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* Discrete Mathematics (DM) - Assignment Number - 2

Name :- Kaustubh Shrikant Kabra
Class :- Second Year Engineering
Div :- A Roll Number :-
Batch :-
Department :- Computer Department
College :- AISSMS's IOIT

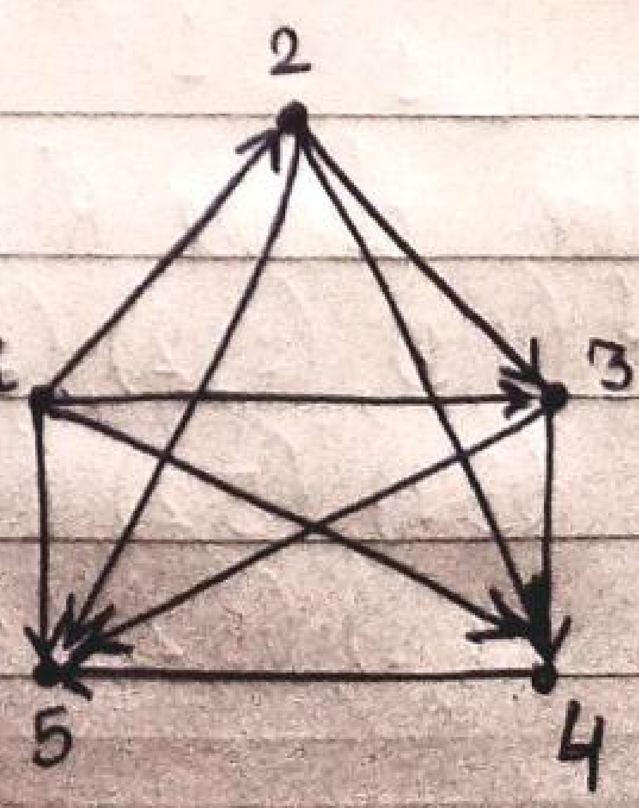
Q-1. Let $A = \{1, 2, 3, 4, 5\}$.
Define the following relation R on A aRb if and only if $a < b$.
Find :- i) R in roster form
ii) Domain and Range of R.
iii) Diagraph of R.

→ i) Let relation R be defined as -
$R = \{(a, b) \mid a < b\}$ on set A.
$\therefore R = \{(1,2), (1,3), (1,4), (1,5), (2,3), (2,4), (2,5), (3,4), (3,5), (4,5)\}$.

ii) Domain of R = Set of all first elements in R.
$= \{1, 2, 3, 4\}$.

Range of R = Set of all second elements in R
$= \{2, 3, 4, 5\}$.

iii) Diagraph of R -



Q-2. Let $R = \{(1,4), (2,5), (2,4), (4,3), (5,3), (3,2)\}$ on the set $A = \{1,2,3,4,5\}$. Use Warshall's algorithm to find transitive closer to R.

→ Let matrix representation of R be M_R.

$$\therefore M_R = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

$\therefore W_0 = M_R$.

For $k = 1$, place 1 is already in the position $(2,4)$, Hence $W_0 = W_1$.

For $k = 2$, place 1 in the position $(3,1)$, $(3,4)$, and $(3,5)$.

$$\therefore W_2 = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

For $k = 3$ and then $k = 4$, we finally get

$$W_4 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

$\therefore$ Transitive closure R^+ will be -

$R^+ = \{(1,1), (1,2), (1,3), (1,4) (1,5), (2,1), (2,2) (2,3) (2,4), (2,5), (3,1), (3,2) (3,3), (3,4), (3,5), (4,1), (4,2), (4,3) (4,4), (4,5), (5,1), (5,2), (5,3), (5,4), (5,5)\}$.