

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

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.

$2^{2 \cdot 4} - 1$

2. Prove that $\sqrt{2}$ 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

$$M_R = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}, \quad M_S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

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

$$= m^2 + n^2 \\ = 2^2 + 2^2 \\ = 4 + 4 \\ = 8$$

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

a) $f(m, n) = m + n$

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.

GOOD LUCK