

6CCS3VER 2024-25

Coursework 1 – 15% of your mark

- Please make sure you read the instructions fully before you start implementing the project.
- The project is done on the Xchek tool, available as a part of the KCL VM installation or as a standalone software <http://www.cs.toronto.edu/~arie/xchek/>, which you can install on Linux and Mac machines.
- The final product of the project is the zip file containing the report and the source code files for the models and the sets of properties. The source code files should be written in GCLang and compile in Xchek. The CTL properties should be written in plain text in a separate text file in GCLang format. Executing the properties as written in your files should have the result described in your report.
- In the project, you will implement a system that simulates a counter modulo 8 as a binary model for Xchek and a set of properties. The stages of the project are as follows:
 1. Build a model M_1 for the counter that counts from 0 to 7 (that is, a counter modulo 8) with binary variables in GCLang. Use as few variables as possible. The initial state (start state) of your model is the state where the counter is 0.
 2. Write an initial set of up to 4 CTL properties to verify your model. Argue that the set represents the intuitive specification of what we can expect from the counter. For each property, indicate whether it is a safety property or a liveness property and explain why.
 3. Change the model so that it has two initial states: one where the counter is 0 and another where the counter is 7. Write the new model M_2 in GCLang.
 4. Prove that M_2 has two initial states by writing 2 new properties and showing the result of their execution on the model (the result should imply the existence of two initial states).
 5. Introduce a bug in your original model M_1 that is not caught by any of the properties.
 6. Explain why this happened and write an additional property that exposes this bug. Demonstrate a counterexample.
- In your report, include figures of your models as Kripke structures. If the model is too large, include a part of the figure and explain how the rest of the model looks like.

- Models that do not compile or do not run on Xchek will result in 0 for the coursework. Properties that are grammatically incorrect and hence cannot be understood by Xchek using copy-paste from your file will result in 0 for the relevant questions. Reports without Kripke structures will receive reduced marks for the matching questions.
- Marking scheme: 35% for question 1, 25% for question 3, 10% for each of the questions 2,4,5,6.