CS4/531
Spring 1997
Homework #4

(No credit will be given for unsupported answers.)

1. Give an *optimal* EREW PRAM algorithm to compute the parallel prefix of n values $x_1, x_2, \ldots, x_n$.

2. Give an efficient algorithm to perform Carry-Lookahead Addition of 2 n-bit numbers on a PRAM. Hint: Keep track of whether each 1-bit subaddition is: Stop a carry, Propagate a carry, or Generate a carry.

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0101110010010010
0110100001011100
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sgppgpssppsgppps
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Note: The value of the i^{th} carry is a 1 iff the leftmost non-p to the right of the i^{th} position is a g.

3. Give an optimal algorithm for computing the parallel prefix of n values, initially distributed one per processor on a q-dimensional mesh of size n. Prove that your algorithm is optimal.

4. Given a set of N points with heights along the horizontal axis, give an efficient algorithm for computing the set of points that are observable from the origin of the line. Solve this for a PRAM, tree machine, and mesh computer.

5. Give an optimal algorithm for computing the parallel prefix of n values, initially distributed one per processor in the base of a pyramid computer. Prove that your algorithm is optimal.

6. Give an optimal algorithm for computing the parallel prefix of n values stored one per processor in the base of a mesh-of-trees of base size n.

7. Give an optimal algorithm for computing the parallel prefix of n values stored one per processor on a hypercube of size n.