CS 745 Fall 2017

Assignment # 3

Due in class on Nov. 21st

0. Consider a program with two processes, P1 and P2, running concurrently. The computations of the program are `weakly fair' if, whenever a transition (of a process) is enabled continuously the transition is taken infinitely often.

The computations of the program are `strongly fair' if, whenever a transition (of a process) is enabled infinitely often then the transition is taken infinitely often.

The computations of the program are `unconditionally fair' if, each process gets a turn at execution infinitely often.

i. Write LTL formulae describing the 3 different fairness condtions of the 2 process models.

ii. If a model is `unconditionally fair' must it also be `strongly fair'? Explain your answer.

1. Consider an n process token ring model with program P = ||_i P(i), operates on the network. The processes share a single common token. Each process in the ring
has access to a common variable only when the process controls the shared token. When a process
with the token finishes using the shard resource the process passes the token to the neighbor on the right.

(i) Write a local, per process, specification that requires each process with the token to pass the token to the neighbor on the right.

(ii) Write a global specification expressing that the processes each have `fair' access to the token.

(iii) Assuming that the processes in the program P operate according to the condition given in part (i) must the program

P satisfy the condition in (ii)? Explain your answer.

2.
Consider a Buchi automaton B = (Sigma, Q, delta, Q_0, F), as described in class.

B accepts an infinte string, sigma, from the alphabet Sigma, if there is a run of B on sigma that vists an accepting state in F infinitely often.

Express the acceptance condition for Buchi automata in LTL.

A Rabin automaton is similar to a Buchi automaton except that the acceptance condition is given by a set of pairs ((Green_1, Red_1), ..., (Green_k, Red_k)), where each of the Green_i and Red_i are subsets of Q.

A run of the Rabin automaton is acceted if
there exists a pair (Green_i, Red_i) such that some element in Green_i occurs infinitely often and none of the elements in Red_i occur infinitely often.

Express the Rabin acceptance condition as a formula in LTL.

4. Consider the token ring example discussed in part 1.
(i) Write an LTL or CTL correctness specification saying that only the process with token may access the shared resource.

(ii) Write a specification saying that any process that wants access to the shared resource eventually eventually receives the token from the process that currently owns the toke

(iii) In what way are your specifications `symmetric'? Explain your answer.