

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	: CSE	Semester	:III
Title of the Course	:Discrete Structure	Course Code	:CSL 201

Time: 2 Hours

Maximum Marks: 25

1. If x, y are any two elements of a group G , then prove that $(xy)^{-1} = y^{-1}x^{-1}$. [3 Marks]
2. Let G be a set consisting of all the order pair (x, y) such that x, y belongs to R and $x \neq 0$. A composition $*$ is defined as follow:

$$(x, y) * (z, w) = (xz, yz + w)$$
 Then show that $(G, *)$ is a non-abelian group. [3 Marks]
3. Consider the function $g : R \rightarrow R$, $g(x) = x^2$. Do we also have that two distinct real's have distinct images? [2 Marks]
4. Let $f : X \rightarrow Y$ and $g : Y \rightarrow Z$ be two injective functions. Prove that $g \circ f$ is also injective. [3 Marks]
5. If you have 10 black socks and 10 white socks, and you are picking socks randomly, you will only need to pick three to find a matching pair. [2 Marks]
6. Prove that if x is a real number, then
7. Verify by truth table that $(P \text{ IMPLIES } Q) \text{ OR } (Q \text{ IMPLIES } P)$ is valid? [2 Marks]
8. Let P and Q be propositional formulas. Describe a single formula, R , using only AND's, OR's, NOT's, and copies of P and Q , such that R is valid iff P and Q are equivalent. [2 Marks]
9. A set of propositional formulas $P_1; : : : P_k$ is consistent iff there is an environment in which they are all true. Write a formula, S , so that the set $P_1; : : : P_k$ is not consistent iff S is valid. [2 Marks]
10. If A and B are sets, prove that $A \cup B = (A - B) \cup B$. [2 Marks]
11. If A, B, C and D are sets does it mean that $(A \oplus B) \oplus (C \oplus D) = (A \oplus D) \oplus (B \oplus C)$ [2 Marks]
12. Find the matrix of relation R from A to B and S from B to A relative to the ordering given and Also find the RS, SR, SRS and RSR using matrix. [2 Marks]
 - i. $R = \{(a, 1), (b, 2), (c, 3), (b, 3), (c, 4)\}$
 - ii. $S = \{(1, d), (3, c), (4, a), (2, b)\}$