National University of Computer and Emerging Sciences
Lahore Campus

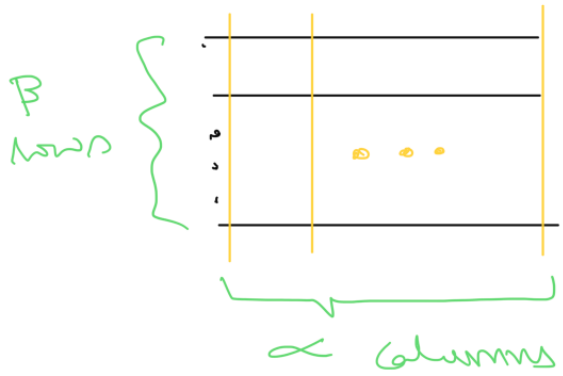
Quiz 6
Total Marks : 10
Time allowed: 10 Minute
Date: March 27, 2025
Section: BCS-6A

Q1: [10 Marks] For a two-dimensional mesh that has $\boldsymbol{\beta}$ number of rows and $\boldsymbol{\alpha}$ number of columns, what will be the communication cost of performing **all-to-all reduction**? In your expression clearly mention your assumptions and what each symbol means?

Solution:

Cost of all-to-all reduction will be same as cost of all-to-all broadcast because they are each other's dual.

(We are assuming cost of combining data is negligible as compared to t_w terms.)



$$\text{Columns Cost} = (t_s + (\alpha \cdot m) \cdot t_w)(\beta - 1)$$

$$\text{Rows Cost} = (t_s + m \cdot t_w)(\alpha - 1)$$

$$\text{Total Cost} = (\alpha + \beta - 2) \cdot t_s + (\alpha\beta - 1) \cdot m \cdot t_w$$