

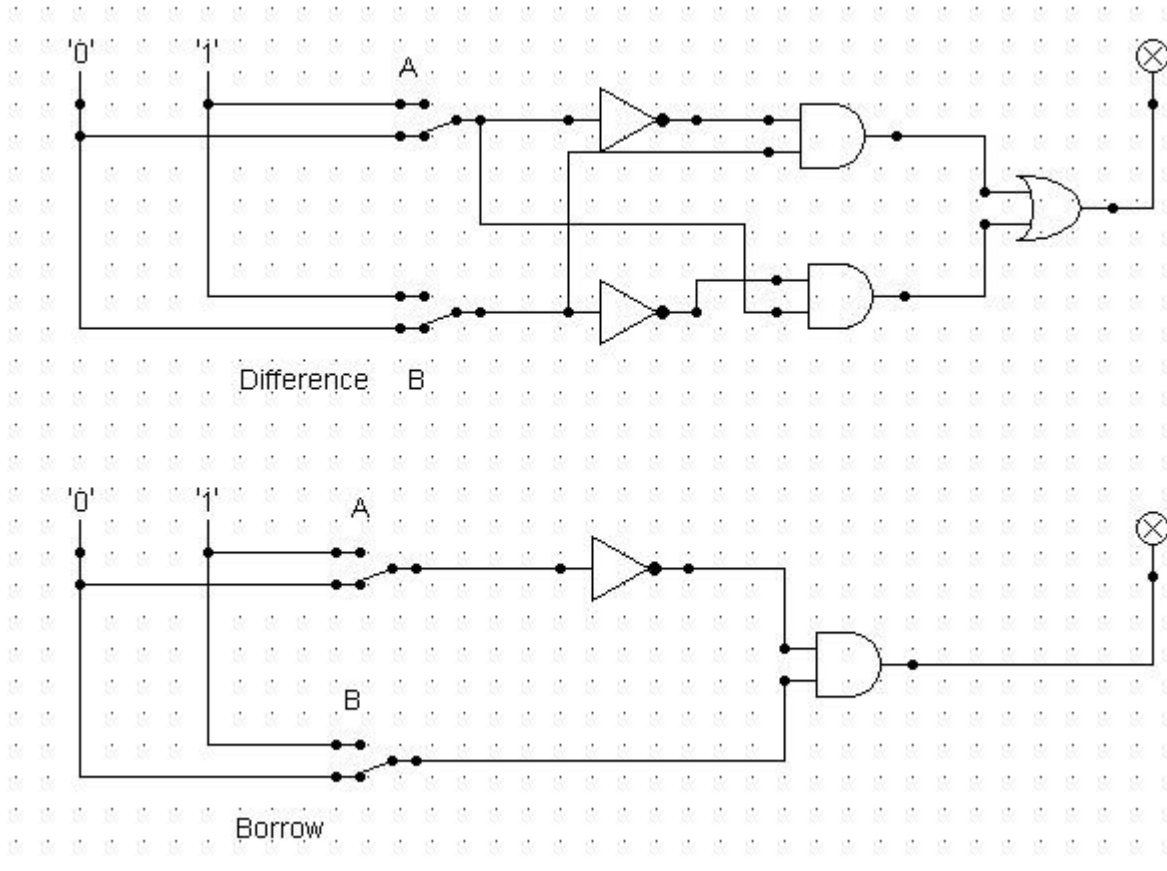
1. The table below shows the Truth table of Half Subtractor, write SOP expression for difference and borrow and design the circuit using Logsim.

Ans:

SOP

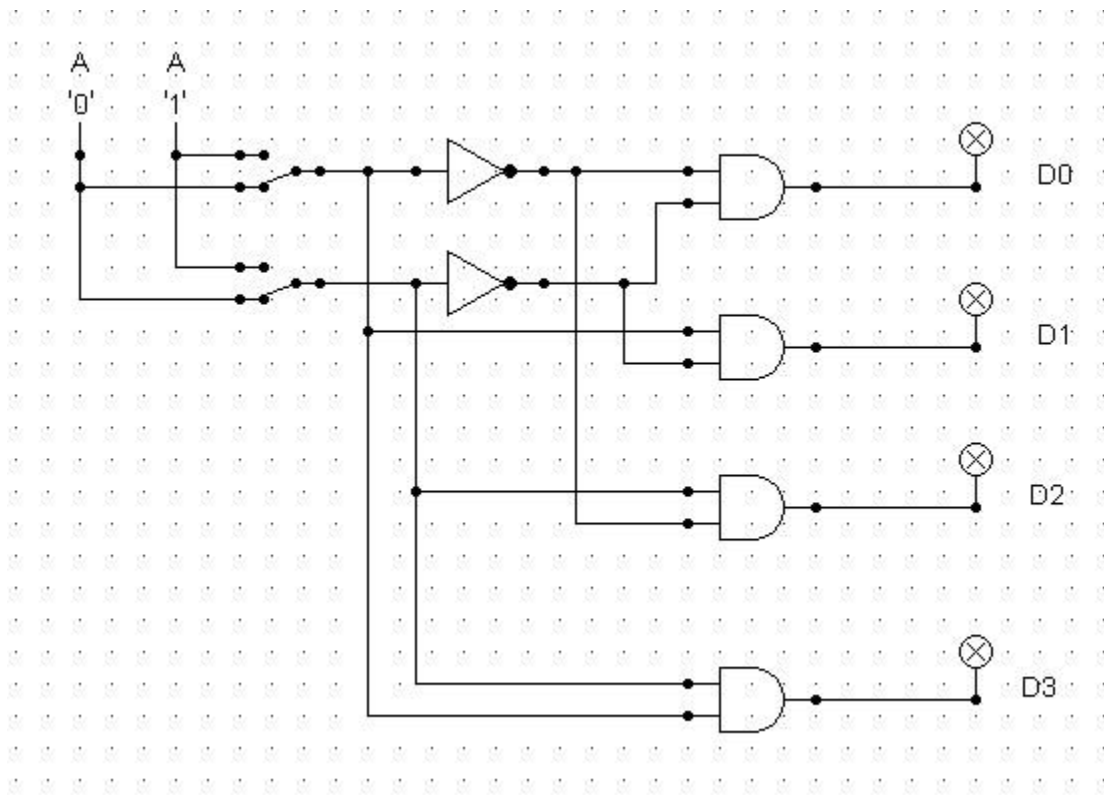
Difference:  $A'B + AB'$

Borrow:  $A'B$



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

Ans:

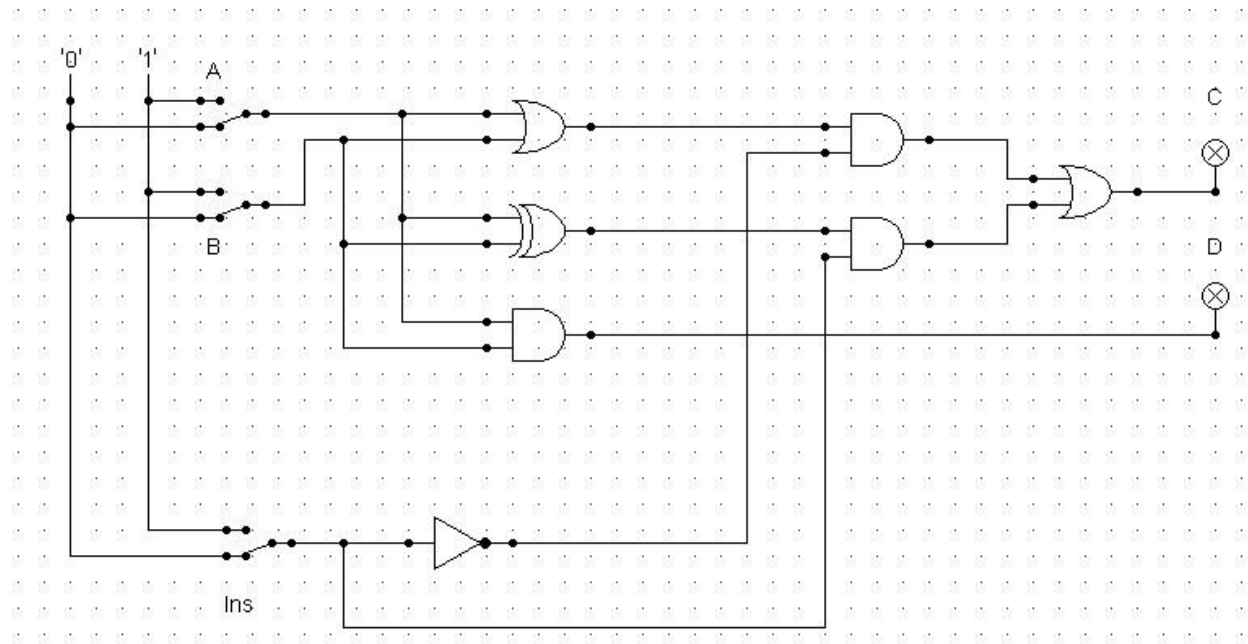


Truth Table:

In put		Output			
A0	A1	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.

Ans:



Input		Output			
A	B	C @Ins =0	C @Ins =1	D @Ins =0	D @Ins =1
0	0	0	0	0	0
0	1	1	1	0	0
1	0	1	1	0	0
1	1	1	0	1	1

When the instruction is '0' then the output 'C' is (0,1,1,1) and 'D' is (0,0,0,1) and when the instruction is '1' then the output 'C' is (0,1,1,0) and 'D' is (0,0,0,1).

4. Write short notes on the following topic:

a) ALU:

Arithmetic logic units are digital circuits with both arithmetic and logic capabilities. It stands in for the core element of the central processing unit of a computer. The ALUs of today's CPUs are highly powerful and sophisticated. A control unit in addition to ALUs is a feature of current CPUs.

For the majority of CPU operations, one or more ALUs load data from input registers. A CPU part called a register is a very small storage area. The ALU gets commands from the control unit on what operation to do on the data, and it then stores the result in an output register. Through the control unit, information is sent between these registers, the ALU, and memory. Computers can only store and process binary numbers, sometimes known as 0 and 1, as data. Transistor switches are used to deal with binary digits since a switch can only be in one of two potential states—open or closed. The symbol for an open transistor, or one through which there is no current, is 0. The symbol for a closed transistor that is conducting current is a 1.

b) Decoder:

A decoder converts  $n$  input lines into  $2^n$  output lines and generates the original signal from the input signal lines that have been coded. One too many relations exist in the decoder. An enable line, ' $n$ ' inputs, and  $2^n$  outputs are all present in a decoder. An AND gate, which only produces a high output when all inputs are high, can serve as the basic decoding component. There are several varieties of decoders, including 2- to 4-line and 3- to 8-line decoders, among others. One too many relations exist in the decoder. An enable line, ' $n$ ' inputs, and  $2^n$  outputs are all present in a decoder.

When active, the decoder's output simply represents the rows of " $n$ " input variables incorrectly. Although bigger line decoders can be built similarly, it is also possible to merge smaller decoders into larger decoders using binaries.

c) Multiplexer:

A multiplexer is a circuit that combines two or more circuits to produce a single output line from a circuit having  $n$  or more input lines. An analog-to-digital converter or the transmission of a communication media can be shared by several input signals instead of requiring a separate device for each input signal. Multiplexers can be used to implement boolean functions with a lot of variables.

It is less expensive and more convenient to enforce distinct channels for each information source than to provide multiplexing or demultiplexing operations. A multiplexer is a device that combines a multiplexer and a demultiplexer into one unit. A computer's data and address buses are controlled by multiplexers, which enables the processor to select data from various data sources. In digital communications, multiplexers allow for numerous connections to be made over a single channel by connecting the single output of the multiplexer to the single input of the demultiplexer.