Indian Institute of Information Technology Allahabad
Discrete Mathematical Structures
C1 Review test

Program: B.Tech. 2nd Semester (IT+IB)
Duration: **60+ 10 minutes** Full Marks: 16
Date: May 22, 2022 Time:: 5:00 PM - 6:10 PM

Important Instructions:

1. Attempt all the questions.
2. Write down your name and enrolment number. Write the solutions clearly with all the steps in details.
3. Submit the solution in PDF format through Google Classroom. **Name the PDF as DMS-your enrolment number**. We will not accept the solution through emails.

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1. Let us define sets A and B as follows:

$$A = \{\textbf{Your first name}\} \text{ and } B = \{\textbf{ Your last name}\}$$

In the absense of last name, take $B = \{l, a, s, t, n, m, e\}$
For example: if your name is **Peter Massopust**, then $A = \{p, e, t, r\}$ and $B = \{m, a, s, o, p, u, t\}$.

Now, define $C = A \cup B$ and $D = A \cap B$. Then

(I) Construct two distinct partial order relations (name these relations R_1 and R_2 respectively) on C. [4]

(II) Find all maximal and minimal elements of the constructed partial ordered sets (C, R_1) and (C, R_2). [4]

(III) Find the supremum and infimum (if they exist) of the constructed partial ordered sets (C, R_1) and (C, R_2). [2]

(IV) Determine whether the following sets are finite, countably infinite (countable) or uncountable: [3]

(a) $X =$ the collection of all functions from C to D.

(b) $Y =$ the collection of all functions from C to $\mathbb{N}$, where $\mathbb{N}$ denotes the set of natural numbers.

(c) $Z =$ the collection of all functions from $\mathbb{N}$ to C.

2. Let $n \in \mathbb{N}$ and suppose we are given real numbers $a_1 \geq a_2 \geq \ldots \geq a_n \geq 0$. Show that Arithmetic mean (AM) $= \frac{a_1+a_2+\ldots a_n}{2} \geq (a_1 a_2 \ldots a_n)^{\frac{1}{n}} =$ GM (Geometric mean). [3]