National University of Computer and Emerging Sciences, Lahore Campus

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Course:	Parallel and Distributed Computing	Course Code:	CS-3006
Program:	BS (Computer Science)	Semester:	Spring 2023
Duration:	30 Minutes	Total Marks:	12
Paper Date:	05-Apr-2023	Weight	2.5%
Section:	BCS (6E-6F)	Page(s):	2
Exam:	Quiz 2	Roll No.	

Name & Section:

Attempt all questions on the question paper. Rough sheets can be used but it should not be attached. If you think some information is missing then assume it and mention it clearly.

Question # 1: [2+2 marks, CLO # 3] – Basic Communication Operations

(i) **How is all-reduce different from total-exchange? Explain with the help of figures.**

All-Reduce:

- Use all-to-one reduction followed by one-to-all broadcast.
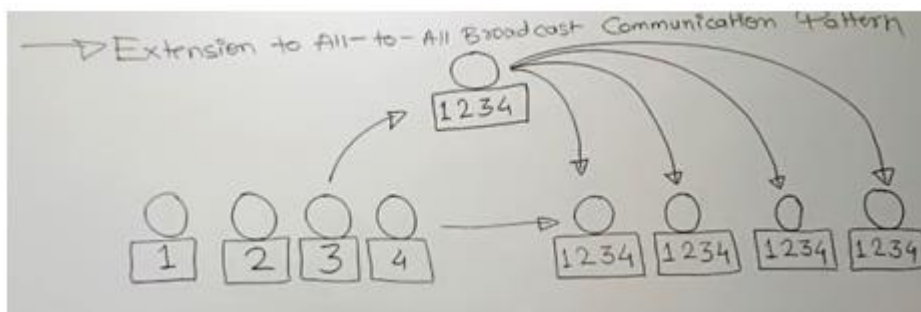
Total Exchange:

- Each node sends a distinct message of size m to every other node.

Question # 2: [2+3+3 marks, CLO # 3] – Basic Communication Operations

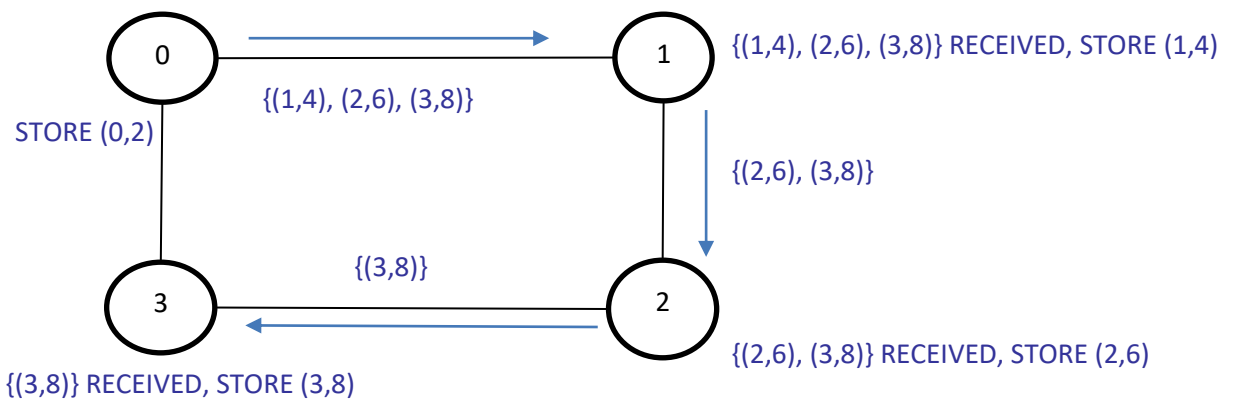Assume we have a 4*4 matrix with the following values:

2 4 6 8
1 3 5 7
10 12 14 16
11 13 15 17

Assume each row is stored at different processes, row 1 (2, 4, 6, 8) is stored at process P0, row 2 at P1, row 3 at P2, and row 4 (11, 13, 15, 17) at P3. We want to apply a matrix transpose. Describe:

(i)   The operation that needs to take place

        Total exchange (a form of all-to-all personalized communication)

(ii)   Draw the message originating from process P0 and show what happens at each step with this message

STORE (0,2)

0 →{(1,4), (2,6), (3,8)}→ 1   {(1,4), (2,6), (3,8)} RECEIVED, STORE (1,4)

{(2,6), (3,8)}

2   {(2,6), (3,8)} RECEIVED, STORE (2,6)

{(3,8)}

3 ← {(3,8)} RECEIVED, STORE (3,8)

(iii)   Draw the message originating from process P3 and show what happens at each step with this message

STORE (0,11)   0 →{(1,13), (2,15)}→ 1   STORE (1,13)

{(0,11), (1,13), (2,15)}   {(2,15)}

STORE (3,17)   3   2   STORE (3,17)