

CS 745 Fall 2019

Assignment # 2

Due in class on Nov. 12th

The questions all have the same weight.

Part 0. Consider a token ring network. Each process has a non-trying, a trying, and a critical section. The processes cycle from non-trying to trying to critical and back to non-trying. A process may transition, non-deterministically from non-trying to trying and from critical to non-trying. However, to transition from trying to critical, the process must own the single token. When a process is finished w/ the token, i.e. on leaving its critical sections, it passes the token to the process on the left.

- a) provide a program skeleton for the processes.
- b) describe a safety property in English (give more details) and temporal logic, saying that a process must have the token while it is in the critical section.
- c) describe a property in English (give more detail) and temporal logic saying that a process in its trying state eventually enters its critical region.
- d) describe a fairness property that says if processes enter their trying region infinitely often then they enter their critical section infinitely often.
- e) does the process model in part a) satisfy the specifications given in parts b, c and d? Explain your answer.
- f) what happens if the single token is 'lost'? Do the processes behave correctly? Do they satisfy their specifications? Explain your answers.
- g) what happens if the model suddenly has 2 tokens? Do the processes behave correctly? Do they satisfy their specifications? Explain your answers.

Part 1. Consider the temporal specification: a process that sends a request infinitely often receives access infinitely often.

- a) Describe a Buchi automaton that represents this specification.
- b) Suppose there are two such processes, each requesting access to the same resource. Describe a Buchi automaton that represents the joint specification of both processes.

Part 2. Consider the 2 process mutual exclusion example discussed in class. Explain how to use automata theoretic model checking to show that the specification $F(C1 \wedge C2)$ is false on the model. Can you provide a counter example?