



Autumn Midsemester Examination-2019

Discrete Mathematics [MA-2013]

Full Marks: 20

Time: 1.5 hours

Answer any four questions including question no.1 which is compulsory.

1. Answer all the following questions. [1 × 5]
 - (a) p : It is below freezing, q : It is snowing. What is the inverse of $p \longrightarrow q$?
 - (b) Write the negation of the statement “Some birds can not fly”.
 - (c) Let, p : Today is Monday, q : It is raining, r : It is hot. Write the word expression of $\neg(p \vee q) \longleftrightarrow r$.
 - (d) $[(p \longrightarrow q) \wedge \neg q] \longrightarrow \neg p$ is a tautology. Which rule of inference does it represent ?
 - (e) Write the reflexive closure and symmetric closure of a relation $R = \{(a, b) : a > b\}$.
2. [2.5 × 2]
 - (a) Show that, $[\neg p \wedge (p \vee q)] \longrightarrow q$ is a tautology.
 - (b) Using laws of proposition, show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent.
3. [2.5 × 2]
 - (a) Show that the following argument is valid using rules of inference.
Hypotheses: $\neg p \longleftrightarrow q$, $q \longrightarrow r$, $\neg r$ and Conclusion: p
 - (b) Derive the relevant conclusion or conclusions from the following hypotheses using rules of inference.
“All insects have six legs”, “Dragonflies are insects”, “Spiders do not have six legs”
4. [2.5 × 2]
 - (a) Among the first 500 positive integers, determine the number of integers which are neither divisible by 3, 7 nor 11.
 - (b) Let $A = \{1, 2, 3\}$ and $R = \{(1, 1), (1, 2), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$ be a relation defined on A . Is it reflexive ?symmetric ?antisymmetric ?transitive ?
5. [2.5 × 2]
 - (a) Using mathematical induction, prove that for every positive integer n ,
$$\sum_{k=1}^n k2^k = (n-1)2^{n+1} + 2$$
 - (b) Let $a_0 = 1$, $a_n = a_{n-1} + a_{n-2} + \dots + a_0 + 1$, prove that $a_n = 2^n$, $n \geq 1$ using method of strong induction.

—END—