

Question 1

Imagine a gear box created out of the different characters of your first name. For example instead of displaying N for neutral it displays F and instead of displaying R for reverse it displays I and son on. Write a truth table for the seven segment decoder used in this gear box. Your gear box should have the following inputs: P, N, R, and D. From the truth table write the Boolean expressions of the different decoder outputs. **Hint:** look at lecture 16 slide 5.

Question 2

The truth table of a 4 input priority encoder is as follows:

| I1 | I2 | I3 | I4 | O1 | O2 |
|----|----|----|----|----|----|
| 0 | 0 | 0 | 0 | X | X |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |

1. In few words, explain how the priority encoder works.
2. Using K-map find the simplified Boolean expression of O1 as sum of product.
3. Realize the expression in 2 using two input Nand/Not gates only and count the number of transistors.
4. Using K-map find the simplified Boolean expression of O2 as product of sum.
5. Realize the expression in 4 using Nor/Not gates only and count the number of transistors

Question 3

1. Write the Boolean expression of an 8 to 1 multiplexer where S_2 , S_1 , and S_0 are used for the selection and D_0 to D_7 are the single bit inputs.
2. Write the Boolean expressions of a 1 to 8 demultiplexer where S_2 , S_1 , and S_0 are used for the selection and D_0 to D_7 are the single bit outputs.
3. Explain what need to be done to transform the above mux/demuxes to accept input/output signals of 8 bits each.

Question 4

In this problem please assume the select input as active high.

1. Continue the following truth table for a 2-to-1 multiplexer, where input1 and input2 are the two inputs to the multiplexer and Sel is the select.

