# 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: | 15 Minutes | Total Marks: | 12 |
| Paper Date: | 20-Feb-2023 | Weight | 2.5% |
| Section: | BCS (6E-6F) | Page(s): | 2 |
| Exam: | Quiz 01-A | 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. 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

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

3. 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

4. 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

**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 70% of the code.
ii. Increase the number of processors from 1 to 8 and parallelize 50% of the code.

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

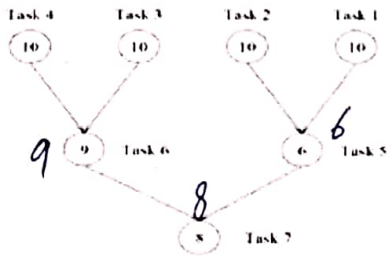
(i) Speedup $= \frac{1}{(1-P)+(P/n)} = \frac{1}{(1-0.7)+(0.7/4)} = \frac{1}{0.3+0.175} = \boxed{2.10}$

(ii) Speedup $= \frac{1}{(1-P)+(P/n)} = \frac{1}{(1-0.5)+(0.5/8)} = \frac{1}{0.5+0.0625} = \boxed{1.78}$

☆ 70% parallelize code with 4 processors gives better performance than 50% parallelize code with 8 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+9+8 = 27

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

= (10+10+10+10+9+6+8)/27 = 63/27 = $\boxed{2.33}$