

Create a $2^2 \times 1$ MUX that implements the function $f(x, y, z) = x'y + y'z'$, using yz as control lines
Provide the MUX's output expression

1) Write the binary values possible for xyz

table 1	x	y	z	row #
x'	0	0	0	0
	0	0	1	1
	0	1	0	2
	0	1	1	3
x	1	0	0	4
	1	0	1	5
	1	1	0	6
	1	1	1	7

2) Decompose $x'y + y'z'$ into their literal numeric values:

$$\begin{array}{ccc} x'y & + & y'z' \\ \downarrow & & \downarrow \\ 01 & & 00 \end{array}$$

find the rows in the table where:

$$\begin{array}{l} x \text{ and } y \text{ equal } 01 \\ y \text{ and } z \text{ equal } 00 \end{array}$$

3) Draw a table with headers for all the MUX inputs. Since the MUX is a 4×1 MUX, then it will have 4 inputs: $I_0 \dots I_3$

table 2	I_0	I_1	I_2	I_3	
x'	0	1	2	3	→ rows in table 1 where x is 0
x	4	5	6	7	→ rows in table 1 where x is 1

- According to the problem statement, y and z will be used for the select lines, so the remaining variables, x in this case, will be used for the inputs to the MUX.

So if we take a look at table 1, we identify all the values where x is 0 and where x is 1

- When x is 0, we can represent it as x'

When x is 1, we can represent it as just x

4) In table 2, circle all the row numbers that correspond to the numeric values that we determined in step 2.

	I_0	I_1	I_2	I_3
x'	0	1	2	3
x	4	5	6	7
	1	0	x'	x'

5) Designate a value for I_n depending on what is being circled:

- If all numbers in the column for I_n are circled, then:

$$I_n = 1$$

- If no numbers are circled:

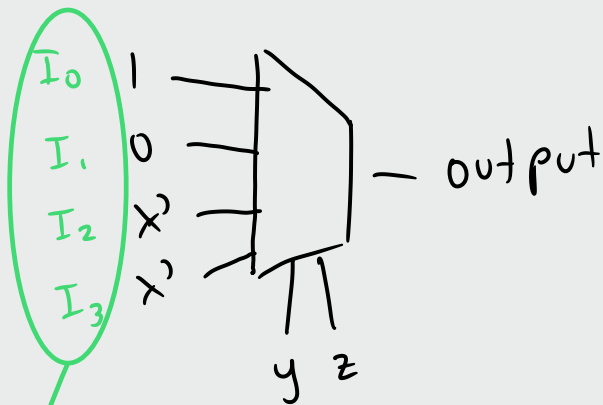
$$I_n = 0$$

- If only one or a few are circled, then

I_n is assigned an expression that corresponds to the variable of the row in which the circled number is in:

↳ eg. in table 2, the number 2 is circled in row x' , so $I_2 = x'$ and likewise, $I_3 = x'$

6) Draw the MUX:



7) Finally, we write the output expression of the MUX, which will be a sum of minterms, where each minterm will contain an I_n variable.

$$I_0 yz + I_1 yz + I_2 yz + I_3 yz$$

00
01
10
11

This is just the skeleton of the expression. The numbers in green are designating numeric values to yz , counting upwards.

For the actual expression, we will negate y and z in accordance to these numbers.

$$I_0 y'z' + I_1 y'z + I_2 yz' + I_3 yz$$

↳ substitute the I_n terms with their appropriate value:

$$y'z + x'y'z' + x'yz$$