

DESIGN A 4-BIT ALU

AIM:

To design and simulate a 4-bit ALU.

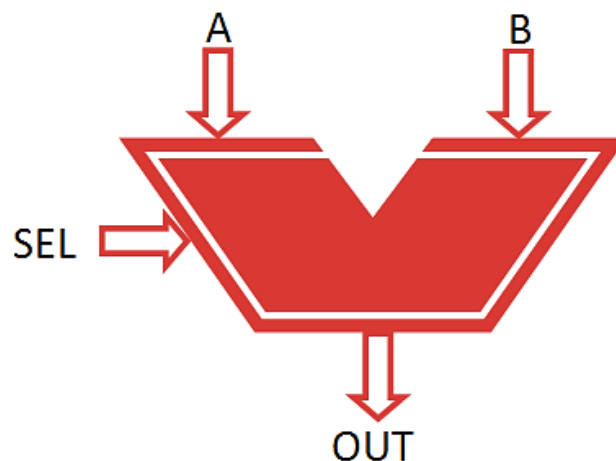
4-BIT ALU:

Arithmetic logic unit is that part of the computer which performs the different logic operations and arithmetic operations like addition, subtraction, multiplication and division. It is the high-speed digital circuit that solves calculations and does comparisons.

Functions of ALU:

- ✚ Almost all the actions are done by it. It gets its data from a certain computer memory called Processor Register. After the data gets processed, its results get stored in output registers of the ALU.
- ✚ The arithmetic logic unit can perform integer arithmetic operations like addition, subtraction etc.
- ✚ It can also perform bitwise logical operations like AND, OR, XOR etc.
- ✚ The arithmetic logic unit performs bit shifting operations like rotating or shifting a certain word to either the left or the right by a given number of bits. These can also be represented as divisions by 2 and also multiplications by 2. These are the simple operations carried out by the ALU. An ALU can be designed by using 8x1 multiplexer. By the three functions select inputs S_0 , S_1 , S_2 distinct arithmetic or logical operations can be performed.

The block diagram of an ALU is shown below:



FUNCTION TABLE FOR ALU:

SELECT LINES			OPERATION PERFORMED	TYPE OF OPERATION
S_2	S_1	S_0		
0	0	0	$A + B$	ARITHMETIC
0	0	1	$A - B$	
0	1	0	$A + 1$	
0	1	1	$A - 1$	
1	0	0	$A \text{ AND } B$	LOGICAL
1	0	1	$A \text{ OR } B$	
1	1	0	$\text{NOT } A$	
1	1	1	$A \text{ XOR } B$	

The i/o ports needed for the formation of 4-Bit ALU is given below:

Port Name	INPUT/OUTPUT	Bus
A	In	4-Bit Bus (3 downto 0)
B	In	4-Bit Bus (3 downto 0)
Select	In	3-Bit Bus (2 downto 0)
ALU_Out	Out	4-Bit Bus (3 downto 0)

- **NB: Use temporary variable where ever necessary.**