HANDS ON 2 : NuSMV

CS60030 Formal Systems

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FMSAFE

FORMAL METHODS FOR SAFETY CRITICAL SYSTEMS

Introduction

1. NuSMV is a symbolic model checker developed by ITC-IRST and UniTN with the collaboration of CMU and UniGE.
2. NuSMV is OpenSource and has a free software licence.
3. Download the binaries from the following link.

   http://nusmv.fbk.eu/

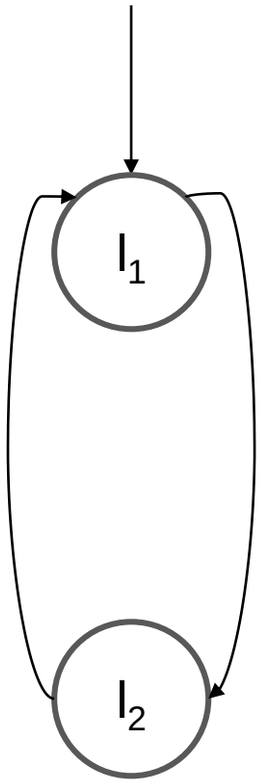
   Click on version 2.6.0 and click on download binaries

   Enter the captcha

   Download the binaries with Zchaff suited for your machine

   Unzip the tar file and check by executing (NuSMV.exe/ NuSMV.sh –int)

Modeling a Simple Transition System



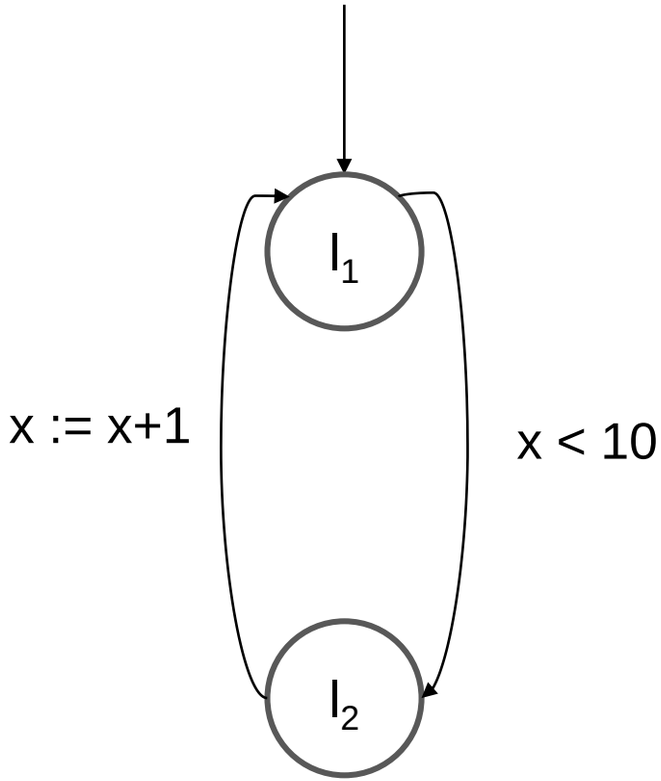

```
MODULE main
VAR
        location : {l1,l2};          //Description of states
ASSIGN                               //Description of transitions
        init(location) := l1;
        next(location) := case
                (location = l1) : l2;
                (location = l2) : l1;
                esac;
```

Write this code in a file with extension .smv

Commands to Build Model

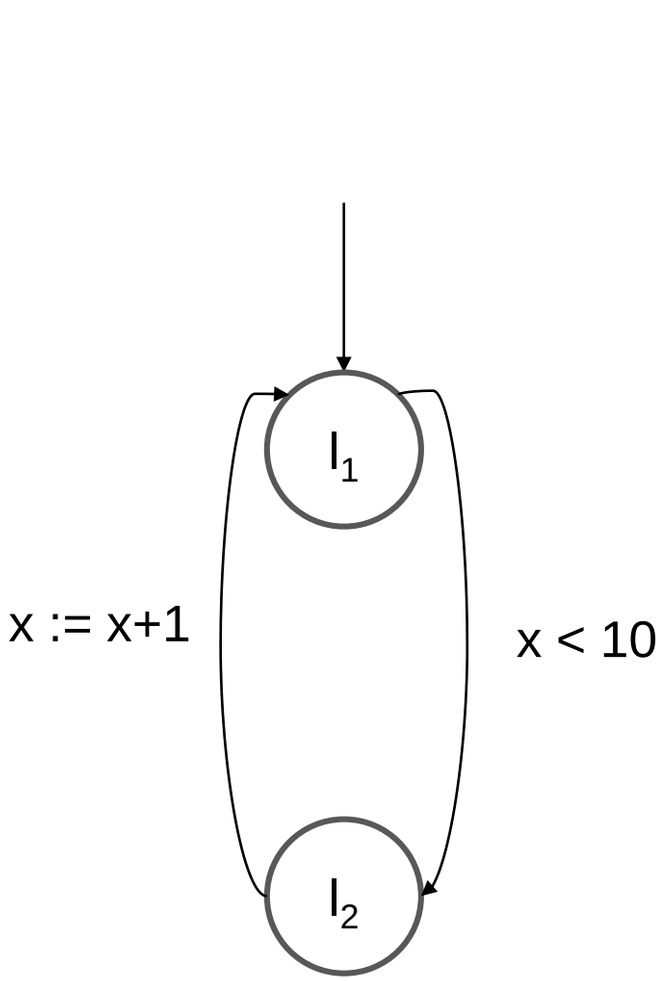
```
NuSMV -int

NuSMV > read_model -i demo.smv

NuSMV > flatten_hierarchy

NuSMV > encode_variables

NuSMV > build_model

NuSMV > pick_state –i                    //See the initial state

NuSMV > simulate -i -k 10                //Simulate the model for 10 steps

NuSMV > print_reachable_states –v        //Print the reachable states and their descriptions
```

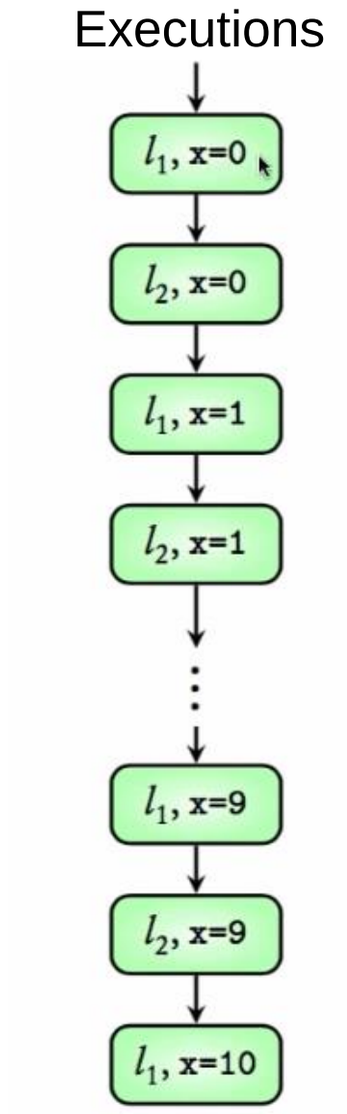
Modeling a Simple Transition System




```
MODULE main
VAR
        location : {l1,l2};
        x : 0 .. 100;
ASSIGN
        init(location) := l1;
        init(x) := 0;
        next(location) := case
                (location = l1) & (x<10) : l2;
                (location = l2) : l1;
                TRUE : location;
                esac;
        next(x) := case
                (location = l2) & x<100: x+1;
                TRUE : x;
```

Checking properties in NuSMV



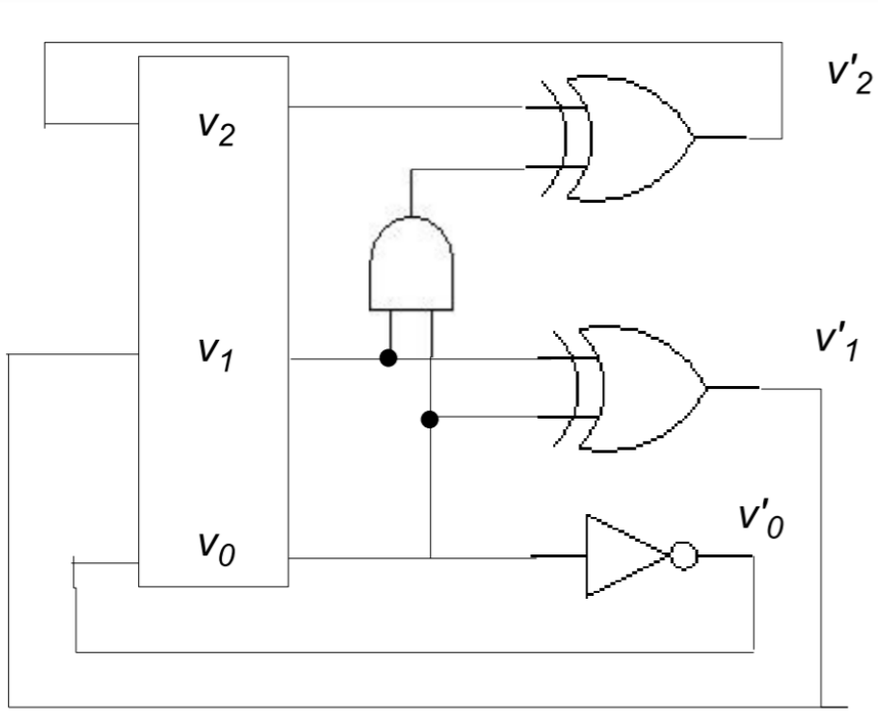


In order to check LTL properties run the following commands

NuSMV > check_ltlspec –p “G (x>=0)”

NuSMV > check_ltlspec –p “F (x>=11)”

3 Bit Up Counter Gate Level Modelling




```
MODULE counter(reset)
VAR
   v0 : boolean; v1 : boolean; v2 :
boolean;
ASSIGN
   next(v0) := case
            reset = TRUE : FALSE;
            TRUE : !v0;
         esac;

   next(v1) := case
            reset = TRUE : FALSE;
            TRUE : v0 xor v1;
         esac;
   next(v2) := case
            reset = TRUE : FALSE;
            TRUE : (v0 & v1) xor v2;
         esac;
```

```
MODULE main
VAR
   reset : boolean;
   dut : counter(reset);
ASSIGN
   init(reset) := TRUE;
```

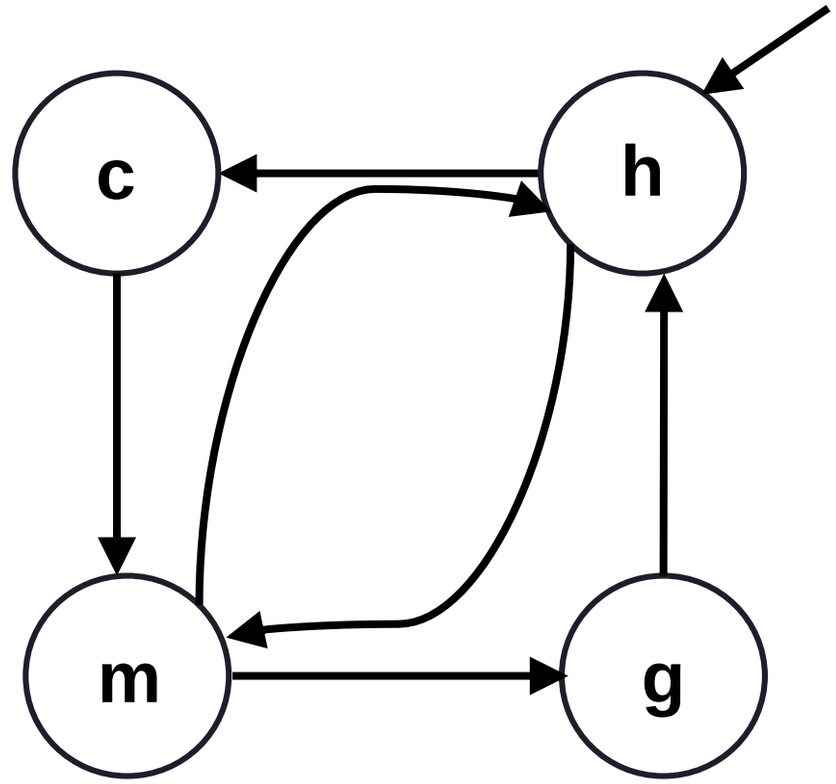
Model in NuSMV and Check Properties

c : Class

h : Hostel

m : Mess

g : Gymkhana



Write the LTL formulations for the following sentences:

1. The Mess is visited infinitely often
2. Eventually the class is always visited.
3. Once in class a student eventually goes to Mess after spending some time is Gymkhana