Instruction:

Complete all questions in **1 hour.**

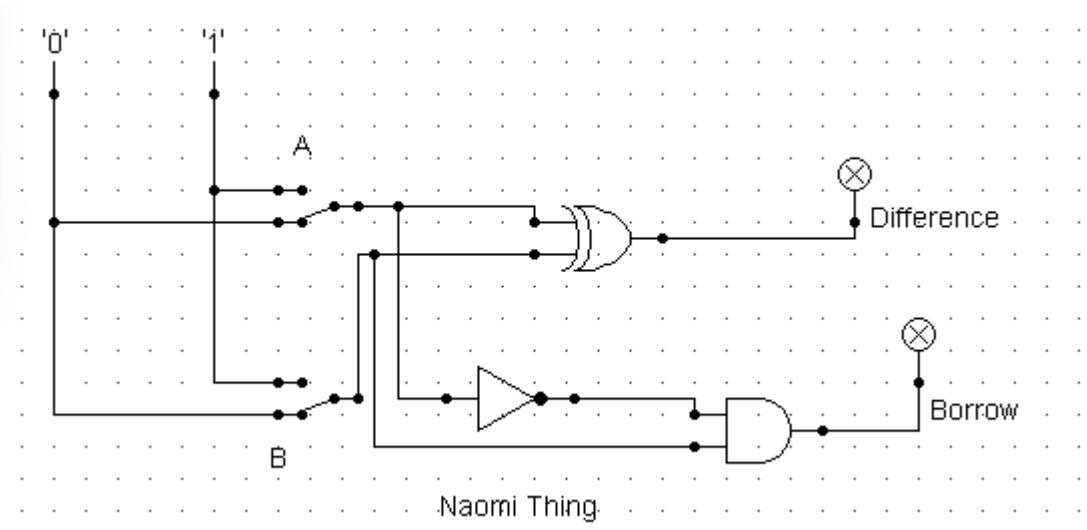
1. The table below shows the Truth table of Half Subtractor, write SOP expression for difference and borrow and design the circuit using Logsim.

A	B	Difference	Borrow
0	**0**	**0**	**0**
0	**1**	**1**	**1**
1	**0**	**1**	**0**
1	**1**	**0**	**0**

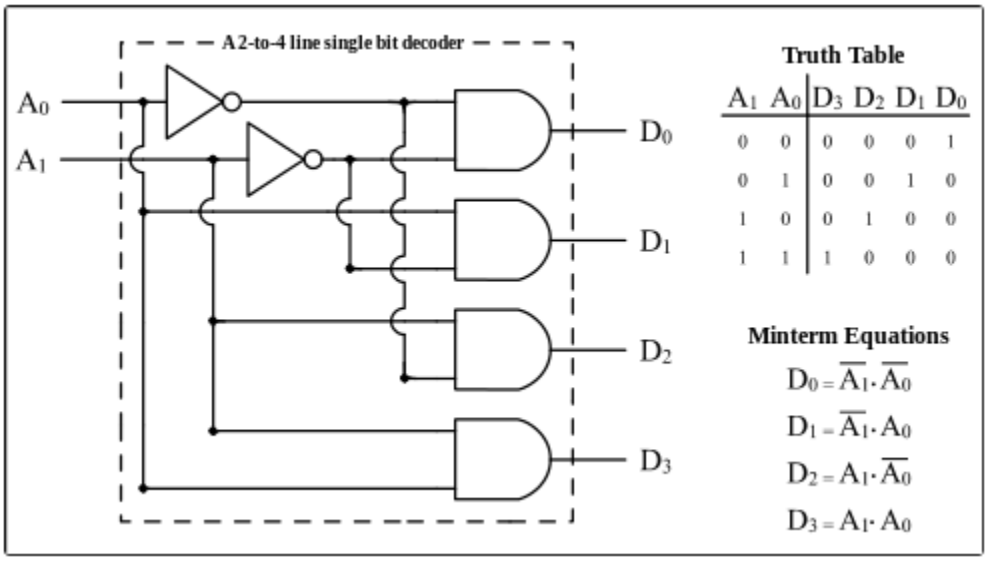
= The SOP expression for difference is: A'B+AB' =A$\oplus$B

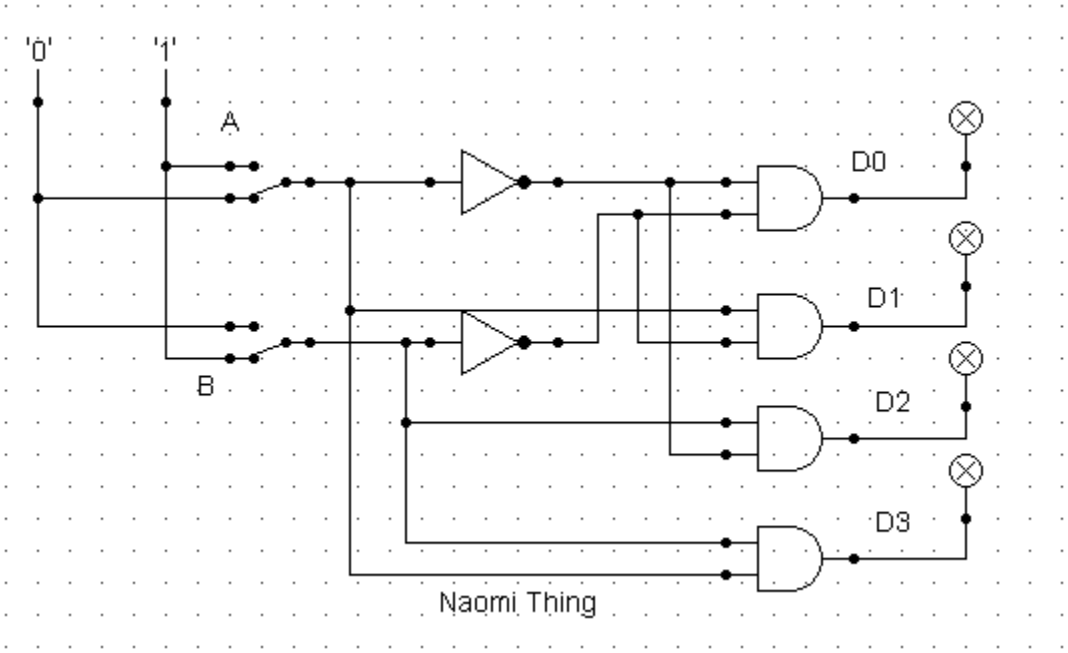
= The SOP expression for borrow is: A'B

Insert your Gif image here.



2. Design 2:4 decoder using logsim and Construct Truth table.

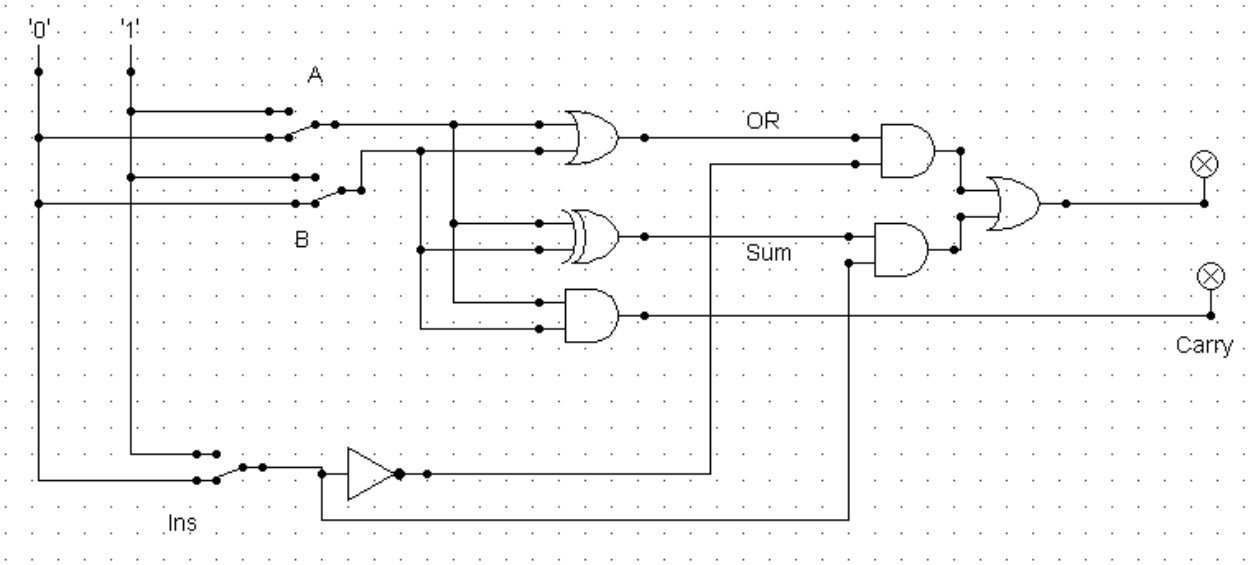




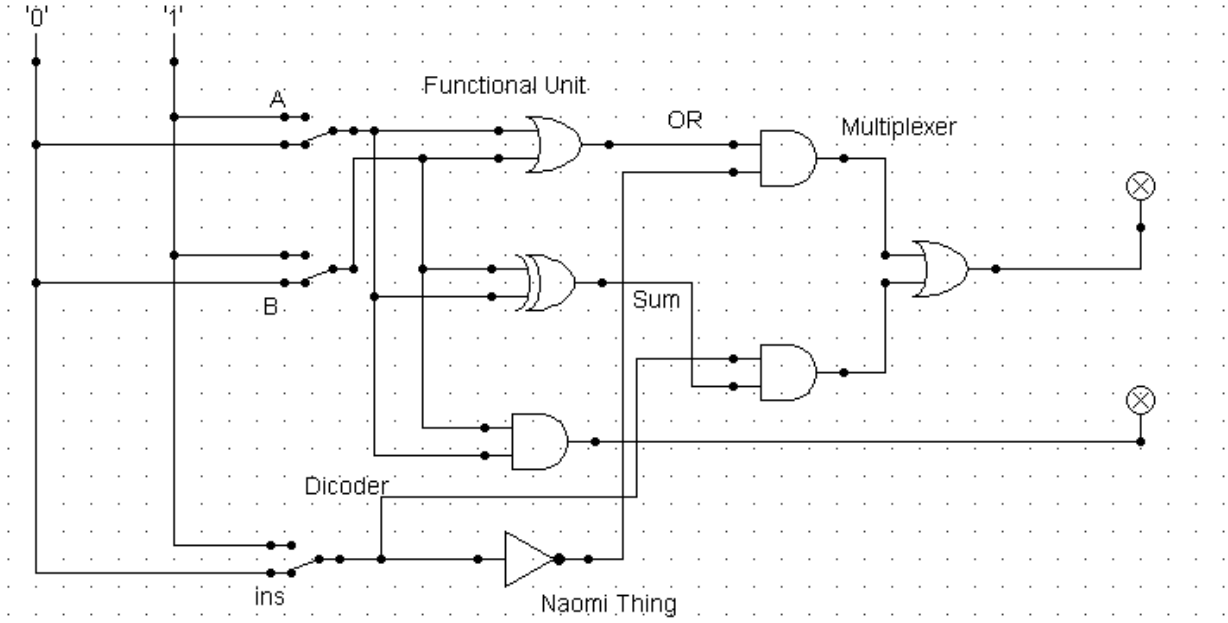
Truth Table:

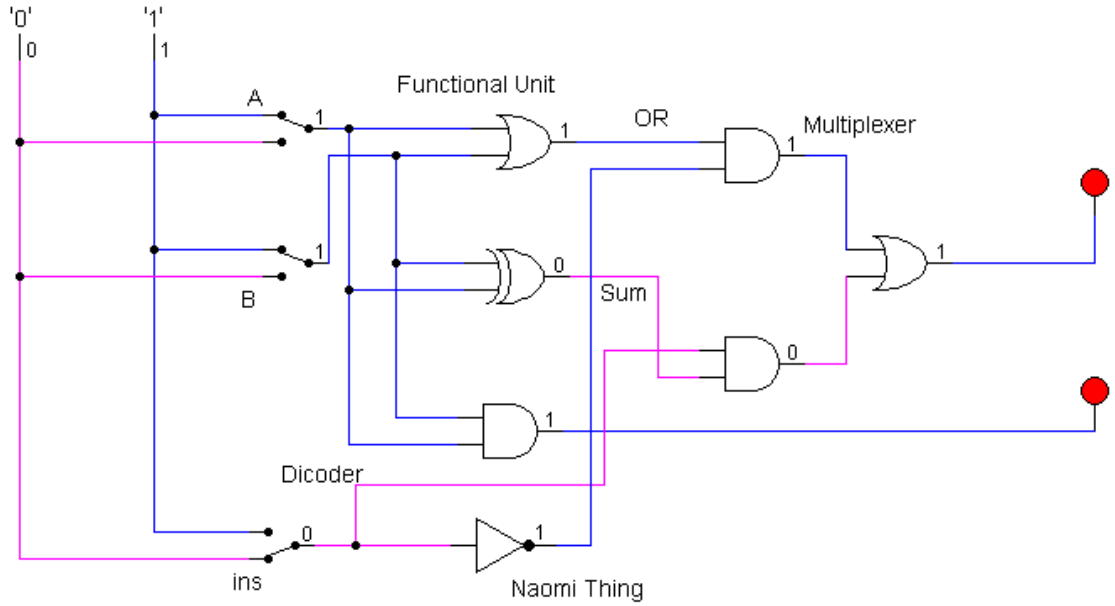
A	**B**	**D0**	D1	**D2**	**D3**
0	**0**	1	**0**	**0**	**0**
0	**1**	0	**1**	**0**	**0**
1	**0**	0	**0**	**1**	**0**
1	**1**	**0**	**0**	**0**	**1**

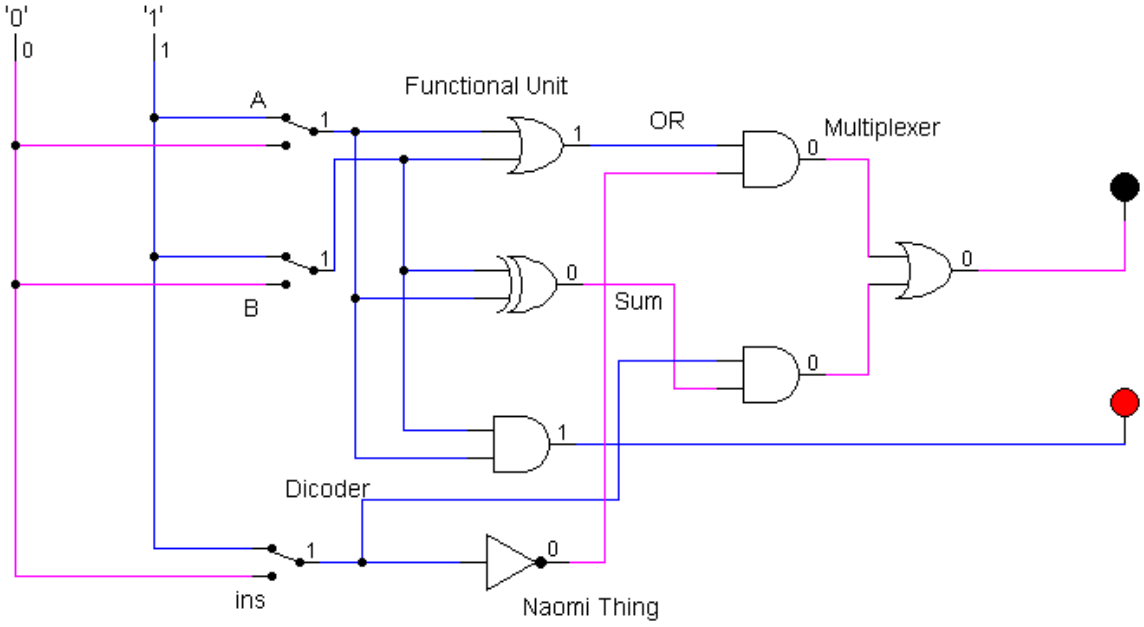
3. Draw the following simple ALU circuit using Logsim and describe the outputs when instructions are 1 and 0.



Answer:




'0'
'1'
A
Functional Unit
OR
Multiplexer
B
Sum
Dicoder
ins
Naomi Thing


'0'
'1'
A
Functional Unit
OR
Multiplexer
B
Sum
Dicoder
ins
Naomi Thing

= When the instruction is 0 the ALU performs addition or OR and when the Instruction is 1 then the ALU performs multiplication or AND.

4. Write sort notes on the following topic:
   a) ALU

= ALU stands for Arithmetic Logic Unit. An electronic circuit which performs arithmetic and logical operations is known as ALU. It performs tasks in form of 2s complement. John von Neumann came up with the idea of ALU in 1946. ALU loads data from input registers, processes the info, and stores the data into the output registers.

   b) Decoder

= A decoder is a combinational circuit which has “n” input lines and “2^n” output lines. The most common decoders everyone uses is 2x4 decoder. To detect the presence of a specified combination of bits on its input and to show that presence by a specified output level is the basic function of a decoder.

   c) Multiplexer

= The Multiplexer is a device that has multiple inputs and single line output. The select lines figure out which input is connected to the output and increase the amount of data that can be sent over a network within a certain time. It is also called a data selector. The multiplexer is used to perform high-speed switching and is constructed by electronic components.