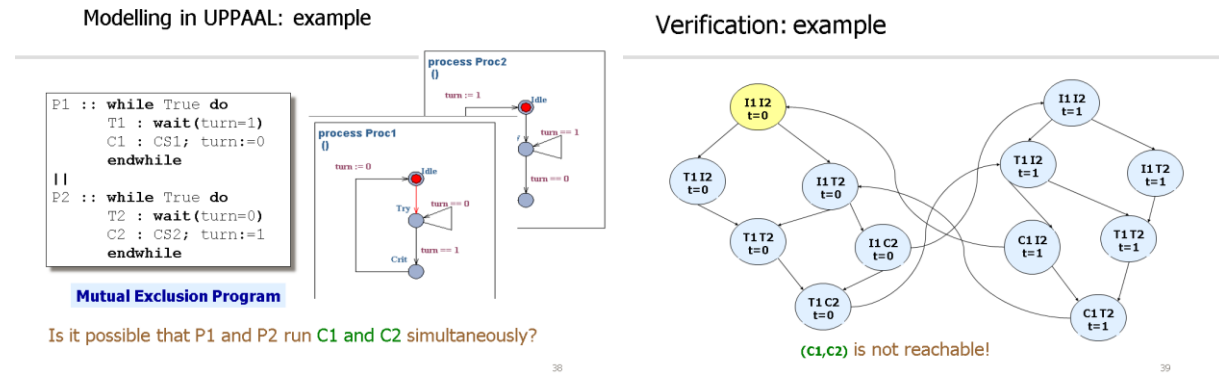## CIS 541: Embedded and Cyber Physical Systems

Assignment 3: Due Wednesday, Feb 24, 2010

Recall slides 38—39 of "Modeling & Analysis of Timed Systems", which are shown here:

a. Create an Uppaal model for this program. Since the two processes exhibits similar behavior, your model should contain two instances of the same template, parameterized in process ids (0 for Process 1, 1 for Process 2).

b. Run the Uppaal model in the simulator. Observe the simulation trace to see if Process 1 and Process 2 are both in the critical section.

c. How many possible (combined) states in all can the system have? How many of them are reachable? For each of the unreachable state, give a one line explanation what it means. (You may group similar unreachable states.)

d. Please write two specifications of the system in Uppaal:
   1. The system will not deadlock.
   2. Process 1 and Process 2 cannot be in critical section at any time.

e. Are they safety or liveness properties?

f. Verify the two properties with Uppaal.

To submit your work, please send them to Professor Lee (lee@cis.upenn.edu) and Shaohui "Vincent" Wang (shaohui@seas.upenn.edu).