Problem Set 2

Due: In class on Wednesday, February 18.
Starred problems are optional.

Problem 2-1. A *segmented prefix computation* (also called *segmented scan*) consists of a sequence of disjoint prefix computations. For example, given input $x_{11}, \cdots, x_{1N}|x_{21}, \cdots, x_{2N}| \cdots |x_{N1}, \cdots, x_{NN}$, we might want to compute $y_{ij} = x_{i1} \otimes \cdots \otimes x_{ij}$ for $1 \leq i, j \leq N$. Show how to compute an arbitrary segmented scan as a single prefix computation. Your solution should treat the location of segment boundaries as part of the input (e.g., $x_i ='' \ |''$ if and only if a new segment starts at location i).

Problem 2-2. Show how to add 2 N-bit numbers on a $\sqrt{N}$ x $\sqrt{N}$ mesh in $O(\sqrt{N})$ steps. How long does it take on an $N^{1/3}$ x $N^{1/3}$ x $N^{1/3}$ mesh? Explain your reasoning. (Hint: this problem has a very short solution.)

Problem 2-3. * Prove that the bisection width of the $\sqrt{N}$ x $\sqrt{N}$ mesh is at least $\sqrt{N}$.
