B. Tech.
_ Semester (_*AB & Back) Spring 2023-2024 (*SAS)

MID SEMETER EXAMINATION, SPRING 2023-2024
Subject: Discrete Mathematics
Code: MA21002

Full Marks: 20 **Time: 90 minutes**

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.
All parts of a question should be answered at one place only.

Q.1 **Answer the following Questions**

a) What is the negation of the proposition "At least 10 inches of rain fell today in Miami?" [1]

b) Translate the proposition "Not everyone is perfect" into a logical expression. [1]

c) Let p: It is below freezing. q: It is snowing. [1]
Write the following proposition using p and q and logical connectives.
That it is below freezing is necessary and sufficient for it to be snowing.

d) State which rule(s) of inference is/are used in the argument: "All men are mortal. Socrates is a man. Therefore, Socrates is mortal." [1]

e) Let $R = \{(1,1), (1,3), (2,1),), (2,2)\}$ and $S = \{(1,2), (2,3), (3,1), (3,3)\}$ are two relations defined on a set $\{1,2,3\}$. Find the composite relations $S\ o\ R$ and $R\ o\ S$. [1]

Q.2

a) 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."

b) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology by developing a series of logical equivalences. [2.5]

Q.3

a) Determine whether the relation $R = \{(x, y): x + y = 0\}$ on the set of real numbers is reflexive, symmetric, anti-symmetric or transitive. Justify your answer. [2.5]

b) Using method of induction, prove that $n^2 - 1$ is divisible by 8 whenever n is an odd positive integer. [2.5]

Q.4

a) There are 2504 computer science students at a school. Of these, 1876 have taken a course in PASCAL, 999 have taken a course in FORTRAN, and 345 have taken a course in C. Further, 876 have taken courses in both PASCAL and FORTRAN, 231 have taken courses in both FORTRAN and C, and 290 have taken courses in both PASCAL and C. If 189 of these students have taken all three courses, how many of them have not taken a course in any of these three subjects? [2.5]

b) Using the rules of inference show that the following argument is valid. [2.5]
"If today is Tuesday, I have a test of Mathematics or Economics. If my Economics Professor is sick, I will not have a test of Economics. Today is Tuesday and my Economics Professor is sick. Therefore, I have a test of Mathematics."

Q.5 Find reflexive closure and symmetric closure of the relation $R = \{(2,1), (2,3), (3,1), (3,4), (4,1), (4,3)\}$ on the set $\{1,2,3,4\}$. Use Warshall's algorithm to find the transitive closure of R. [5]

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