

Experiment 4

As the chief engineer of Patriot Mason Enterprises, you have decided to diversify your product line. Your first circuit is to be a combinational circuit to illuminate three lights indicating the status of the oil level in an automobile engine. The engine is capable of holding 7 liters of oil, but has a tendency to pull oil into the intake manifold when the level is equal to or greater than 5 liters. At the other extreme, it has been determined that an oil level of less than 2 liters does not insure that there is a sufficient supply of oil to the oil pressure pump. For proper, safe operation, the engine should have an oil level between these two extremes. In order to simplify the information for the average driver, you have decided to make an indicator with three lights: Red, Green, and Yellow. These lights are to be illuminated under the following conditions:

- Red Light: Oil level greater than 5 or less than 2 liters.
- Yellow Light: Oil level greater than 4 or less than 3 liters.
- Green Light: Oil level equal to 3 or 4 liters.

More than one light may be on at a time.

You have also found that there is a commercially available oil level indicator that has a binary output proportional to oil level as in the table below:

Oil Level (liters)	Output Signal Lines (Oil Level)		
	A	B	C
0	0	0	0
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0
5	1	1	1
6	1	0	1
7	1	0	0

1. Design a combinational circuit to perform the functions described above.
2. Minimize the functions using any appropriate method.
3. Write a VHDL behavioral description to implement the circuit, including the following:
 - a. Entity declaration
 - b. Behavioral architecture body
 - c. An appropriate testbench
4. Simulate and print the resulting waveforms for all possible inputs.
5. Draw a detailed diagram showing all the pin connections.
6. Implement the circuit in hardware, using the TTL devices from the parts list.
7. Compare the results of the two approaches with respect to the timing characteristics of the outputs.