Kathmandu University

Term Test-I - 2025

Subject: **MCSC - 201 (Discrete Mathematics)**

Year/ Sem - II/I | Time : 1 Hr

Group: C. E. | F.M. : 20

Attempt ALL questions.

1. Define Characteristic function. Prove that $f_{A \cup B} = f_A + f_B - f_A f_B$, symbols have their usual meaning. **(1+3)**

2. State the "Division Algorithm Theorem" for integer. Also, use Euclidian algorithm to find GCD of 2045 and 2450 and express it as combination of given numbers. **(1 + 1 +2)**

3. Prove by mathematical induction:
   (a) If $A_1, A_2, \ldots, A_n$ are n sets, then $\overline{(\bigcap_1^n A_i)} = (\bigcup_1^n \overline{A_i})$ for $n \geq 2$
   (b) $\mathbf{n! \geq 2^{n-1}}$ for all $n \geq 1$ **(2+ 2)**

4. Define the Boolean matrix. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ prove that:

   $(A \odot B) \odot C = A \odot (B \odot C)$. **(1+ 3)**

5. Define matrix of relation on a set. R be the relation on A ={a, b, c } whose matrix is $M_R = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$. Draw digraph of R and find the in degree and out degree of each vertices. **(1 + 3)**

The End