University of Pretoria

# Model Checking

COS 741

Practical Assignment 5

**EXERCISE 1** (9 Marks)**:**
The goal of this practical is to reduce (un)satisfiability solving to model checking. The template SAT.pml defines a process 'solver' that constructs two propositional logic formulas Y and Z over the Boolean variables a, b, c, d. Moreover, the template contains two LTL formulas UnsatY and UnsatZ. UnsatY specifies that eventually the solver reaches END and then the propositional logic formula !Y holds (Y is false). Hence, model checking UnsatY with SPIN will return 'no error' if for all possible executions Y is false in the end, and it will return 'error found' if there exists an execution where Y is true in the end. (The same for UnsatZ and the formula Z.)

a) [7 Marks]:
Extend the template such that model checking UnsatY (UnsatZ) decides the unsatisfiability of Y (Z). I. e. model checking UnsatY with SPIN shall return 'no error' if there does not exist a truth assignment that makes Y true, and it shall return 'error found' if there exists a truth assignment that makes Y true.

Remember that if SPIN detects an error, then the corresponding error trail can be replayed under 'Simulate'. Make sure that if your program finds an error for UnsatY (UnsatZ) then the simulation of the error trail will output the corresponding truth assignment that makes the propositional logic formula true.

b) [2 Marks]:
Is Y satisfiable? If yes, for which truth assignment? Is Z satisfiable? If yes, for which truth assignment?