UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Third Semester – Fall 2021

Roll No. .....

Paper: Discrete Mathematics (IT) **Course Code: MATH-231/IT-21404** **Time: 3 Hrs. Marks: 60**

Q.1. Solve the following: (15x2=30)

1. Find the total number of one-to-one functions, from a set with three elements to a set with four elements?
2. Define transitive relation.
3. Which term of the sequence 4,1,-2,... is -77?
4. Define tautology.
5. Suppose that f is defined recursively by $f(0) = 3, f(n + 1) = 2f(n) + 3$. Find $f(1)$?
6. Use DeMorgan's Laws to write the negation of $-1 < x \leq 4$ for $x \in R$.
7. Construct a truth table for the statement $(p \wedge q) \vee (\sim p \vee (p \wedge \sim q))$.
8. What is a statement?
9. Let R be a binary relation on a set A. Prove that If R is symmetric, then R^{-1} is symmetric.
10. Expand $(a-b)^3$.
11. Let R and S be reflexive relations on a set A. Prove SoR is reflexive.
12. Define a binary relation P from R to R as follows:
    for all real numbers x and y, $(x, y) \in P \Leftrightarrow x = y^2$. Is P a function? Explain.
13. Find x and y given $(2x, x + y) = (6, 2)$.
14. Find four binary relations from X = {a, b} to Y = {u, v} that are not functions.
15. Define inverse of function.

Q.2. Solve the following: (5x6=30)

1. Let $A = \{4,5,6\}$ and $B = \{5,6\}$ and define binary relations R and S from A to B as follows:
   for all $(x,y) \in A \times B, (x,y) \in R \Leftrightarrow x \geq y$
   for all $(x,y) \in A \times B, (x,y) \in S \Leftrightarrow 2|(x-y)$
   a). Represent R and S as a set of ordered pairs.
   b). Indicate whether R or S is a function.
2. Given any two distinct rational numbers r and s with $r < s$. Prove that there is a rational number x such that $r < x < s$.
3. Use mathematical induction to prove that $1+3+5+...+(2n-1) = n^2$ for all integers $n \geq 1$.
4. Let f: R $\rightarrow$R be defined by the rule $f(x) = x^3$. Show that f is a bijective.
5. Find the 8th term of the following geometric sequence 4, 12, 36, 108, …