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PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester Session 2022-23 CT1

B. Tech. 3rd Semester

Discrete Structures & Theory of Logic (KCS-303)

CO umber	Course Outcome
CO1	Define **[1.Knowledge]** various discrete structures, basic properties of lattices, modern algebra, graphs & trees, can count using advanced counting computing techniques like generating functions and recurrence relation so that they can study the problems
CO2	Discuss **[2.Comprehension]** the basic concepts of sets, various relations & functions, modern algebra and express the arrangements of basic elements of circuits using Boolean algebra.
CO3	Employ **[3.Application]** their logical ability such as reasoning, logical deduction and examine the correctness of algorithms, setup mathematical model real life problem by applying advanced counting/computing techniques like generating functions and recurrence relations which in turn will increase their problem solving approach as well as their programming skills.

Time: 1.5 Hrs. M. M. 15

Section A

tempt all questions: **(1X3 = 3 Marks)**

If A and B are sets, then find the value of $(A \cap B) \cup (A \cap \sim B)$ using set identities. CO1

Find the Negation of the following predicate statement $(\forall x)(\exists y)(P(x) \vee Q(y))$ CO1

Given that $p \rightarrow q$ is False, then identify whether $(\neg p \vee \neg q) \rightarrow q$ is True or False. CO1

Section B

mpt all questions: **(2X4 = 8 Marks)**

dentify the truth table of the compound statement $(\urcorner P \vee Q) \leftrightarrow (Q \rightarrow R)$ CO2

Or

Show the following equivalence without using truth table $P \rightarrow (Q \rightarrow R) \Leftrightarrow (P \wedge Q) \rightarrow R$ CO2

Show that $R \rightarrow S$ can be derived from the premises $P \rightarrow (Q \rightarrow S)$, $\neg R \vee P$ and Q CO2

Or

Show that the following premises $P \vee (Q \rightarrow S)$, $\urcorner R \rightarrow (S \rightarrow A)$, $P \rightarrow R$ and $\urcorner R$, leads to the conclusion: $Q \rightarrow A$ CO2 c i) Identify whether the following relations defined on the set $X = \{1,2,3,4\}$ are reflexive, symmetric, transitive and/or antisymmetric? Determine for every relation separately. CO2

(i) $R_1 = \{ (1,1), (1,2), (2,1) \}$

(ii) $R_2 = \{ (1,1), (1,2), (1,4), (2,1), (2,2), (3,3), (4,1), (4,4) \}$

(iii) $R_3 = \{ (2,1), (3,1), (3,2), (4,1), (4,2), (4,3) \}$

Or

ii) Show in general that A X (B- C) = A X B - A X C, where A,B,C are any sets CO2

d i) Translate the following statements in quantified expressions of predicate logic CO2

(i) No Camel can speak Hindi.
(ii) For every number there is a number greater than that number.
(iii) Not every student is perfect.
(iv) There is no student in the class who knows Java and Python.

Or

ii) Let $S = \{(x,3),(y,2),(z,3)\}$ and $T = \{(w,2),(x,4),(y,3)\}$ be the multisets. CO2

Estimate the following sets

(i) $S \cup T$ (ii) $S - T$ (iii) $T - S$ (iv) $S \cap T$

Section C

(4X1 = 4 Marks)

Q3.

i) Let S be a relation on set of real numbers, such that CO3

$S=\{(x,y) : |x-y| <1\}$, i.e. $(x, y)\in S$ such that $|x-y| <1$.

Identify whether it is an equivalence relation or not. Also Demonstrate Partial order relation.

Or

ii) Show that from the following premises: CO3

$(\forall x)\ (P(x) \vee Q(x))$, $(\forall x)\ (\neg Q(x) \vee R(x))$, $(\forall x)\ (S(x) \rightarrow \neg R(x))$ and $(\exists x) \neg P(x)$

The conclusion follows is $(\exists x) \neg S(x)$