CS4/531
Spring 1997
Homework #5

(No credit will be given for unsupported answers.)

1. Give an efficient algorithm to sort a set of n bits (0's and 1's) on each of the following architectures:
   a) RAM
   b) PRAM
   c) Mesh
2. Give an efficient algorithm to sort a set of n GPAs on each of the following architectures, where each 2-digit GPA is in the range of [0.0-4.0]:
   a) RAM
   b) PRAM
   c) Mesh
3. Given a matrix $A = \{a_{i,j}\}$ distributed in a natural fashion on a mesh of size n so that processor $p_{i,j}$ stores $a_{i,j}$, give an asymptotically optimal algorithm to transpose A so that processor $p_{i,j}$ stores $a_{j,i}$.
4. Given an asymptotically optimal algorithm to merge 4 sets of ordered data, initially given in each base quadrant of a pyramid of base size n.
5. [Akl] Let X and Y be two sorted sequences of numbers of length n and m, respectively.
   a) Given an efficient RAM algorithm for finding the kth smallest element among all elements of X and Y.
   b) Use this algorithm to obtain a PRAM algorithm for merging X and Y together into a sorted sequence Z of length $n+m$.
6. Given a set of n line segments, each of which is either horizontal or vertical, give an efficient algorithm to determine whether or not any line segments intersect. Give algorithms for the following:
   a) RAM
   b) PRAM
   c) Mesh