

Assignment 2
Due next Tuesday before class.

1 Problems

- Q1: *Searching*: Find one of the indices where x occurs in $A[1..n]$ in $O(1)$ time on a CRCW Common PRAM model.
- (a) Give pseudocode.
 - (b) For $p \leq n$, calculate T_p , S_p , E_p , cost and work of your algorithm.
 - (b) Derive its range of (cost) optimality.

Q2.13 The labels in a d -dimensional hypercube use d bits. Fixing any k of these bits, prove that the nodes whose labels differ in the remaining $d - k$ bit positions form a $(d - k)$ - dimensional subcube composed of $2^{(d-k)}$ nodes.

Q2.17 A mesh of trees is a network that imposes a tree interconnection on a grid of processing nodes. A $\sqrt{p} \times \sqrt{p}$ mesh of trees is constructed as follows. Starting with a $\sqrt{p} \times \sqrt{p}$ grid, a complete binary tree is imposed on each row of the grid. Then a complete binary tree is imposed on each column of the grid. Figure 2.36 illustrates the construction of a 4×4 mesh of trees. Assume that the nodes at intermediate levels are switching nodes. Determine the bisection width, diameter, and total number of switching nodes in a $\sqrt{p} \times \sqrt{p}$ mesh of trees (only calculate the order, in terms of big-Oh notation).

2 Individual Programming

Matrix multiplication: Write two shared memory programs to multiply two $n \times n$ matrices. The first will use round robin method to allocate rows of the resultant matrix to processes and the second will allocate band of the resultant matrix to processors. Fill up the matrices with some constant values so that it would be easier for you to verify the resultant matrix for correctness.

Prepare a speedup plot with varying n and vary number of processes in the available range. Use pure sequential time without any overhead for T_1^* . Put both algorithms data lines on the same plot.

Hint: You may copy the timing template in `/usr/class/c6310/shared_memory/add/plladd2.c`. Also, you can start with your previous team program for matrix addition and your warm-assignment for matrix multiplication.

Submission: Submit your source code as .txt file.