is f one-to-one? Prove or give a counterexample.
(ii) Is f onto? Prove or give a counterexample.

6.

a. Define $H: \mathbf{R} \to \mathbf{R}$ by the rule $H(x) = x^2$, for each real number x.
(i) Is H one-to-one? Prove or give a counterexample.
(ii) Is H onto? Prove or give a counterexample.