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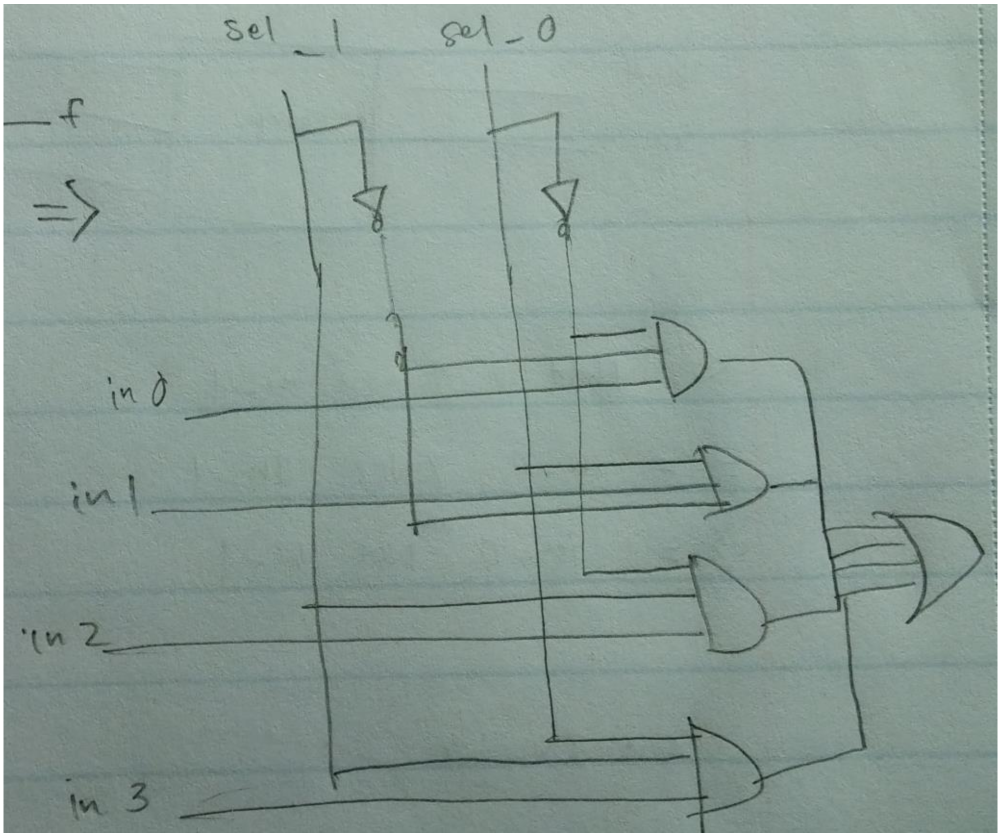
Assignment 1 Lab Report

4-to-1 Multiplexer (MUX):

The 4-to-1 multiplexer is a circuit that takes in 4 inputs and sends a signal out depending on which select gate is switched on or off.

Gate Implementation:



Truth Table:

Sel_1	Sel_0	f
0	0	In_0
0	1	In_1
1	0	In_2
1	1	In_3

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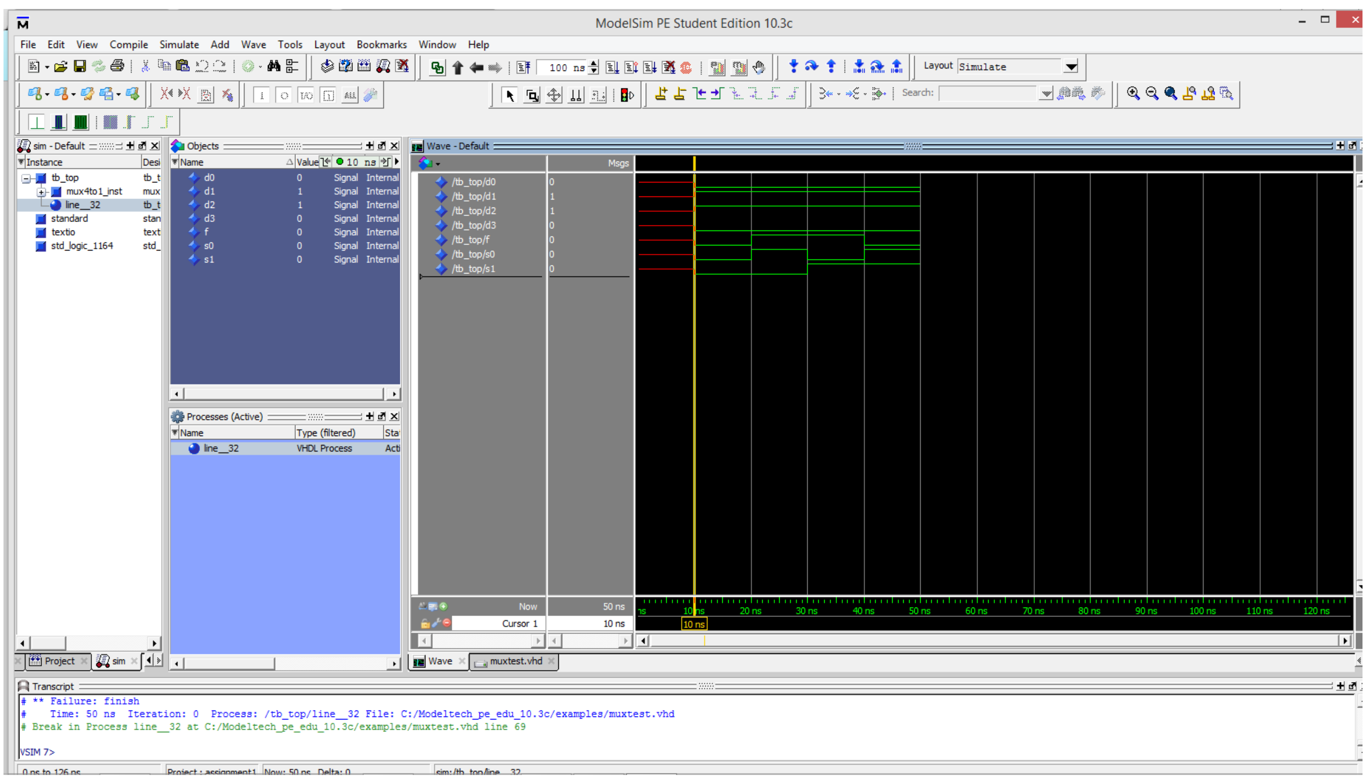
K-Map;

Sel_0 **Sel_1**	**0**	**1**
0	In_0	In_1
1	In_2	In_3

Boolean Expressions:

f = (in_0*sel_0’*sel_1’) + (in_1*sel_0’*sel_1) + (in_2*sel_0sel_1’) + (in_3*sel_0*sel_1)

Waveforms:



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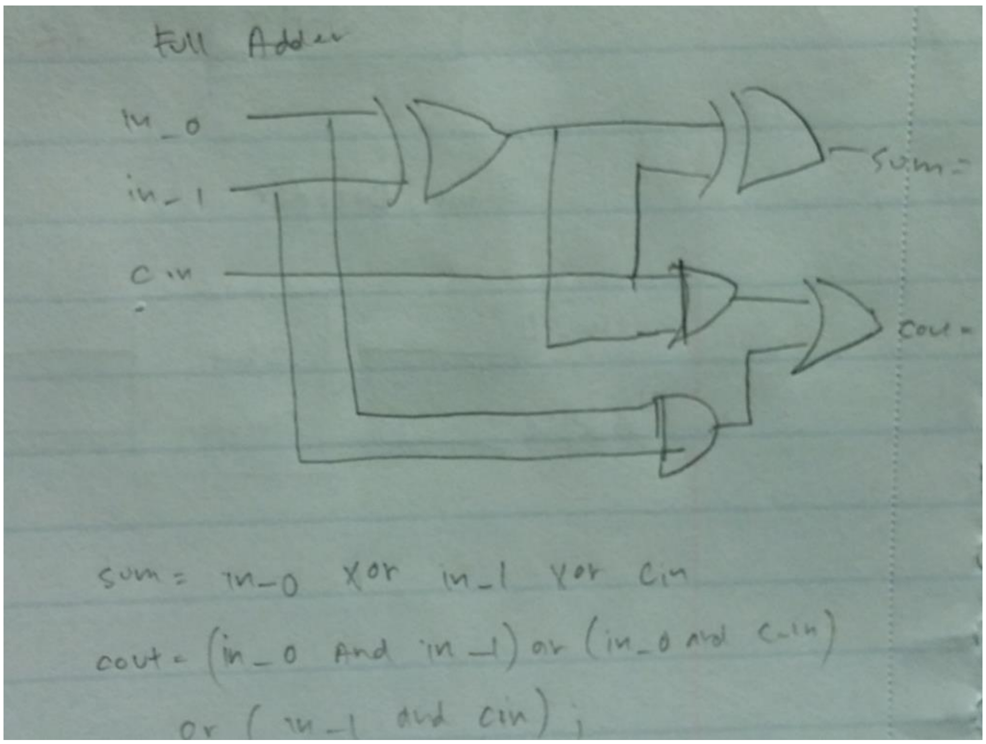
Full Adder/Subtractor :

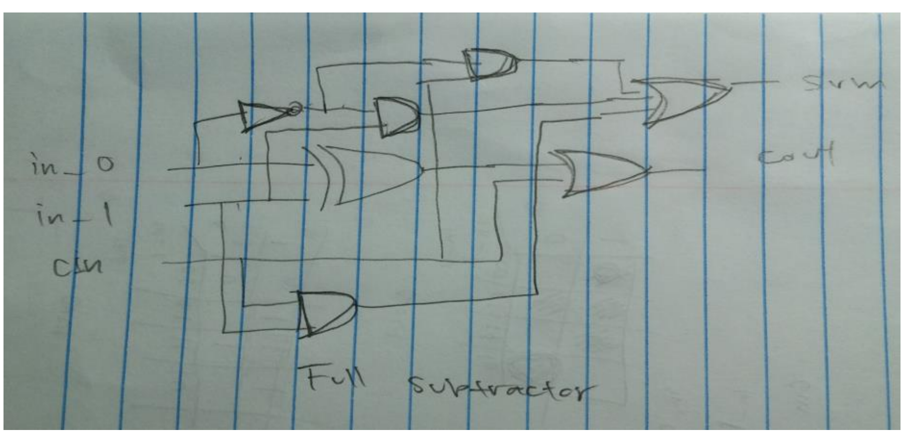
The full adder and subtractor is a circuit that takes in 2 1-bit binary numbers and either add or subtract them depending on the signal which the circuit is designed to choose. In my circuit 0 is add and 1 is subtract. What makes a fuller adder and subtractor different from the half adder and subtractor is that in a full adder and subtractor, carry ins and carry outs are taken in consideration during the mathematical process.

Gate Implementation:

Full Adder Gate:



Full Subtractor Gate:



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Truth Table :

Adder

addorsub	in_0	in_1	cin	cout	sum
0	0	0	0	0	0
0	0	0	1	0	1
0	0	1	0	0	1
0	0	1	1	1	0
0	1	0	0	0	1
0	1	0	1	1	0
0	1	1	0	1	0
0	1	1	1	1	1

Subtractor

addorsub	in_0	in_1	cin	cout	sum
1	0	0	0	0	0
1	0	0	1	1	1
1	0	1	0	1	1
1	0	1	1	1	0
1	1	0	0	0	1
1	1	0	1	0	0
1	1	1	0	0	0
1	1	1	1	1	1

K-Map

Sum:

in_0in_1	O0	O1	11	10
cin 0		1		1
1	1		1	

Adder cout

in_0in_1	O0	O0	11	10
cin 0			1	
1		1	1	1

Subtractor cout

in_0in_1	O0	O1	11	10
cin 0		1		
1	1	1	1	

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Boolean Equations:

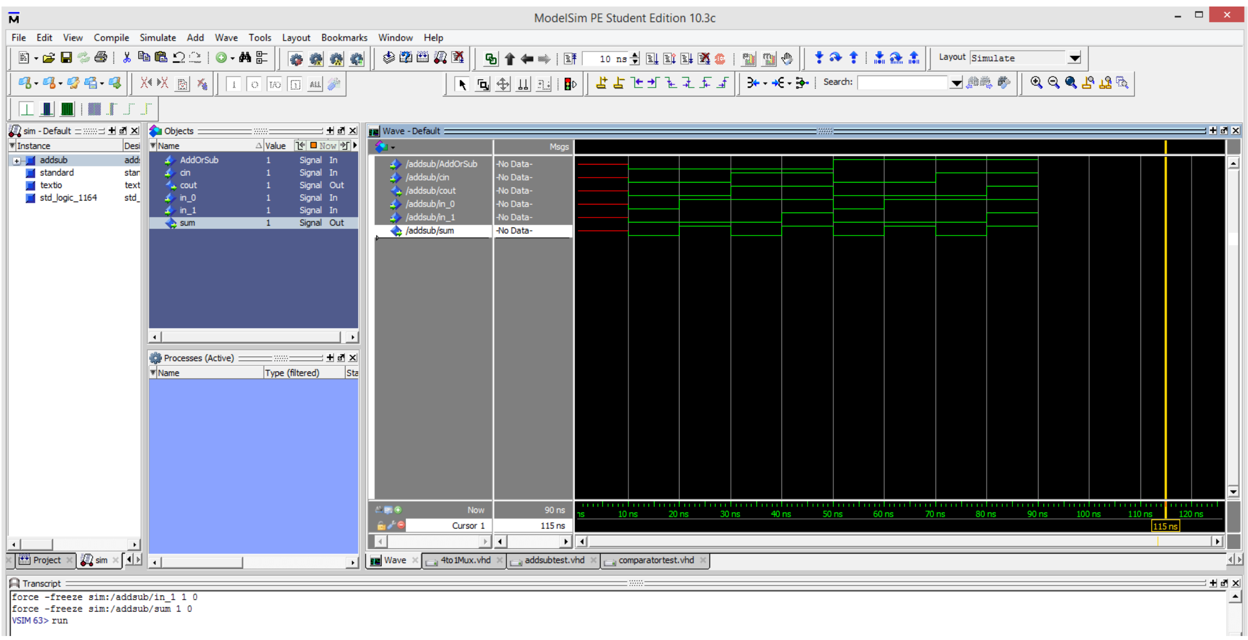
Full Adder:

Sum = in_0 xor in_1 xor cin
Cout = (in_0*in_1) + (in_0*cin) + (in_1 *cin)

Full Subtractor:

Sum = in_0 xor in_1 xor cin
Cout = (in_0’ * in_1) + (in_0’ * cin) + (in_1 * cin)

Wave map:



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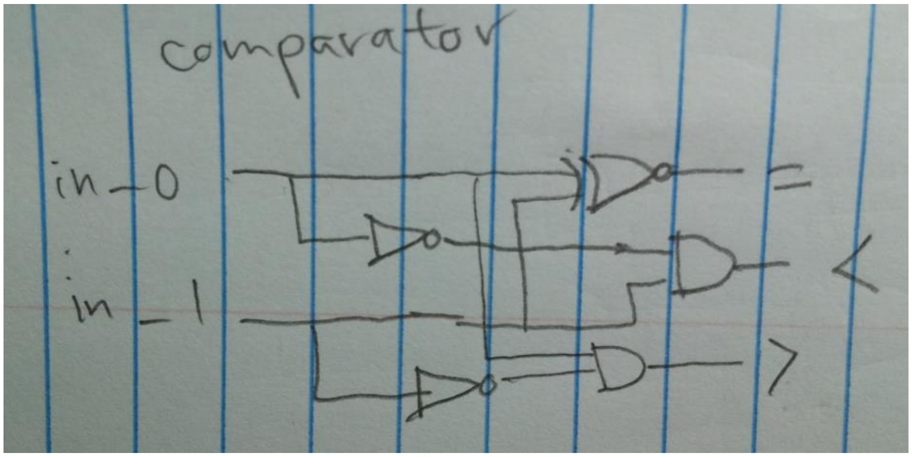
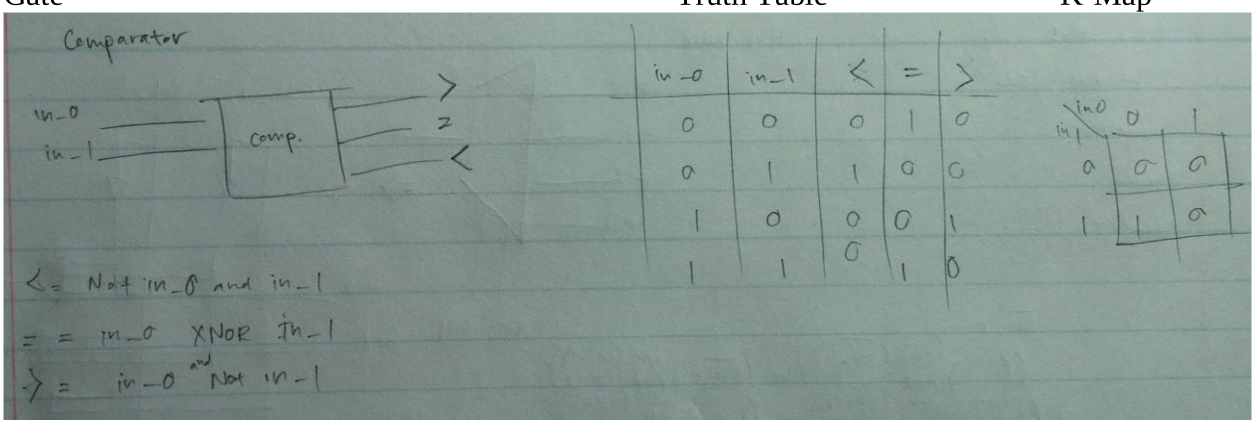
Comparator:

The comparator is a circuit that compares two 1-bit numbers and sends a signal through the gate corresponding to whether the 1st bit is either greater than, equal to, or less than the 2nd bit.

Gate Implementation:



Gate Truth Table K-Map



Boolean Equations

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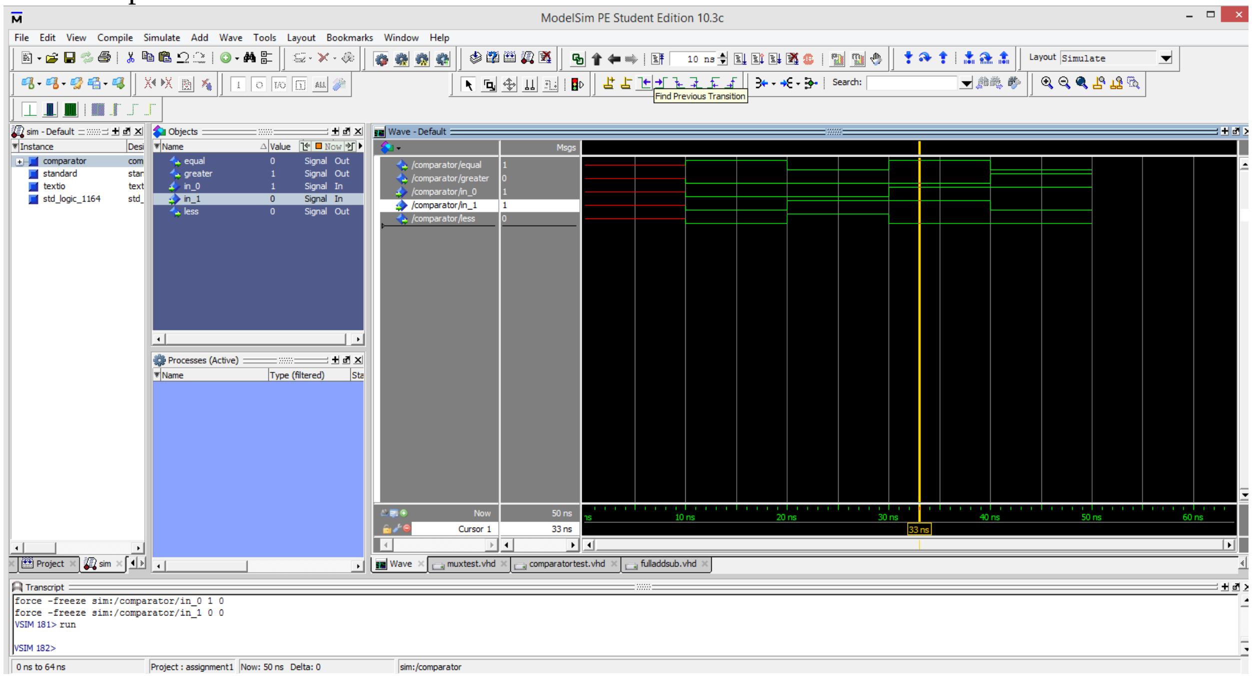
Wave Map:



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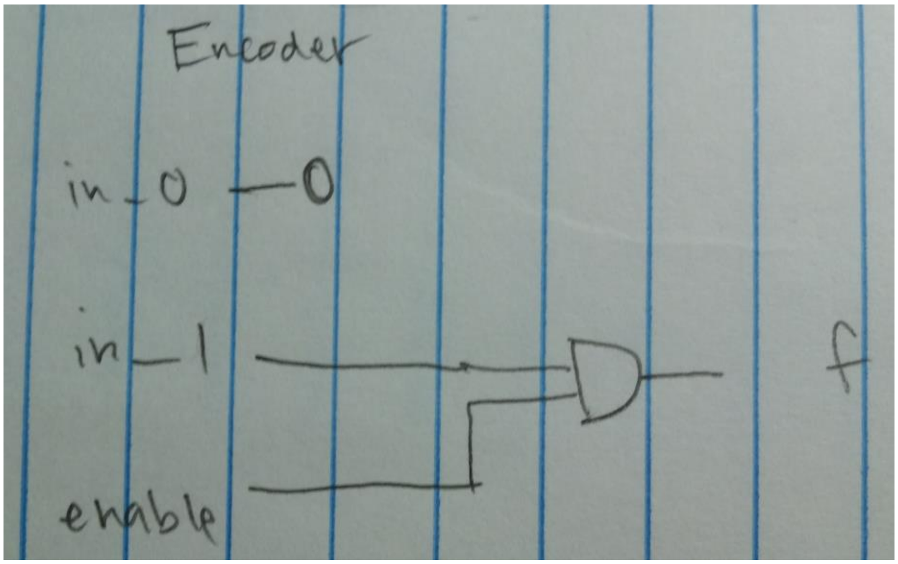
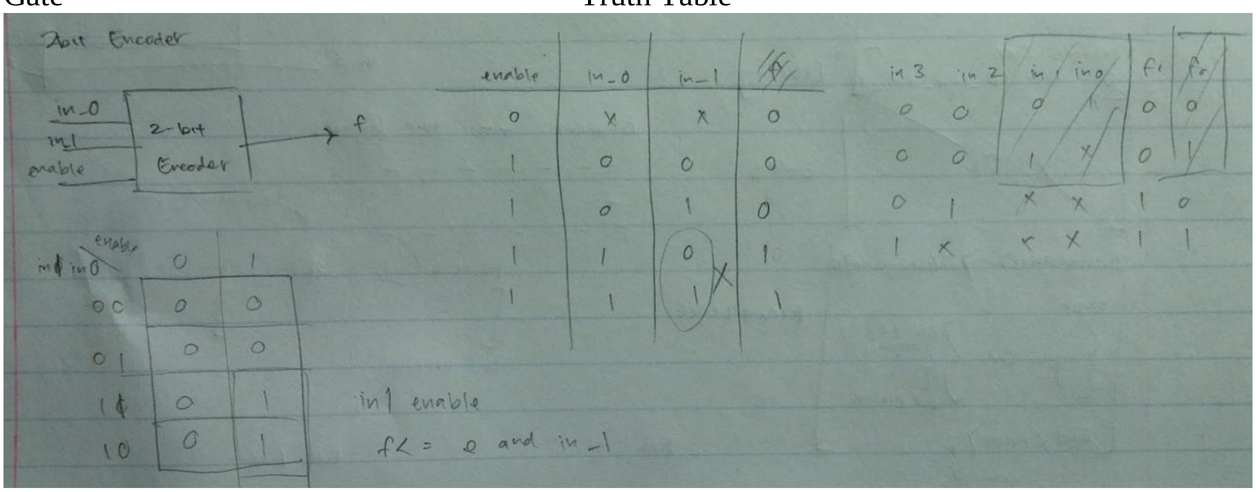
Encoder:

The encoder is a circuit that takes in a decimal number and transcribes it into a binary number.

Gate Implementation:



Gate   Truth Table



K- Map   Boolean Equation

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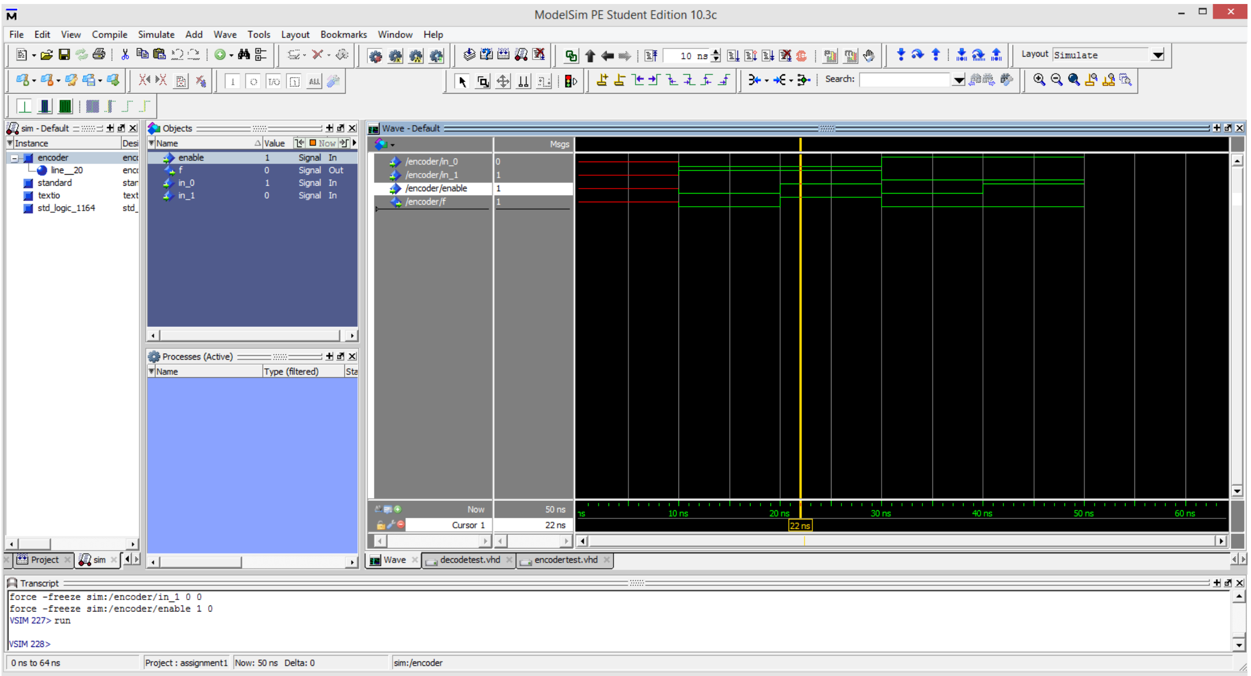
Wave Map:



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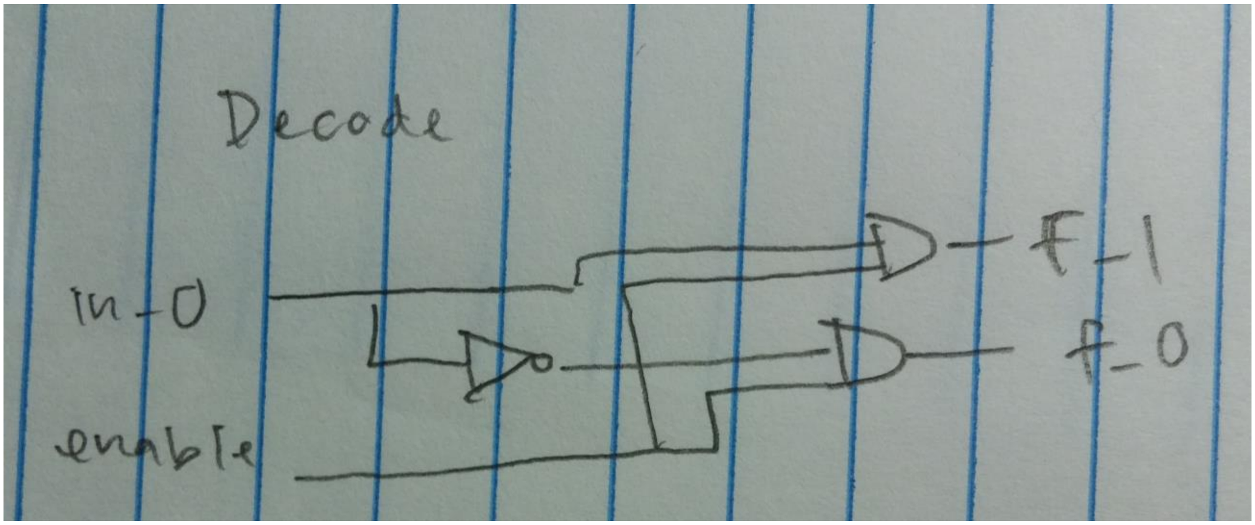
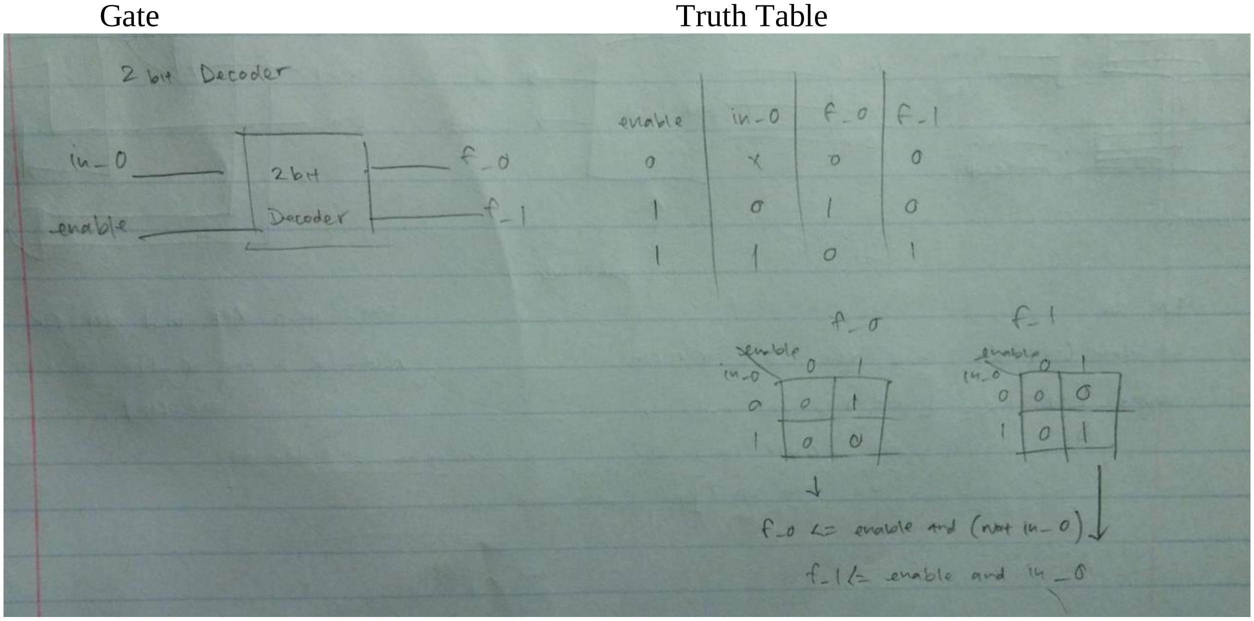
Decoder:

The decoder is a circuit that takes a binary number and transcribes it into a decimal number, It is the opposite of an encoder.

Gate Implementation:



Gate Truth Table



K- Map Boolean Equation

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Wave Map: