CS 720, Fall 2016
Homework 1

Due Date: September 21

1. Baier and Katoen, Exercise 2.1a.
   (This problem asks you to convert two sequential circuits into a transition system.)

2. On slide 153 of the slides for the September 12 lecture, a GCL program is given for the beverage vending machine, and on the next slide (the last one in the lecture slides), the transition system for the program is given (assuming that the value of max is 3). The program graph that comes from the GCL program and that was converted to the transition system is not given. For this problem, I am asking you to give the missing program graph. (It will have two locations, start and select.)

3. In the September 14 lecture, we looked at Peterson's algorithm and showed that it ensured mutual exclusion if the two assignments done when a process moves from noncritical to wait are done atomically. We also showed that if the two assignments are done non-atomically with the assignment to x being done first and then the assignment to b_i, then mutual exclusion is not met. In this problem, you will investigate what happens if the two assignments are done non-atomically with the assignment to b_i done first and then the assignment to x.

   (a) Give the program graphs $\mathcal{P}_1$ and $\mathcal{P}_2$ for the two processes when the assignments are done non-atomically with the assignment to b_i coming first.

   (b) Give the reachable part of the transition system $\mathcal{T}_{\mathcal{P}_1|||\mathcal{P}_2}$.
   (I am not asking you to give the interleaved program graph $\mathcal{P}_1|||\mathcal{P}_2$ separately, but you will probably want to compute this as an intermediate step in answering this part.)

   (c) Does this version of Peterson's algorithm achieve mutual exclusion?

4. In the September 14 lecture, we saw a railroad crossing example that was unsuccessful because it allowed the train to enter the crossing with the gate up.

   (a) Keeping Train and Gate the same, give a modified version of Controller that makes it impossible for the train to enter the crossing with the gate up.

   (b) Give the reachable part of $Train||Controller||Gate$, showing that the train cannot enter the crossing with the gate up.