National University of Computer and Emerging Sciences

Parallel and Distributed Computing (CS3006)

Date: Sep 24th 2024

Course Instructors:
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Sessional-I Exam

Total Time: 1 Hour
Total Marks: 30
Total Questions: 5

Semester: Fall-2024
Campus: Lahore
Dept: CS

Vetted by _____ Vetter Signature _____

CLO # 1: Demonstrate understanding of various concepts involved in parallel and distributed computer architectures.

Q1: Assume a sequential program *S* has an execution time of *500* seconds. Further, assume that S_p is the execution time of the parallel variant of *S*. After an experimental evaluation over different number of processors, the following running times were achieved: **[2 + 2 + 1 marks]**

P	2	4	6	8
S_p Parallel Execution Time (seconds)	294	203.84	176.62	164.92

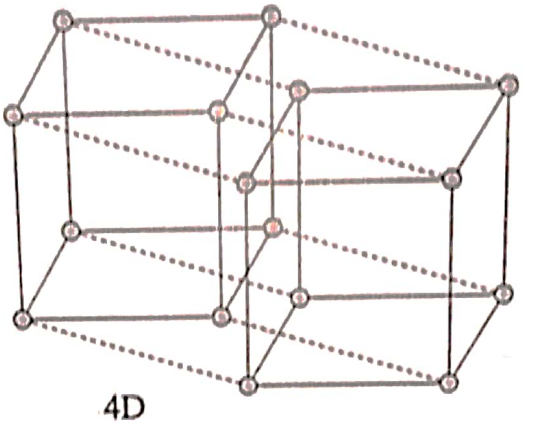
a) Calculate speedups for each of the experimental configurations.

b) Calculate the values for the Karp-Flatt metric. Furthermore, also interpret the results of Karp-Flatt metric and write your opinion accordingly.

CLO # 1: Demonstrate understanding of various concepts involved in parallel and distributed computer architectures.

Q2: Calculate diameter, arc connectivity, cost and bisection width for the following architectures: **[2 + 2 marks]**

a) Four-dimensional hypercube (size=*16 Nodes*)



4D

b) Complete binary tree having 3 levels as shown in figure below

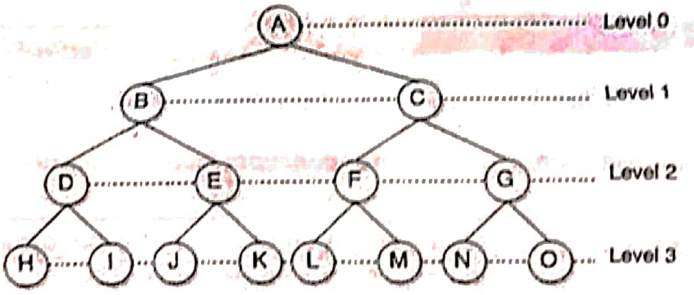
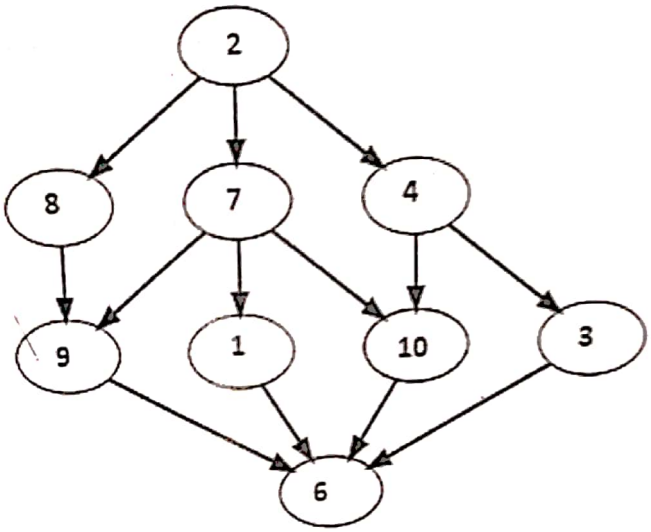


Fig. Complete Binary Tree

CLO # 3: Perform analytical modelling, dependence, and performance analysis of parallel algorithms and programs.

Q3: For the task dependency graph given in figure below, find the following parameters:

a) Maximum degree of concurrency
b) Total Amount of Work
c) Critical Path Length
d) Average degree of concurrency



e) Furthermore, map the task dependency graph on three processes, namely Pa, Pb and Pc, to reduce the interaction overhead.

[1 + 1 + 2 + 2 +2 marks]

CLO # 3: Perform analytical modelling, dependence, and performance analysis of parallel algorithms and programs.

Q4: From Flex, we want to enlist the students enrolled in the CS or DS program of FAST School of Computing in the Lahore campus of NUCES. For the query given below, make a simple task dependency graph. Also confirm how many tasks will be performed for the complete execution of the query. **[5 marks]**

CAMPUS = "LAHORE" AND SCHOOL = "COMPUTING" AND (PROGRAM = "CS" OR PROGRAM = "DS")

CLO # 2: Implement different parallel and distributed programming paradigms and algorithms using Message-Passing Interface (MPI) and OpenMP.

Q5 [For sections BCS-7A and BCS-7B ONLY]: Consider the following integral:

$$\int_0^1 \frac{1}{1+x+x^2+x^4}$$

a) Write a C code to compute this integral.

b) Convert the code written in part (a) into a parallel OPENMP code without using the "omp for" construct.

[3 + 5 marks]

CLO # 3: Perform analytical modelling, dependence, and performance analysis of parallel algorithms and programs.

Q5 [For section BCS-7C ONLY]: Draw an 8 x 8 Omega network (8 processes and 8 mem modules) and explain how P3 will access M1. What will be the cost of this network? How many switching nodes will be required for this network? **[2 + 2 + 2 + 2 marks]**