

As you may have read in the latest issue of the National Enquirer, NASA is about to launch its first manned mission to Mars! You have been commissioned to accompany the mission as the electronics specialist.

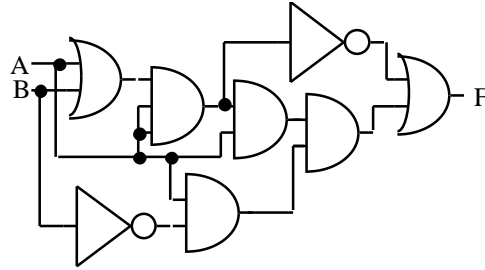
Part I: Political Incorrectness

Soon after liftoff, Mission Control radios the crew and informs you that there is a small modification that needs to be made to the life support circuitry in order to properly recycle your air. As it is a simple change, Martin Fodder, the first politician in space, offers to make the change for you and scurries off to the lab.

Hours pass and you begin to notice stuffiness and an acrid tinge to the air. Wandering down to the lab, you encounter Martin leaning over a smoking chip. A tangle of blackened wires on another table and the smell of ozone indicate that Martin has been having difficulty. As you watch from the hatch, Martin begins chanting over the mess:

*By blood of gerrymander,
And barrel of pork,
With guano of bat,
Let this circuit work.*

You interrupt the poor fellow and ask him what is going wrong. He responds that he has developed a circuit that should solve the problem, but that it is so complicated that he is having trouble building it. He hands you the following circuit, sketched on the back of a traffic ticket:



The circuit he designed is obviously quite a bit more complex than necessary. Help Martin by constructing a truth table for F in the space below. Then design a new circuit that will implement the function using as few gates as possible.

A	B	F
0	0	
0	1	
1	0	
1	1	

Draw new circuit here:

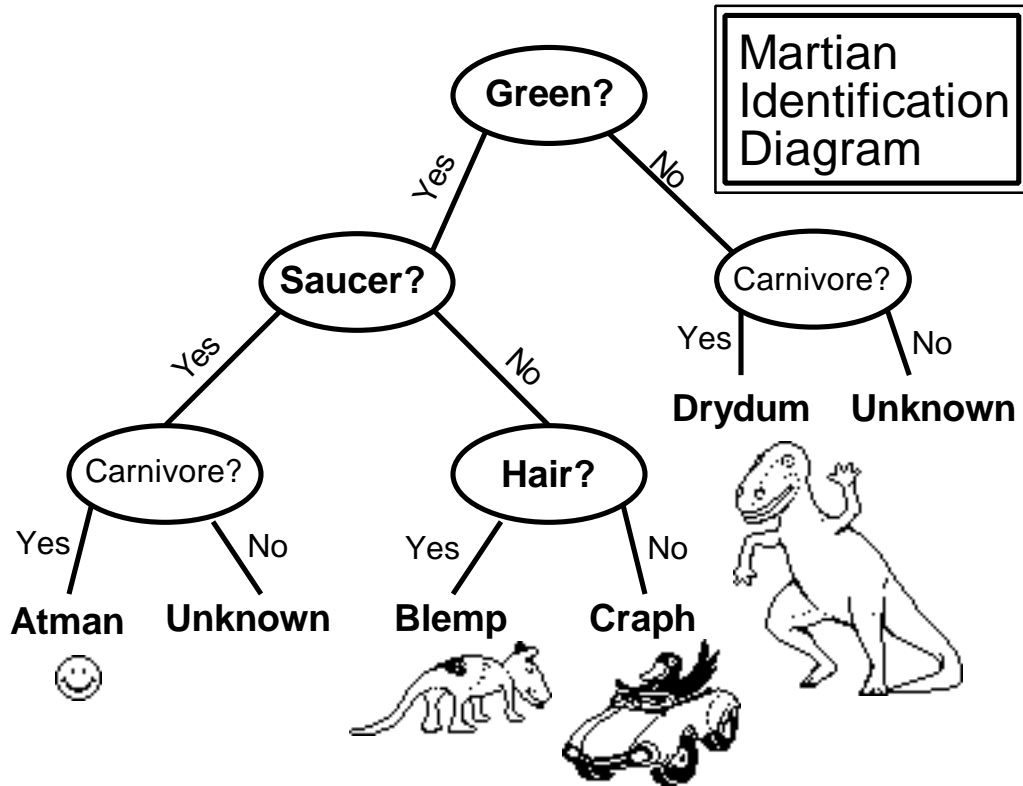
When you complete this section, have it checked off.

Part II: A Taxonomy of Native Martian Fauna

After fixing the air recycling circuitry, you finally take a deep breath of fresh air. There is a boring period of many weeks eating nothing but dehydrated astronaut food and slop squeezed from toothpaste tubes, but finally you reach Mars and land the spacecraft.

To the surprise of everyone save a few science fiction writers, your mission crew discovers that Mars is crawling with a wide form of life never detected by previous unmanned missions (see attached photograph of barren landscape taken by the Viking lander). Being good scientists, the crew immediately begins to classify the various species of alien life.

The biologist on board develops a set of tests to classify Martian life forms. The tests check if the species is green (using advanced spectroscopy equipment), if it gets around in a flying saucer (using radar detectors), if it is carnivorous (by sticking Martin Fodder's arm in its mouth and observing if it bites), and if it has hair (by looking for the characteristic barber shop).



Your job is to build a circuit that takes the results of these four tests (Green, Saucer, Carnivore, and Hair) as Boolean variables with 1 = Yes and 0 = No) and lights up one of five LEDs corresponding to Atman, Blemp, Craph, Drydum, or Unknown.

Your first task is to write a Boolean equation for each species. Craph has been done already for you.

A =

B =

C = $G\bar{S}\bar{H}$

D =

U =

Have your equations checked off. It's important to thoroughly understand the problem so far so that you can build a functional circuit.

The next step is to actually design a circuit that solves this classification problem. You should be able to do it using gates on the chips in your kit. Draw the circuit below. It should take inputs from four switches (Green, Saucer, Carnivore, and Hair) and control 5 LED outputs (Atman, Blemp, Craph, Drydum, and Unknown). Have your circuit checked off, then build the circuit on your protoboard.

When your circuit works, congratulations! Come back next week for the next exciting installment of Digital Electronics & Chip Design!