Homework 1

CDA 4630/CDA 5636: Spring 2025

Due Date: February **5**, 2025 **11:30**pm **Total Points:** 20 points

You are not allowed to take or give help in completing this assignment. Submit the PDF version of the submission in e-learning website before the deadline. Late submission (by email attachment to prabhat@ufl.edu) is allowed (up to 24 hours) with a 20% penalty (irrespective of whether it is late for 10 minutes or 10 hours). No grades for late submissions after 24 hours from the deadline. Handwritten (scanned PDF) submissions will NOT be accepted unless you have excellent handwriting and drawing capability! For example, you can write it in Latex or Microsoft Word and convert it to PDF. *Please do not include the questions in your submitted PDF since it affects the plagiarism checker.* Please include the following sentence on top of your submission (PDF):

I have neither given nor received any unauthorized aid on this assignment.

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1. **[5+1] Draw** a condition/event Petri net model for postal mail delivery synchronization. The process is as follows. Consider a city that has only one post office, only one house (home) and only one cafe. There are only three people in the city – one mailman (let's call him MM) who manages the post office, one lady (let's call her LL) who either lives at home or manages the café, and one customer (CC). The job of MM is to deliver only one letter to LL. In the post office, MM waits for a letter to arrive (assume only one letter arrives at a time). If a letter comes to the post-office from another city, MM immediately carries that letter for delivery to the house or the café (MM chooses between the house and café in a nondeterministic way). If LL is in the house (or café) and MM also reaches there at that time, MM delivers the letter and goes back to the post office. If LL is not in the place (house or café) when MM arrives there, MM goes back to the post office with the letter and the same process is repeated. Please note that LL will be either in the house or cafe. She goes to the café when a customer is waiting. Similarly, she goes home when there is no customer at the café. In your design, assume the basic condition/event model where a transition is activated when there is one token in each of the input places, and after activation one token is placed in each of the output places (no need to show any number on the arcs). In your design, please show the following four transitions (events): *deliver letter at home*, *deliver letter at café*, *lady going to café*, and *lady coming home*. You can use the following four places (tokens) in your design: *mailman*, *letter*, *lady*, and *customer*. Please use additional places/tokens/transitions, if needed. **Place** tokens in your Petri net to show the scenario when LL is about to go to café (customer waiting) and MM is about to go to LL's home with the letter. Note that you should design the Petri net model first that covers all the scenarios described above. Once your model is complete, then show the placement of the tokens for the specific scenario.

2. **[4+4] Implement** the above synchronization using two languages: i) **SystemC** and ii) choose either **Verilog** or **VHDL**. No need to simulate your code. If your code looks reasonably perfect, you will get the full marks. Write your code in the same PDF. Please do not attach any additional files.

3. **[2+2+2]** This question has three parts. Consider an intersection of two roads (let's call them Museum Road and University Ave) where each side is controlled by a traffic light controller. Assume that the

traffic light controller uses two variables A and B for one side and another two variables C and D for the other side. Assume that initially one side is green, and the other side is red. After 55 seconds in green state, the green changes to amber (the other side remains red). After 5 seconds in amber state, the amber changes to red. As soon as one side becomes red, the other side becomes green (no delay). Therefore, a red state becomes green after waiting 60 seconds (the other side should have become red in 55 + 5 seconds). You can assume that each side maintains a timer to count seconds.

Museum Road Traffic Light	**University Ave Traffic Light**
A=0, B=0 implies GREEN	C=0, D=0 implies GREEN
A=0, B=1 implies AMBER	C=0, D=1 implies AMBER
A=1, B=0 implies RED	C=1, D=0 implies RED

a) **Draw two local FSMs** (one for each side) and indicate how and when they should communicate (if any) with each other. Please note that each state has only two variables where each variable can have only binary values. Please show all the valid states (circles) and valid transitions (arrows). Please ignore any circumstances (e.g., exceptions) that are not outlined above.

b) The above example (**two FSMs**) assumes that each state has only two variables (either A/B or C/D). **Draw one global FSM** consisting of both traffic light controllers and show all the valid states (circles) and valid transitions (arrows). For example, a valid state is "Museum Road is GREEN and University Ave is RED". Please note that each state has four variables (A, B, C and D) where each variable can have only binary values. Please ignore any circumstances (e.g., exceptions) that are not outlined above.

c) **Compare** the solutions (two local FSMs versus one global FSM) in terms of their computational/**modeling capability** (if one is better than the other in terms of representing/capturing functionality) and **complexity** (memory requirement). Comment on your observations. For example, if you expect the complexity to be significantly higher or lower in a general ("global FSM versus multiple local FSMs") scenario than in this specific case, explain why?