CSE 390B Mock Exam

Instructions:

- *You will be writing your exam answers on a blank sheet of paper. Make sure to include your name (first & last), your student ID # as well as for each exam question, clearly indicate the exam question number and your answer on your paper.*
- *This exam is closed-note, closed-book (except for the given reference sheet).*
- *Please have your zoom video on and audio muted during the exam.*
- *Questions are not necessarily in order of difficulty.*
- *You have 25 minutes to complete the exam.*
- *When you are finished with the exam, take a picture of your paper and upload it to Gradescope.*

Good luck!

Question 1 *[15 points]*

Complete the circuit diagram below to implement a reverse 2-bit counter which goes through the sequence `11` → `10` → `01` → `00` → `11`. You are provided two DFF gates (A, B) to start, which are directly connected to outputs. For example, if the state is `10`, A=`1` and B=`0`. Assume the DFF gates all start storing 1's, and are implicitly connected to the hardware clock. You may only use And, Or, and Not gates in your implementation.

a. Here is a template for a truth table that you can fill out to guide your implementation. Fill out the truth table with the correct values based on the transitions described above.

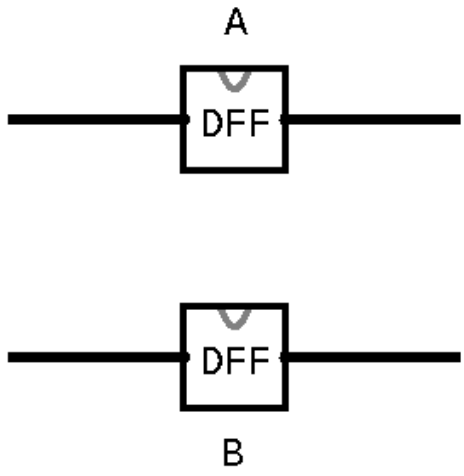
A_t	B_t	→	A_{t+1}	B_{t+1}
1	1			
1	0			
0	1			
0	0			

b. We haven't shown you many two-output truth tables, but you can essentially think of them as 2 separate truth tables smushed together (that is you can think of it as defining **A**(t+1) based on **A**(t) and **B**(t), and separately defining **B**(t+1) based on **A**(t) and **B**(t)). Using your truth table, define two boolean expressions, one for **A**(t+1) and one for **B**(t+1), based on **A**(t) and **B**(t).

A(t+1) = <your expression here>
B(t+1) = <your expression here>

c. Finish the circuit on the next page to implement the logic expressions you wrote above. Your circuit diagram should connect the outputs (**A**(t) and **B**(t)) using logic gates and feed the result back into the corresponding input gates.

This symbol indicates a wire splitting into multiple.


A
DFF
DFF
B

Question 2 *[6 points]*

Dana needs 300 pickets for her colorful picket fence. She wants equal amounts of each of her 4 selected colors. She already has 32 red, 26 green, 9 yellow, and no blue. If the pickets cost 25 cents and you get 20% off if you purchase 50 or more of the same color, and 30% off if you purchase 60 or more of one color, how much does Dana need to spend? List your answer to two decimal places. You may use a calculator application on your computer to solve this problem.

Question 3 *[10 points]*

Write a Hack assembly program that stores -1, 0, or 1 in R1 based on the sign of R0. To be more specific, your program should store a -1 in R1 if R0 is negative, a 0 in R1 if R0 is 0, and a 1 in R1 if R0 is positive.

Question 4 *[4 points]*

Name two (2) stations that the Seattle Link Light Rail train stops at.