BU CLA CS 530: Analysis of Algorithms

Spring 1996

Problem Set 11

Due Thursday 96.04.11, at 11:00 am, in class. Late submissions not accepted.

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1. Design a CREW algorithm to sort an array $A[1\,..\,n]$ of $n \geqslant 1$ integers, in $\mathcal{O}(\log n)$ time using $\mathcal{O}(n^2)$ processors.

2. Let $G = (V, E)$ be a directed acyclic graph (a so-called *dag*). Describe a CREW algorithm to construct a topological ordering of the vertices in G, in $\mathcal{O}(\log^2 n)$ time using $\mathcal{O}(n^3)$ processors. (*Hint*: Consult the solution of Problem 3 in Problem Set 10, to define a first phase of your algorithm. You will also need to do sorting in a second phase.)

3. Exercise 31.2-3, page 744 in [CLR].
(The definition of "little-oh" is given at the bottom of page 29 in [CLR]. The simpler defintion to work with is given at the top of page 30, namely, we write $f(n) = o(g(n))$ iff $\lim_{n\to\infty}(f(n)/g(n)) = 0$.)

4. Exercise 31.5-1, page 765 in [CLR].

5. **Bonus question**: In Section 30.5 of [CLR], pages 721-722, a EREW algorithm is given for the problem of finding a maximal independent set in a linked list with $n \geq 1$ nodes. It is shown that $\mathcal{O}(\log^* n)$ iterations are required for the algorithm to terminate, and it is assumed (but not proved) that each iteration can be excuted in constant time. Recall that the task of iteration $k+1$ is to compute a coloring C_{k+1} from the previous coloring C_k (this is described in the third and fourth paragraphs from the top on page 722). Investigate the conditions under which the computation of C_{k+1} from C_k can be carried out in constant time. You can do the investigation on your own or, which is perhaps easier, you can consult the references [47] and [84] given in the book (see the last two sentences on page 729).

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