

**School of Mathematical and Computational Sciences  
Indian Association for the Cultivation of Science**

*Master's/Integrated Master's-PhD Program/ Integrated  
Bachelor's-Master's Program/PhD Course*

**Theory of Computation II: COM 5108**

*Tutorial III (24 August 2023)*

*Instructor: Goutam Biswas*

*Autumn Semester 2023*

1. Use *diagonalization*(directly) to show that there is no bijection from  $\mathbb{N} \rightarrow \mathcal{P}\mathbb{N}$ .
2. Use *diagonalization* to prove that there is no bijection from  $\mathbb{N}$  to  $[0, 1)$ .
3. Use *diagonalization* to prove that the language

$$H = \{ \langle M, x \rangle : \text{the DTM } M \text{ halts on input } x \}.$$

is not *decidable*(*recursive*).