Problem 1:

1. See “problem 1” in “lab2.circ” project file
2. AND gate: 7408 (18 ns)
   OR gate: 7432 (15 ns)
   NOT gate: 7402 (15 ns) (This is actually a NOR gate, but by grounding the second input it will operate like a NOT gate)
3. (Using 74LSxx data sheets from Fairchild Semiconductor assuming Vcc = 5V, temp=25C, timings provided are max values along the longest path)
   Part A: 66 ns
   Part B: 66 ns
4. I used “Propagation Delay Time” but the data sheets I used listed many values based on whether it was low-to-high, high-to-low or other factors. Therefore I used the maximum timing.

Problem 2:

1. Design Parameters:
   a. 7 switches will be used (1 motored car, 6 regular cars)
   b. 4 wires in data bus (1 bit, 2 bit, 4 bit, and a “0 bit” or a bit to show the number)
   c. Encoder should be able to encode numbers 0 through 6 (inclusive) into 3 bits and 1 “show” bit. Decoder should be able to do the reverse (take binary number, convert it to decimal, and use that decimal representation to emit the correct values for each of the seven segment display parts)
2. I read this one: http://www.ti.com/lit/ds/symlink/sn5447a.pdf
3. See “problem 2” in “lab2.circ” project file
4. An user can press whichever button is in their car. This will trigger engage the encoder to encode the car number in binary. This value is then transferred across the data bus to the 7 segment display decoder. The decoder then converts the number from binary to seven segment display and feeds this information into the seven segment display that is visible to the train engineer. The engineer would then handle the situation and return the emergency switch back to its default position.