CS 62 Quiz

Parallel Performance

Mawhorter Spring 2017

(Please write your name at the bottom of the back page of this quiz)

The mergesort algorithm normally takes O(n log n) time, with log n layers of merging to perform and a total of n work to do in each layer. A "layer" here refers to merging results of a specific size, so for example, in the first layer, we merge all of the length-1 results into length-2 results, and then in the second layer we merge all length-2 results into length-4 results, etc. Assume for a moment that the individual merge steps in each layer of work can be done in parallel.

1. Write an expression for the time taken by parallel mergesort with unlimited processors T_∞ as a sum over the different layers of merging. *(Note that each merge operation is still O(*n*) in terms of the number of items being merged, but now all merge operations in a given layer can be performed simultaneously.)*

2. What is the big-O run time of our parallel mergesort algorithm, assuming access to an infinite number of processors? (i.e., what is T_∞ in big-O terms?)

3. What is the speedup for parallel mergesort with an unlimited number of processors?