Programming Assignment #1 - NuSMV

ComS 412/512 - Due: Feb 23, 2024

Problem Specification

The farmer from Homework #1 is still not convinced there is a safe way to get everyone to the West side of the river. To double check that it is indeed possible, the farmer decides to use NuSMV - a symbolic model checking software - to help cross the river safely.

As a quick reminder, the farmer's problem can be described as follows: a farmer, a goat, a cabbage, and a wolf are on the East side of a river (we will not worry about the boat in this assignment). The farmer can cross the river with up to one passenger at a time. However, the goat and cabbage cannot be together without the farmer. Similarly, the wolf and goat cannot be left alone together. *We can logically represent the illegal states of this system as* $((goat = wolf) \lor (goat = cabbage)) \land (goat \neq farmer)$. Can the farmer get everyone to the West side of the river?

Assignment

This assignment will require you to use NuSMV. Instructions, guides, and examples can be found in the 'files' section of the Canvas page, and the NuSMV Homepage is a good place to start. Make sure you can both run and understand the example programs (definitely simple.txt) before continuing.

In this programming assignment, you should use NuSMV to model the farmer problem, as specified above. A starting template has been provided. Your program should:

- **Create an underlying Kripke Structure for the farmer problem** AND

- **Evaluate whether or not there is a safe path which gets everyone to the Western bank**

    - The initial state should be "everyone is on the Eastern bank"
    - If a safe path is found, your program should return that path

There are two (intuitive) ways to complete this assignment. You can either: create a 'safe' Kripke Structure (unsafe states are not included in the system), OR create a full Kripke Structure of all possible moves and define your CTL formula such that unsafe states are checked for along each path.

You decide which method you want to implement - both methods come with their own challenges. That said, we recommend you start by creating the full Kripke Structure, and then decide to either remove unsafe states or write more a complex CTL safety check.

Submission

You should submit a program .txt file called 'PA1-NuSMV.txt'. When run, the program should show a safe path to the Western shore, or declare that one does not exist. Make sure your file has good documentation (use "- -" to start a comment), and your name at the top.