	Course:	Discrete Structures	Course Code:	CS1005
STATE OF THE STATE	Program:	BSE	Semester:	Spring 22
	Duration:	180 mins	Total Marks:	30
	Paper Date:	24-03-2022	Weightage	15
	Section:	2A, 4A, 4B	Page(s):	01
	Exam:	Mid-I	Roll No:	20L-10

- 1. Whether $(\neg q \land (p \rightarrow q)) \rightarrow \neg p$ is tautology or not? Prove or disprove it. (5)
- Translate each of these statements into logical expressions using predicates, quantifiers and logical connectives. Let the domain consist of all people.(6)
 - a. Someone in your class can speak Urdu.
 - b. Everyone in your class is friendly.
 - c. There is a person in your class who was not born in Pakistan.
- 3. Explain the rules of inference and draw conclusion. (5)

"If I eat spicy foods, then I have strange dreams." "I have strange dreams if there is thunder while I sleep." "I did not have strange dreams."

a. Find a counterexample, if possible, to this universally quantified statement,
where the domain for all variables consists of all integers.

$$\forall x \exists y (y^2 - x < 1000)$$

/4.

- b. Negate the following statement: If n is even, then $\frac{n}{2}$ is an integer.
- Prove the distributive law A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C) without using membership table.
- 6. Translate following by using logical connectives: (4)
 - a. You get an A on the final, but you don't do every exercise in this book nevertheless, you get an A in this class.
 - b. The difference of two negative integers is not necessarily negative.

GOOD LUCK

National University of Computer and Emerging Sciences, Lahore Campus CS1005 Course Code: Discrete Structures Course: Spring 22 Semester: BSE Program: Total Marks: 30 60 mins Duration: 15 Weightage 09-05-2022 Paper Date: Page(s): 2A,4B,4A Section: Roll No: Mid-II Exam: Attempt All Questions(Each question carry five marks) Instruction/Notes:

- 1. Show that $2^{2n}-1$ is divisible by 3 by using mathematical induction where n is positive integer.
 - a) What is the statement P(1)?
 - b) Show that P(1) is true, completing the basis step of the proof.
 - c) What is the inductive hypothesis?
 - d) What do you need to prove in the inductive step?
 - e) Complete the inductive step.

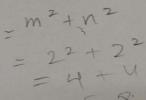
2. Prove that √2 is irrational number. Contradiction.

3. Let m be an integer with m > 1. Show that the relation $R = \{(a, b) \mid a \equiv b \pmod{m}\}$ is an equivalence relation on the set of integers.

4. Let R and S be relations on a set A represented by the matrices

$$M_{R} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} , M_{S} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Find a) $R \circ S$ b) $R \cup S$



5. Determine whether the function $f: \mathbb{Z} \times \mathbb{Z} \to \mathbb{Z}$ is bijective if

 $\mathbf{a)}\,f\left(m,\,n\right)=\,m\,+\,n$

b) $f(m, n) = m^2 + n^2$

6. Given the matrix representing a relation on a finite set, Write code fragment to determine whether the relation is symmetric and/or antisymmetric.

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