22C:294: Seminar on Systems and Networks

Homework 1
Assigned Feb 12, Due Feb 26
Total points = 10 (i.e 10% of your final grade)

*Answer as many questions as you can. Write down your solution using LaTeX.*

**Question 1.** Dijkstra’s seminal paper CACM 1974 presented three algorithms for self-stabilizing mutual exclusion on processes connected by a ring topology. This question refers to the three state algorithm.

Provide a proof for the convergence of the 3 state algorithm. Also prove that the stabilization time is $O(N^2)$.

**Question 2.** Chen, Yu, Huang presented a self-stabilizing algorithm for constructing a spanning tree in a connected network of processes.

(a) Calculate a loose upper bound of the stabilization time.

(b) Can you analyze the algorithm and come up with a better bound for the stabilization time?

**Question 3.** In the Distributed Reset paper, when the reset wave is used to perform the reset operations at the various processes, communication between a process that has been reset, and another process that has not been reset is not allowed. Clearly explain why this restriction has been imposed.

**Question 4.** Consider the hybrid version of the protocol in the paper on Pursuer-Evader games by Demirbas, Arora and Gouda.

(a) How much energy is spent in the chasing game when the evader centric solution is used within a region of radius $R \leq D/2$, from the evader, and the pursuer centric solution is used outside this region?

(b) Consider that there are two pursuers pursing an evader on a sensor network of ring topology. Suggest an algorithm so that some pursuer can eventually catch the evader even if the speed of the pursuers is less than the speed of the evader.