

Problem Set 1: Distributed Averaging

Due: January 27, 2009

This problem set will illustrate the key properties of the distributed averaging algorithm from lab 3. The task is to compute the average of the IDs in your mini-swarm. The goal is to get you thinking early about the properties you must maintain, so that when it is time to implement, you won't go down a bad path.

1 Existence

Show that a global average does indeed exist, and provide an expression for it. (Yes, this is a gimmie)

2 Conservation

Show that local pairwise averages preserve the global average, *i.e.* the global average is invariant to pairwise averages.

3 Conservation Shortcuts

Ben Bitdiddle says that you don't need to do all this pairwise stuff; each robot can compute a local average of all its neighbors simultaneously. Alyssa P. Hacker says this will cause problems, and quickly provides a counter example using a network of three robots. Produce your own counter example using three robots.

4 Convergence

Show that a local pairwise average between two non-equal values reduces the global variance of the distribution of averages.