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Task C-1: Planning the Synchronous Sequential Machines

(5 pts) Interview your stakeholders (TAs, Instructors, family, friend, OR "Yourself"…etc.). Ask questions regarding the form, function, and features needed by potential customers for this design. Make sure to capture what the customer prefers from this type of solution, as well as what environment the customer plans to use this design. Summarize your findings here and document the names of who you interviewed.

Stakeholder name: xxxxx.

Question: What features are important to make the wheelchair convenient?

Stakeholder: The wheelchair should be easily able to move left or right.

Question: What is the most important to you when looking for a wheelchair?

Stakeholder: The wheelchair should be light since we travel a lot as a family. It would be difficult to bring the wheelchair everywhere if it was heavy since we have four kids to watch out for already.

Question: What safety features are important to you when choosing a wheelchair?

Stakeholder: With my daughter being only 3 years old and because of her condition, I think having straps to hold her legs in place would really benefit the wheelchair.

Please include a comment on why your automation adds value from multiple perspectives (technological, societal, financial, environmental, etc.). (*What value does this add? What is the type of customer for whom this is designed? Where is this most needed? What couldn't you do before?*) [2-3 sentences are sufficient]

This wheelchair will mainly be used for everyday use moving from crowds of people to the next crowd so the design must be easy to use and can get user safely from point A to point B.

It is allowable to continue to ask questions of stakeholders throughout the design process (and is preferred of a conscientious engineer). This can be done as you are designing, before you are designing if you need input and clarifications, or after you are done designing if you want feedback on improvements. Summarize any changes to your understanding or design based on the feedback you received during your initial interviews or continual interviews?

Question: Where do you prefer the move forward, backward and stop buttons to be?

Stakeholder: I would like a joystick instead in case my daughter accidently leans her hands on the buttons.

Task C-2: Document the Synchronous Sequential Machines

Design #1: What assumptions did you make in the design of this machine? (Based on stakeholder's requests)

The assumptions that was made was that whenever the user was at the farthest right or left, the state would be reset to 0

Create a state definition table here that describes in plain English what each state in your machine means and what binary values you have assigned to represent each state, inputs, and outputs.

State	Binary	Definition
S0	000	Center
S1	001	First left
S2	010	Second left
S3	011	Third left
S4	100	First right
S5	110	Second right
S6	111	Third right
S7	100	unused

(12 pts) Show your state diagrams, state transition tables and your circuit planning work (Karnaugh maps/MUX/DEC/etc.) used in your design process. (You can do this by hand if you wish, do not show the full circuit schematic here.)

See link for diagrams: https://github.com/YSayaovong/Synchronous-Sequential-Machines

List your final design equations and required logic gates (including types of Flip Flops) needed to complete this circuit. Do not show the full circuit schematic here. You will implement (i.e. build on Digital) only one design. This design will be chosen based on Tasks C-3 and C-4.

Design 2:

Q2: Q1Y'+Q1'X'+Q0X'+QZQ0X+Q1'Q0'XY+Q2'QZ'Q0XY
Q1: Q0'X'Q2 + Q2'Q1'Q0X + Q2'Q1Q0'Y' + Q2'Q1Q0X' + Q2Q1Q0Y' +Q2Q1'Q0'Y
Q0: Q0X'Y' + Q0XY + Q0'X'Y + Q0XY'
A: Q2Q1Q0
B: Q2'Q1Q0

Task C-3: Determine Criteria and Weighting for Judging Your Designs

Using the guidelines in the laboratory FAQ's, list your 5 criteria and associated weights here used to help decide between the two design models (weights should add to 100%):

Criteria	Weight
1. Minimal gates	15
2. Safety	30
3. Compact	20
4. User friendly	30

Task C-4: Apply the Criteria to Pick the Best Design

Describe how you applied each of the criteria and weighting system in the above task to pick the best design. How did you choose these criteria (customer interviews, engineering preference)?

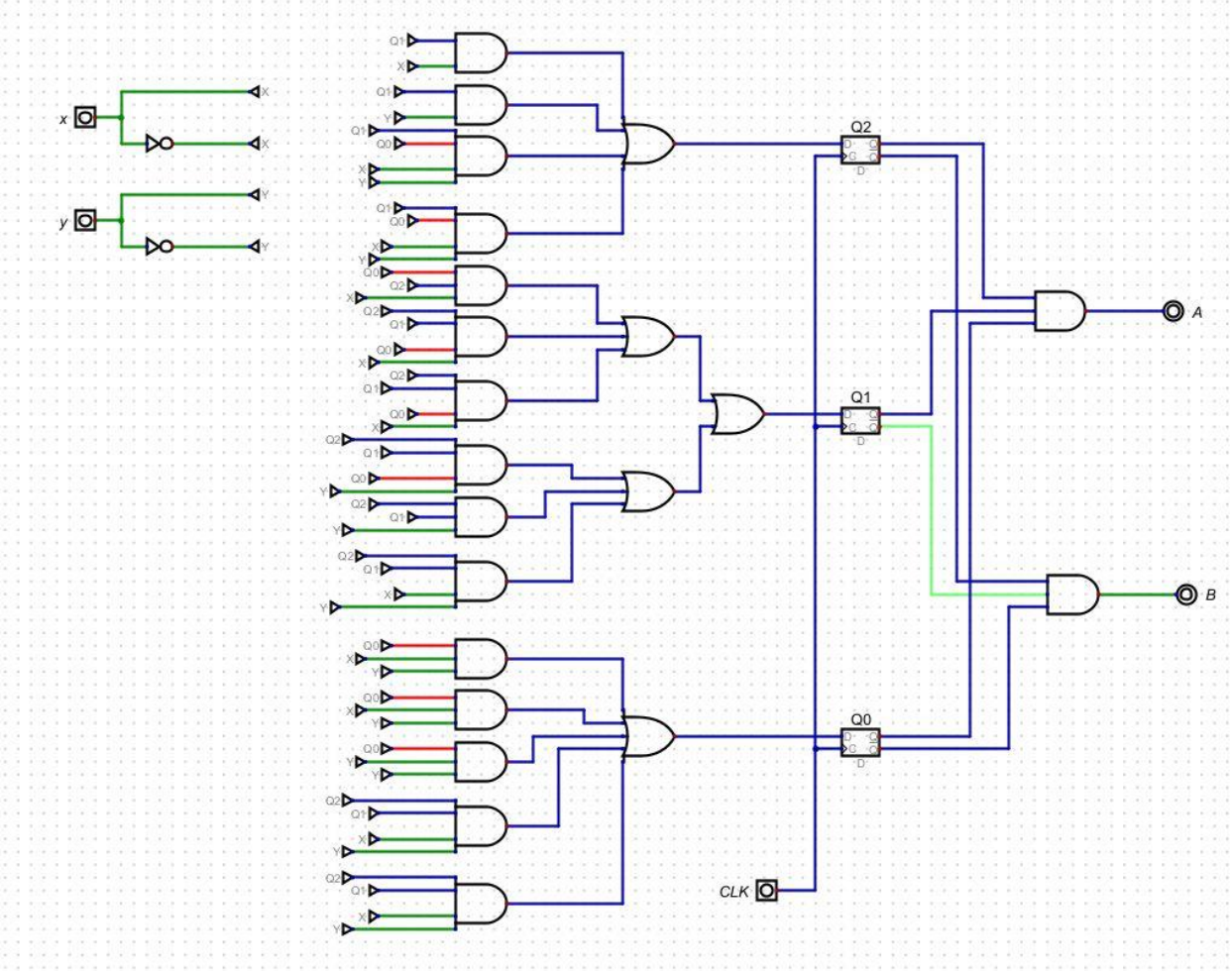
I picked the criteria and weight based on what the customer preference was ranked the highest.

Which design is better based on your criteria and weighting system and why? Please explain how the winning design scored in <u>each</u> category and why (the winning design does not need to score the highest in every category, but it does need to score higher overall when applying the criteria weights).

Design 2 was a better fit for the criteria because it has the least amounts of gates to make the wheelchair functioning.

Task C-5: Build and Simulate Winning Design in Digital

Insert a copy of your chosen Digital Schematic here. Please make sure that you have outputs or tunnels connected to each flip flop so that you can easily monitor your states. Make sure that the logic and equations match the final equations presented in either Design 1 or Design 2.



Testing: Demonstrate that your “best” circuit meets the completed design specification. You only need to test one design, the one you chose according to your criteria in Task C-4. Use the table below for testing your circuit. Note the following:

- First write the names of the inputs and outputs. The names should match the manual’s convention. Do not use A and B, or X and Y. Graders do not understand what those are.
- Fill-in the table with values you tested. Ideally, you need to test all arrows on the state diagram. If it is tedious, you need to come up with a sufficient testing plan.
- Modify the table as needed.
- If your expected output does not match the actual output, answer the questions at the end of this task.

Inputs [Input names go here]	Expected Outputs According to Diagram [Output names go here]	Actual Outputs According to Waveform [Output names go here]
Joystick Position: Left, Right, Center	**Motor Direction:** Forward, Backward, Stop	**Motor Direction**: Forward, Backward, Left, Right, Stop
Enable Signal: On/Off	**LED Indicator:** On/Off (depending on joystick position).	**LED Indicator for Movement**: ON when the wheelchair is in motion (Forward, Backward, Left, Right). OFF when the wheelchair is stopped.
		Error Indicator: If the joystick input is invalid or conflicts occur in the design logic, an error signal (e.g., LED blinking) could activate.

If your circuit does not work, answer the following questions:

- Where do you think the mistake is coming from? The design? The table? The kmaps? The circuit? Something else?
  Answer: Possible sources include design errors in the state diagram, incorrect Karnaugh maps, or mis-wired components in the digital simulation.

- How would you correct this mistake if you were given more time?
  Answer: I would review and debug the state transition logic, verify Karnaugh map simplifications, and cross-check the circuit connections in the simulator for errors.

Task C-6: Record a Video Demonstration of the Winning Design

https://youtu.be/DAnCLOoJpyQ