

AUTUMN MID SEMETER EXAMINATION-2022

Subject: **Discrete Mathematics**

Code: **MA-2013**



Full Marks: 20

Time: 1.5 Hrs

Answer any FOUR QUESTIONS including question No. 1 which is compulsory. The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only

1. Answer the following questions [5×1=5]

- (a) Suppose x is a particular real number and p, q, r are the statements " $1 < x$ ", " $x < 5$ ", " $x = 5$ " respectively. Write the inequality $1 < x \leq 5$ by using propositional logic.
- (b) Write the negation of the statement "This computer program has a logical error or it is being run with an incomplete data set" using De Morgan's law.
- (c) Write the inverse of the conditional statement "An integer is divisible by 5 only if it is divisible by 15" in the form of "if...then...".
- (d) Test whether the argument "If it rains, the prices of vegetables go up", "The prices of vegetables go up", therefore "It rains" is valid.
- (e) Let $P(x)$: x is an odd integer and $Q(x)$: x is a prime integer. Write the statement "Some odd integers are prime" by using predicates and quantifier.

2. (a) Determine whether the statements $p \wedge (q \vee r)$ and $(p \wedge q) \vee r$ are logically equivalent. [2.5]

(b) Are these system specifications consistent? [2.5]

"Whenever the system software is being upgraded, users cannot access the file system. If users can access the file system, then they can save new files. If users cannot save new files, then the system software is not being upgraded."

3. (a) Use truth table to determine whether the following argument form is valid. [2.5]

$$\begin{array}{l} p \rightarrow q \\ \neg(p \vee r) \\ \therefore \neg p \end{array}$$

(b) Write the proposition "Not all real numbers are rational numbers" using predicate and quantifier. [2.5]

4. You are about to leave for your class and discover that you don't have your glasses. You know the following statements are true. [5]

"If I was reading the newspaper in the kitchen, then my glasses are on the kitchen table."
"If my glasses are on the kitchen table, then I saw them at breakfast." "I did not see my glasses at breakfast." "I was reading the newspaper in the living room or in the kitchen."
"If I was reading the newspaper in the living room then my glasses are on the coffee table."

Where are the glasses?

5. What is principle of strong induction? Use strong induction to show that every positive integer can be written as a sum of distinct powers of two. [5]
