



Assignment #1

Due date: _____

Digital Logic Gates and Circuit Design

Reading Assignment:

1. Refer to <http://mfranzen.ca/index.html>
2. Circuit Design Presentation #1 – Circuits, symbols, Binary, Digital Logic, Design, and Troubleshooting
3. Refer to the web site allaboutcircuits.com
 - a. http://www.allaboutcircuits.com/vol_5/chpt_9/1.html Symbols
 - b. http://www.allaboutcircuits.com/vol_4/chpt_6/4.html Circuit equivalents
 - c. <http://www.allaboutcircuits.com/videos/86.html> Logic gates
4. Refer to the help files and tutorials from LOGO!Soft Comfort software

Work Assignments:

1. Logic Gates & Design Process

- a. On a single side sheet of paper, landscape format, create 5 columns with appropriate spacing for required information to neatly fill in about the 5 basic logic gates, with each column title as follows:
 - i. Name
 - ii. Symbol
 - iii. Operator
 - iv. Truth Table
 - v. Equivalent Circuit
- b. On the back, describe in 5 major points the steps to design and create a working circuit design.
- c. Hand in to teacher for reviewing and marks

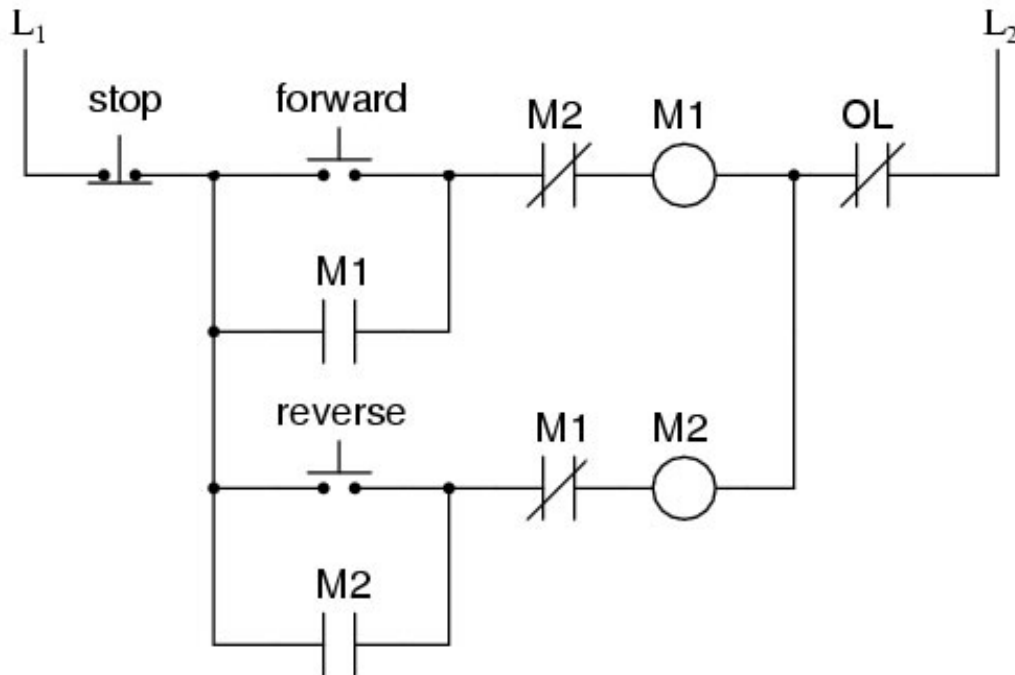
2. Stop Start Motor Circuit

- a. Draw a neat circuit ladder diagram of a stop, start motor control circuit similar to the one in the Circuit Design presentation slide that talks about latching circuits
- b. Ensure that the symbols are correctly drawn neatly using the full width of the page in portrait format
- c. Have the teacher check to see that your drawing is correct
 - i. Below draw the equivalent circuit using the logic gates: AND, OR, and NOT
- d. When the digital circuit solution is complete
 - i. Using LOGO!Soft open up a new file and name it appropriately with your Last initial, first name, - project name
 - ii. Insert title, name, given information, and Sub titles for Inputs, Functions, and outputs using the text tool (Tip: See sample in presentation)
 - iii. Insert your Inputs, Outputs, and Functions using the full screen, configuring each as needed including switching options, comments, etc.
 - iv. Connect up wiring ensuring it is neat and objects are organized and aligned
 - v. Simulate and test to see if circuit is working the way it is required
- e. Save, and have teacher check your work for marks, and keep for later report hand-in



3. Forward Reverse Motor circuit

- Using the following circuit diagram given, create the digital logic equivalent using any of the basic logic gates that were reviewed in the presentation
- Remember to setup your page correctly, place components in the appropriate locations and minimize wire crossings
- Once you have a finished and circuit is working correctly have the teacher check it



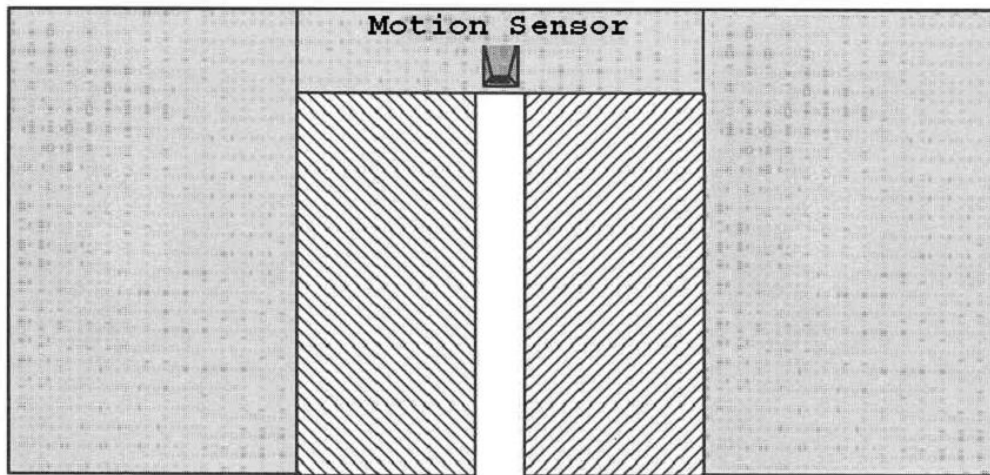
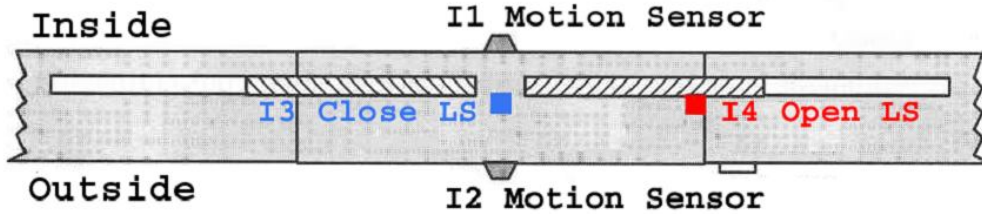
4. Automatic Door

- One often finds automatic door control systems at the entrances to Supermarkets, public buildings, banks, hospitals, etc.
- General Operation: When a person approaches the automatic door, either the inside and/or outside sensor will open the doors. Once doors are open and open limit switch changes state, 4 seconds must past before the door starts to close. If a person steps into range of inside/outside sensors, door will stay open until 4 seconds after they are gone out of range. Once 4 seconds times out with no one around, door will close. When closed, changing closed limit switch, then close motor will stop. Automatic door waits until next person.
- Specific demands on an automatic door
 - When somebody approaches, the door must open automatically
 - Once the open cycle has been engaged, the door must fully open
 - The door must remain open until there is nobody in the doorway for 4 seconds
 - If there is nobody in the doorway anymore (no motion detected) and the door has completed it's open cycle, then after 4 seconds the door should begin to close
 - The open limit **switch** activates (goes high) when the door is fully open
 - The close limit **switch** activates (goes high) when the door is completely shut



d. Your Challenge

- i. Solve the problem with as few gates as possible
- ii. Use the chart and wiring legend-diagram below



Inputs & Outputs	Function
I1	Motion Sensor Inside
I2	Motion Sensor Outside
I3	Closed Limit Switch
I4	Open Limit Switch
Q1	Open Motor
Q2	Close Motor

e. Marking Criteria

- i. Door must be completely open and there must be no motion for 4 seconds before the door begins to close - 5% penalty for non-compliance
- ii. If during the close cycle either motion sensor gets activated the close cycle must cease and then open cycle must begin - 5% penalty for non-compliance
- iii. Once the open door procedure has begun it cannot be interrupted by a loss of motion input - 5% penalty for non-compliance
- iv. A solution with fewer gates will result in a better mark - the best I have seen for this problem is 6
- v. functions (not including the "I"s and "Q"s)
 1. *f* If you use 6 or 7 functions – no penalty
 2. *f* If you use 8 or 9 functions – 5% penalty
 3. *f* If you use 10 or 11 functions – 10% penalty
 4. *f* If you use 12 or more functions – 20% penalty



Technology Education

Western Technical-Commercial School

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Name _____

- f. Suggested steps:
- i. Clarify in your head what a logic gate does and review the 5 basic gates (NOT, AND, OR, NAND, NOR, XOR)
 - ii. Review our solution to the Start/Stop & Forward/Reverse Problem
 - iii. Use the Siemens LOGO!Soft software to create/design/construct a solution for the Open Motor circuit, being careful to utilizing output Q1 for the Open Motor, I1 for the Inside Motion Sensor, I2 for the Outside Motion Sensor, and I4 for the Open Limit Switch
 - iv. Thoroughly test this circuit and be sure that it works properly be sure that it works properly
 - v. Then work on a solution for the Close Motor circuit, being careful to utilize output Q2 for the Close Motor, the same I1 (as the previous circuit) for the Inside Motion Sensor, the same I2 for the Inside Motion Sensor, I3 for the Close Limit Switch, and the same I4 for the open limit switch
 - vi. Before you can complete the above step you will need to investigate the operation of the Special Function On-Delay and Off-Delay Timers
 - vii. Once you have a working circuit ensure that you have included a title, a general description, sub titles- Inputs, Functions, and Outputs, your name, and clean up wiring and component locations, then have the teacher check it