Exercises

Problem 1. Which of the following can be a property of a minimal sorting algorithm?

A. It performs $O(\log n)$ supersteps, where n is the number of elements to sort.
B. It requires a machine to send $O(n/p^{0.99})$ words in some superstep.
C. It requires a machine to spend $O((n/p)\log(n/p))$ CPU time in some superstep.
D. It requires a machine to use $O(n/p^{0.99})$ space in some superstep.

Problem 2. In the seminar, we introduced a minimal algorithm for sorting. Assuming that each machine has n/p elements in its local storage at the beginning of the algorithm, answer the following questions:

(a) In Phase 1, how many elements are sampled from each machine in expectation?

(b) Still in Phase 1, how many elements does each machine *receive* in expectation?

Problem 3. In our argument for proving the lower bound on the load of the cartesian product problem, we had the sentence: "Machine 1 sees $n + L$ elements overall $\Rightarrow$ it can produce at most $(\frac{n+L}{2})^2$ pairs." Give a proof of the sentence.