CS 745 Fall 2017

Assignment # 2

Due in class on Nov. 2nd

0. Consider the readers/writers problem on a single, shared object. Processes cycle over the following states: Non-trying, trying-to-read, trying-to-write, reading, writing. Processes non-deterministically choose between trying-to-read and trying-to-write. Once the choice is made they stay in that mode until they return to non-trying. There is a shared object to read/write and so several processes may read the object at the same time, but a process that is writing must have exclusive access to the object. Assume that each process can `see' the internal state of each of the other processes. Processes execute asynchronously.

Write a correctness specification in CTL or LTL that expresses the requirements given above --- for shared or exclusive access to the resource. Describe a program skeleton model of the processes.

Explain why the model satisfies the temporal specification.

1. True or false: ((GFp) -> (GFq)) EQUIV G(p -> Fq)

2. Let A1 and A2 be Buchi automata. Give a Buchi automaton A for the language L(A1) \cup \L(A2) and explain your answer.

3. Consider a model M with states {a, b, c, d, e}. State a is the initial state. From a there is a transition to b. State b has bidirectional transitions to each of c, d and e. There are no other transitions. State a is labeled with {p}, b is labled with {q}, c is labled with {r}, d is labeled with {s} and e is labeled with {t}.

Consider the sequences of computations encoded in the machine. The sequences of state labels, starting at the initial state define a language of the structure.

Does the language satsify:

FGq?
GFq?
G(~q -> Xq)?
G(r -> XXr)?

Justify your answers.

4. Consider the model in the previous section.
Does the model satisfy:
AG(p + q + r + s + t)?
AG(q -> AXAXq)?
AG(r -> AXEXs)?
AG(r -> AFs)?

Justify your answers.

5. Give a Buchi automaton that recognizes the same lanugage as the LTL formula (GF p1) ^ (GF p2).

Give a Buchi automaton for the ~((GF p1) ^ (GF p2)).