National University of Computer and Emerging Sciences, Lahore Campus

Course:	Parallel and Distributed Computing	Course Code:	CS-3006
Program:	BS (Computer Science)	Semester:	Spring 2023
Duration:	15 Minutes	Total Marks:	12
Paper Date:	20-Feb-2023	Weight	2.5%
Section:	BCS (6E-6F)	Page(s):	2
Exam:	Quiz 01-B	Roll No.	

Name & Section: SOLUTION

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: [4 marks, CLO # 1]

Choose the correct option.

1. With the NUMA architecture, memory access times:
   a. Do not vary due to the disjoint local address spaces
   b. Vary significantly due to the disjoint local address spaces
   c. Do not vary depending on the physical location of the referenced address
   (d.) Vary significantly depending on the physical location of the referenced address

2. The _____ of a task-_____ graph is usually a _____ of the _____ of the task-dependency graph:
   a. edge-set; interaction; superset; nodes
   b. edge-set; mapping; subset; edge-set
   (c.) edge-set; interaction; superset; edge-set
   d. edge-set; interaction; subset; edge-set

3. Most modern day parallel architectures would fall under which category of Flynn's taxonomy?
   a. SISD
   b. MISD
   c. SIMD
   (d.) MIMD

4. What value may assist us in finding out if parallel overhead exists when running a program using multiple processors in parallel?
   (a.) Karp-Flatt Metric
   b. Theoretical Speedup (Amdahl's Law)
   c. Moore's Law
   d. Fraction of the program that is parallelizable

Question # 2: [5 marks, CLO # 1] – Amdahl's Law

Suppose we have a system with one processor and a serial program. We want to upgrade this system and we have the following two options.

i. Increase the number of processors from 1 to 4 and parallelize 80% of the code.
ii. Increase the number of processors from 1 to 6 and parallelize 40% of the code.

Calculate speedup in each case and identify which one is better?

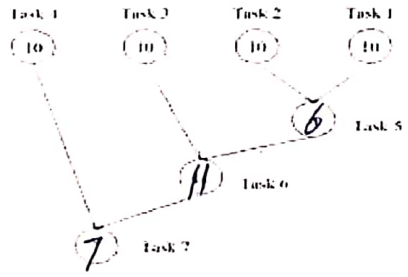
(i) Speedup $= \frac{1}{(1-P)+(P/n)} = \frac{1}{(1-0.8)+(0.8/4)} = \frac{1}{0.2+0.2} =$ **2.50**

(ii) Speedup $= \frac{1}{(1-P)+(P/n)} = \frac{1}{(1-0.4)+(0.4/6)} = \frac{1}{0.6+0.066} =$ **1.51**

* 80% parallelize code with 4 processors gives better performance than 40% parallelize code with 6 processors.

Question # 3: [3 marks, CLO # 1] - Concurrency

Analyze the following task-dependency graph and calculate:



(i) The maximum degree of concurrency = 4

(ii) Critical Path Length = 10+6+11+7 = 34

(iii) The average degree of concurrency = ~~Critical~~ Total Amount / Critical Path Length

= (10+10+10+10+6+11+7) / 34 = 64/34 = **1.88**