PMSCS Program
Department of Computer Science and Engineering
Jahangirnagar University
Final Examination Fall-2021

Answer Script
Total Page# 25

Course Information						
Course Title:	Parallel and Distributed Computing					
Course Code:	PMSCS-657		**Marks:**	30	**Time:**	1 Hour 30 Minutes

Instructions

1. Be present in the corresponding classroom at least 15 minutes prior.
2. Any form of unfair means or cheating (verbal communication, visual copying, unauthorized chit etc.) is a punishable offense.
3. You will not be allowed to use additional sheets. Limit your answer so that it fits within the allocated space.
4. Scan the whole answer script and turn in through Google Classroom.
5. Failing to upload the answer script within the given time span will be considered as disqualification.

Student Information	
Full Name:	ARIK MD ISTHIAQUE
Class Roll:	2024
Date:	09-02-2022

Office Use Only		
Questions	**Marks**	**Remarks**
1.		
2.		
3.		
4.		
Total		

Answer to the question number 1(a):

Parallelism: Parallelism refers to the simultaneous occurrence of events on a computer system. An event typically means one of the following

→ an arithmetical operation
→ a logical operation
→ I/O perform
→ memory accessing

Types of parallelism: There are 4 types of parallelism

① **Job level:** Here several independent Jobs run simultaneously on a system. Suppose a job is excuting and needs to perform I/O before it can

progress further. Then the original job resumes ~~after~~ after the I/O operation has completed.

(ii) program level: Here several tasks are performed simultaneously to solve a single common problem. ~~A example can be~~ A example can be the self charging robot, where the robot ~~find the port and plug~~ itself. Here finding is the combination vision & motion program.

(iii) Instruction level: If several similar ~~types of~~ instructions are to be performed their sub-instruction

Answer to the question number ~~1(b)~~: 1(a)

may be overlapped using a technique called pipelining.

8 (iv) Bit level: when the bits in a word are handled one after the other this is called a bit-serial operation. If the bits are acted on in parallel the operation is bit parallel.

Answer to the question number ~~1(c)~~ 1(b)

Message passing protocol: On message passing protocol their a is two mode-

① SOURCE: send(data, count, datatype, destination)

② DEST: receive(data, count, datatype, source)

Two message passing protocols are

① Synchronous ~~send~~ protocol → Here the send and receives routines overlap in time.

② Asynchronous protocol → Here, the send and receives do not necessarily overlap in time.

Answer to the question number ~~1(c):~~ 1(b)

MPI Point-to-Point Communication: MPI is a most-used method for message passing in a distributed memory concurrent system. Communication between pairs of process is called point to point communication. There are several Java versions of MPI. mpiJava is one of them. In mpiJava it is provided through the methods of the Comm class.

Answer to the question number 2(a):

Butterfly Network: A butterfly network consist of $(k+1)2^k$ nodes divided into $k+1$ rows.

Here, is a butterfly network of $k=3$

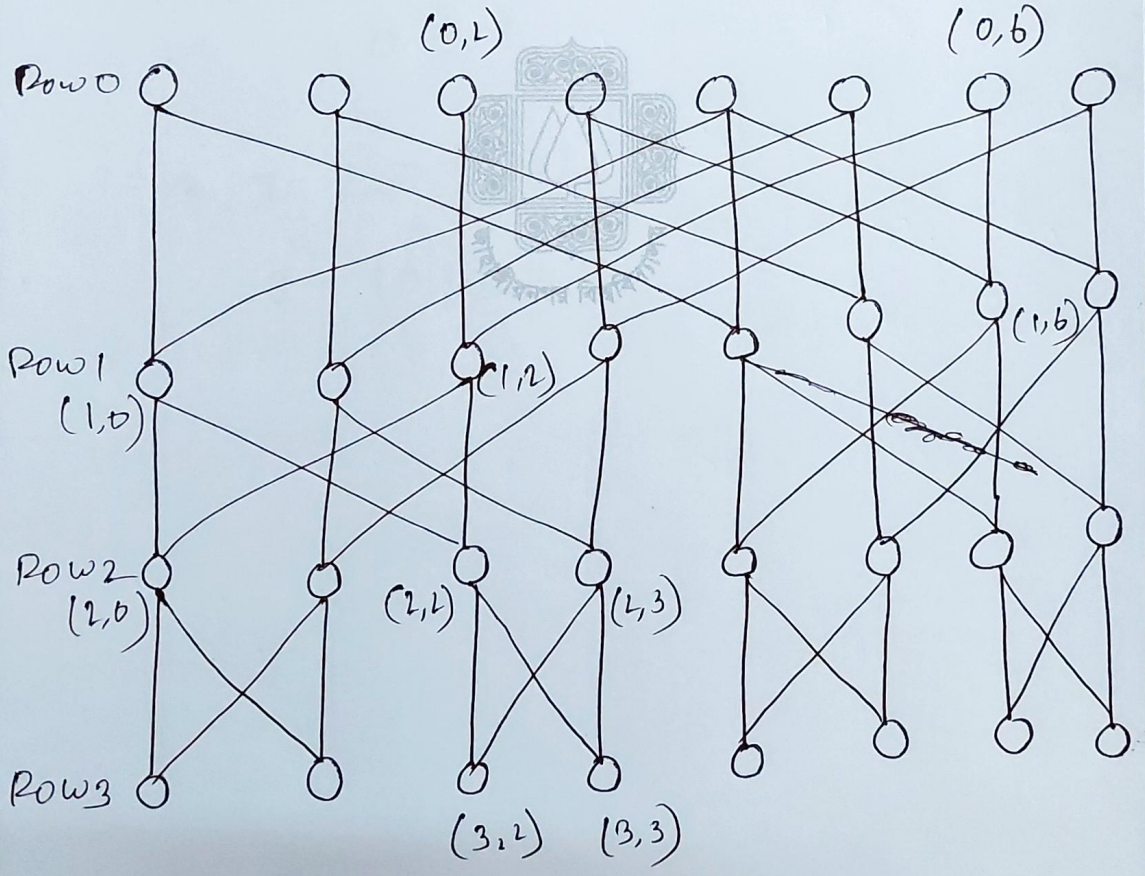

fig: A butterfly Network

Answer to the question number 2(a):

Here,

$i = 1, J = 2 = (010)_2$

$J' = (110)_2 = 6$

$i = 2, J = 2 = (010)_2$

$J' = (000)_2$

$= 0$

$i = 3, J = 2 = (010)_2$

$J' = (011)_2 = 3$

Answer to the question number 2(b):

Scalability: It is a measure of how effectively an algorithm makes use of additional processors. There are 3 types of scalability-

① **Scalable:** if it is possible to keep the efficiency constant by increasing the ~~na~~ problem size as the number of processor increased.

② **Perfectly scalable:** if the efficiency remain ~~stable~~ constant when the problem size and number of processors increased by the same factor.

Answer to the question number 2(b):

(3) Highly Scalable: if the efficiency depends ~~on~~ weakly on the number of processors when the problem size and the number of processor increased by the same factor.

Answer to the question number 2(c):

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Answer to the question number 2(c):

P.T.O

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Answer to the question number 3(a):

Interprocessor communication: In a parallel program their needs to have a some means of sharing data and results processed by different processors. There are two ways to to this process

① **Shared memory:** It consists of a global address space. All the processors can be read from and write into this global address space

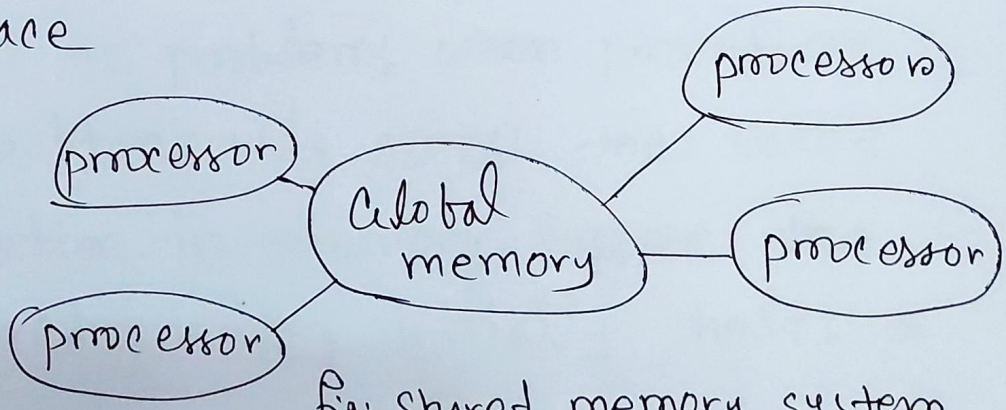

fig: Shared memory system.

Answer to the question number 3(a):

② Message passing: Here each processor has it own private memory and connected by a interconnected network.

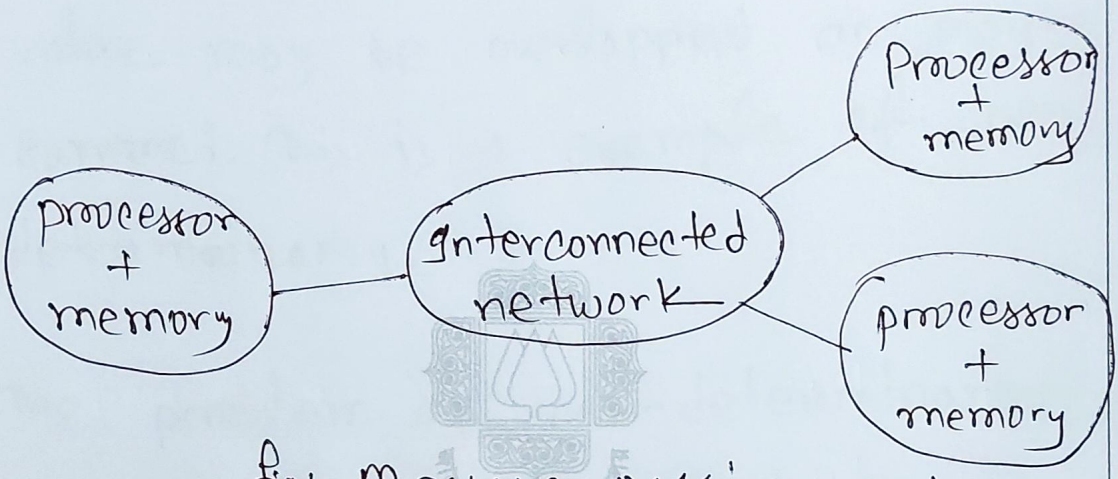

fig: Message passing system.

Shared memory Conflicts: The shared memory approach is simple but can lead to problems when processors simultaneously access the same location in memory. Suppose the shared memory initially holds a

Answer to the question number ~~3(b):~~ 3(a)

holds a variable x with value 0. Processor 1 adds 1 to x and processor 2 adds 2 to x. Then then the final value may be overlapped or maybe summed. This is a example of non determinancy.

The problem of non-determinancy can be solved by synchronising the use of shared data. That is if x = x+1 and x = x+2 were mutually exclusive then the final value of x would alway be 3.

Answer to the question number 3(b):

Shuffle-Exchange Network

Here $k=4$ mean it has $n = 2^4 = 16$ nodes.

So, the noter are $0, 1, \ldots, 15$

① First divide the noter into two half. So the 1st half will become $0, 4, 1, 5, 2, 6, 3, 7$

(ii) The final position of a node can be found by following the shuffle link.

(iii) Let the $a_{n-1}, a_{n-2}, \ldots, a_1, a_0$ is the all the address of nodes in binary

Answer to the question number ~~2(c)~~: 3(b)

(iv) After a shuffle we can get the position of the node and we get back to the initial node from where we pass and get a necklace.

Answer to the question number 3(c):

Answer to the question number 4(a):

Answer to the question number 4(b):

Answer to the question number 4(b):

Answer to the question number 4(c):

Answer to the question number 4(c):

Answer to the question number 4(c):