



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) Determine the truth value of each of these statements if the domain consists of all real numbers.
 - (i) $\exists x(x^2 = 2)$
 - (ii) $\forall x(2x \geq x)$
 - (b) State which rules of inference is used in the argument: "It is either hotter than 40 degrees today or the pollution is dangerous. It is less than 40 degrees outside today. Therefore, the pollution is dangerous."
 - (c) Let p and q be the propositions
 p : You drive over 80 Km per hour. q : You get a speeding ticket.
 Translate the English sentence into propositional logic. "Driving over 80 km per hour is sufficient for getting a speeding ticket."
 - (d) Find the number of reflexive or symmetric relations on a set with 3 distinct elements.
 - (e) What rule of inference used in the proof technique in mathematical induction?
2. (a) Are these system specifications consistent? "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]

 (b) Express the negation of the proposition "There is someone in this class who does not have a good attitude" using quantifiers, and then express the negation in English. [2]
3. (a) What is strong mathematical induction? Use it to prove every positive integer has a binary representation. [3]

 (b) Let, p : I bought a lottery ticket this week and q : I won the million-dollar jackpot, are two propositions. Express the compound proposition $\neg p \vee (p \wedge q)$ as a simple English sentence. [2]
4. (a) If R and S are relations defined on the set of integers given by $R = \{(x, y) | x > y\}$ and $S = \{(x, y) | x < y\}$ then find $R \cup S$, $R \cap S$, $R - S$ and $S \circ R$. [3]

 (b) Find number of positive integers not exceeding 600 that are divisible by 4 or 6 or 7. [2]
5. You are about to leave for your class and discover that you do not have your glasses. You know the following statements are true.
 "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]