COMP590: Homework 2

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Problem 1

I first state the agreement protocol for this digraph:

$$\dot{x} = -L(\mathcal{D})x$$

If I suppose that $x(t) \neq 0$, then compare against the symmetric algorithm

$$L(\mathcal{D}) = L(\mathcal{D})^T$$

Now,

$$L(\mathcal{D}) = \Delta(\mathcal{D}) - A(\mathcal{D}) \text{ and } \Delta(\mathcal{D}) = \Delta(\mathcal{D})^T$$

And for any two matricies of the same dimensions

$$(A + B)^T = A^T + B^T$$

So

$$A = A^T$$

Which is to say, this digraph is bidirectional — for every edge from a to b, there is an edge from b to a. I further stipulate that this symmetric protocol will approach the agreement algorithm for digraphs that are very nearly bidirectional, if the difference is small.

Problem 2

Since the agreement algorithm is normally

$$\bar{x} = -Lx$$

I define

$$m = \frac{\sum_{i=1}^{n} x_i}{n}$$

Problem 3

$$u_i(t)$$

We want

$$p_i + (v_i + u_i(t))dt = \frac{\sum_{j=1,i\neq j}^{n} p_i(t) + v_i(t)dt}{n}$$

$$u_i(t) = \frac{\frac{\sum_{j=1,i\neq j}^{n} p_i(t) + v_i(t)dt}{n} - p_i}{dt} - v_i$$

Problem 4