

Logic Lab Challenges

Complete the following problems on the Logic Lab website:

<http://www.neuroproductions.be/logic-lab/>.

Instructions:

Show your teacher after completing each exercise and save each circuit by recording the URL. To get this, click the save icon:



Then enter your name and challenge number:

SAVE

Your name:

Circuit name:

X

✓

Click the check mark and you will be given a URL:

Thanks for saving !

The direct link to you circuit :

<http://www.neuroproductions.be/logic-lab/index.php?id=105018>

✓

Copy and paste this as a record of your work.

Create a truth table and equation for each output.



Extension: Look for common elements in each output equation and create the simplest possible circuit that uses the fewest logic gates.

Challenges:

#1. Create a circuit that makes a fan turn continuously, except when a push button is pressed. In other words, it is only stopped while the button is being pressed.

#2. Create a circuit that has two switches and a light. The light should only turn on, when one (and only one) of the switches is on. If both switches are on, or both switches are off, the lights should be off.

#3. Create a circuit with a push button and a pixel light. Have the light display green when the push button is pressed and red when it is not.

When push button is pressed:  When push button is not pressed: 

#4. Create a circuit that, when a switch is turned on, beeps for about a second then turns a light on for about a second. This should be a continuous sequence while the switch is on. Beep (1 sec), Light (1 sec), Beep (1 sec), Light (1 sec) etc.

#5. Create a circuit that contains three switches and a light output. The light output should be turned on when an odd number of switches are turned on (1 switch or 3 switches), otherwise it should be turned off.

#6. Create a circuit that contains three switches and a digit output. The digit output should display the number of switches that are turned on.

#7. Create circuit that has a push button, a switch and a pixel light. Make the light change color based on the switch and button based on the following table:

Switch	Push Button	Pixel Light
On	On	Magenta 
On	Off	White 
Off	On	Cyan 
Off	Off	Blue 

Super Challenge: #8. Create a circuit for a new sign outside the "FACE CAFE". It should alternate between displaying the word "FACE" for about two seconds and then display the word "CAFE" for about two seconds. This should continue, as long as a switch is turned on. You will need four digit output controls:



Additional: Logic Lab Car Activity (CodeTrain)

Note: This is a puzzle for you to try and solve. Your job is to experiment by adding logic gates, wire splitters, etc. until you succeed on hitting all the criteria of the challenge. You will not only get marked on the completion of Challenge #1. The remaining challenges, however are required for you to attempt.

Challenge #1: Gas and Brake

Setup your screen such a the following image. You will need 4 propellers (your wheels), 2 switches and 1 or 2 splitters.



Assume the top pedal is the brake. The bottom is the gas.

Program the car with the following features:

- when the gas pedal is pressed (bottom switch), all four wheels start to spin (unless the brake is also pressed)
- when the brake is pressed, all four wheels will be stopped
- when the brake and gas is pressed, the engine should just rev (in other words, all four wheels will be stopped)

Challenge #2: Turning

Building off your existing car, add 2 buttons (to act as the turn switches), 2 lights and a power pulser (plus possibly a splitter for the pulser). See picture below.

Turning will be indicated by having only 2 of the wheels spinning (like for a tank) and the appropriate light is on or flashing. Turning left will mean the top two wheels will be stopped. Turning right will mean the bottom two wheels will be stopped. Then program the car with the following features:

- when the gas pedal is pressed AND the right turn signal is on, the car will turn right (bottom wheels off, lower light flashing)
- when the gas pedal is pressed AND the left turn signal is on, the car will turn left
- if the gas pedal is not pressed, the turn signals will not do anything
- for this scenario, you do NOT need to worry about the cases where both signals are pressed or when both the brake and gas pedals are pressed

Extra challenges/Options:

You have two choices:

1. Continue working on the tough car challenges described on the next page
2. Go learn about electrical circuits in general.
<http://thefusebox.northernpowergrid.com/page/circuitbuilder.cfm> This will start easy but get more complex. It is not directly related to Computing Science, but the more you know about electricity flow, the better you will understand how electricity (and data) flows on the BUS in the computer.

More Logic Lab Car Challenges

Here are some fun things to try if you have time:

- add brake lights
- add a bumper that will turn off the engine in the event of a crash
- add a speedometer. Use multiple switches to represent how far down you are pressing the gas pedal and then wire in the counter to show your speed.
- add whatever else you can think of

When finished, save this set up and record the web address in your Logic Gates assignment from last class so that I can view it later.

Challenges with Flip Flops

Complete the following problems on the Logic Lab website:

<http://www.neuroproductions.be/logic-lab/>. Show your teacher after completing each exercise, to get it marked off.

#1. Create a circuit with a push button and a fan. The fan should turn on and off when the push button is pushed.

#2. Create a circuit with a push button and a pixel output. The pixel light should be off initially. If the button is pressed once it should turn yellow, if it has been pressed twice it should turn magenta, if it is pressed three times it should be white.

#3. Create an a stopwatch circuit with a hexadecimal digit output and a push button. The push button starts and stops the counting, after the counter gets to 15 (hex digit F), the counting go back to zero automatically and the stop. Counting should not start again until the push button is pressed once again.

Super Challenge: #4. Create a circuit that counts down from 15 to 0 in base 10 (2 digit outputs will be needed)