Course Name:	Digital Design Laboratory	Semester:	III
Date of Performance:	21 / 08 / 2023	Batch No:	C-2
Faculty Name:		Roll No:	16010122267
Faculty Sign & Date:		Grade/Marks:	___/25

Experiment No: 4

Title: 4-bit magnitude comparator

Aim and Objective of the Experiment:

To design a 2-bit comparator using logic gates and verify 4-bit magnitude comparator using IC 7485

COs to be achieved:

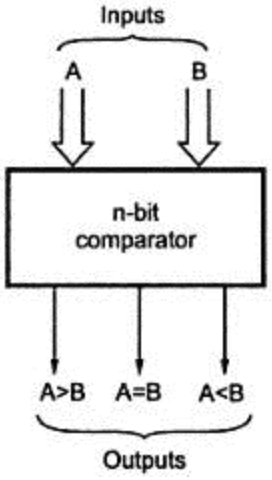
CO2: Use different minimization technique and solve combinational circuits.

Tools used:

Trainer kits

Theory:

Comparator: The comparison of two numbers is an operator that determines one number is greater than, less than (or) equal to the other number. A magnitude comparator is a combinational circuit that compares two numbers A and B and determines their relative magnitude. The outcome of the comparator is specified by three binary variables that indicate whether A>B, A=B (or) A<B.



Two Bit Magnitude Comparator Implementation Details:

Truth Table from the Truth Table:

INPUT				OUTPUT		
A_1	A_0	B_1	B_0	A<B	A=B	A>B
0	0	0	0	0	1	0
0	0	0	1	1	0	0
0	0	1	0	1	0	0
0	0	1	1	1	0	0
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	1	0	0
0	1	1	1	1	0	0
1	0	0	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	0	1	0
1	0	1	1	1	0	0
1	1	0	0	0	0	1
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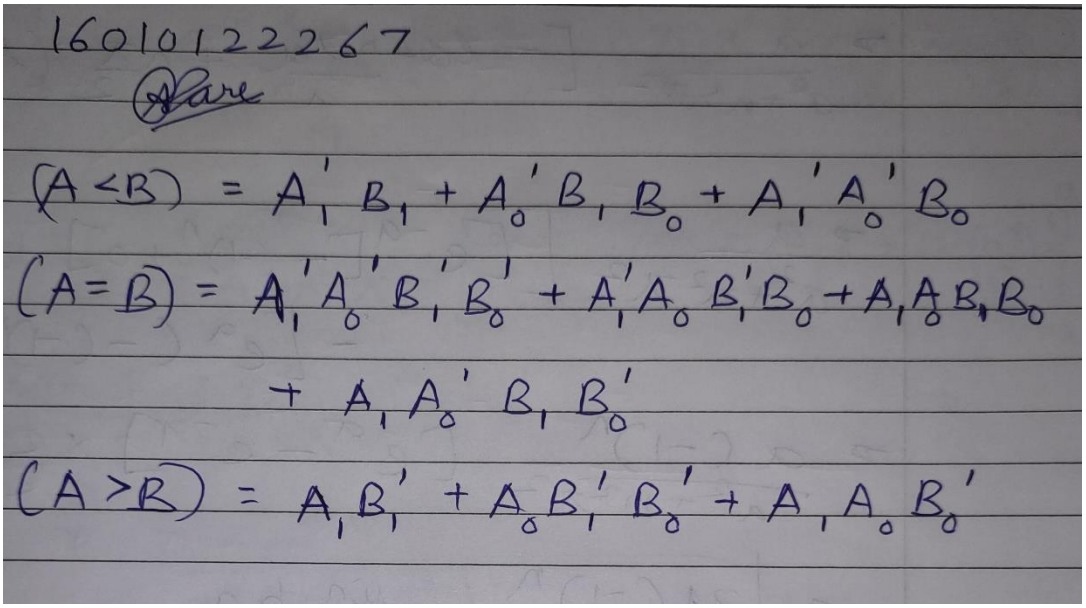
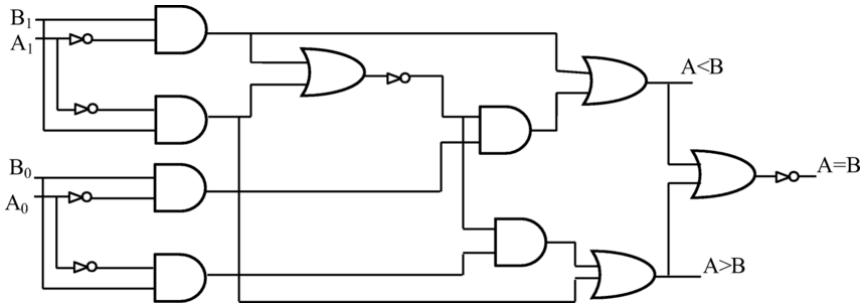
1	1	1	1	0	1	0

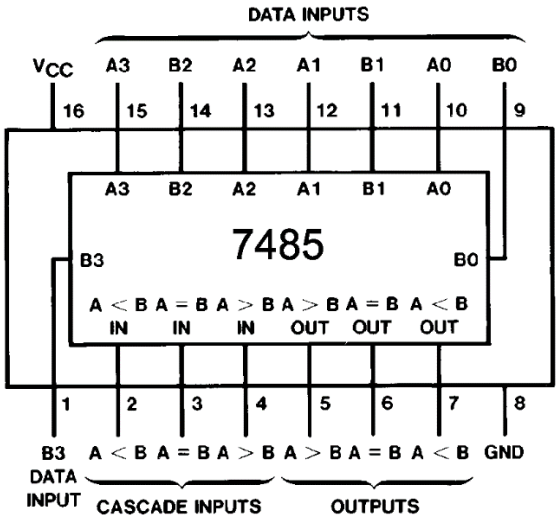


Logic Diagram of 2-bit Comparator

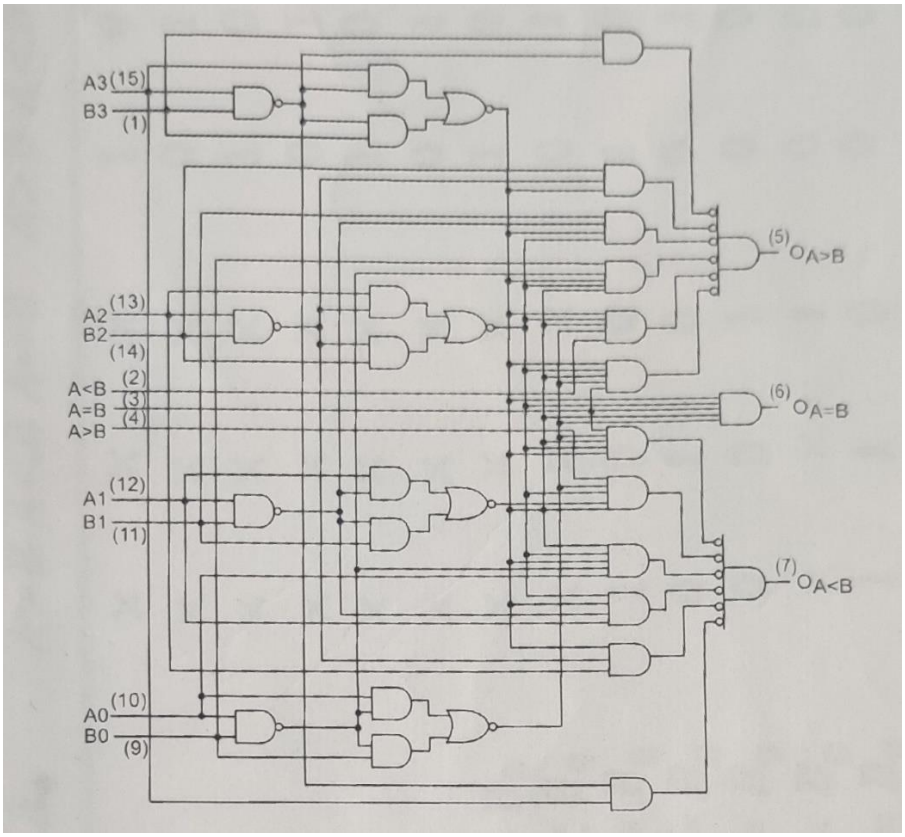


Four Bit Magnitude Comparator Implementation Details

Pin Diagram of IC 7485



Logic Diagram of IC 7485



Comparing Table

TRUTH TABLE

COMPARING INPUTS				CASCADING INPUTS			OUTPUTS		
A_3,B_3	A_2,B_2	A_1,B_1	A_0,B_0	$I_{A>B}$	$I_{A<B}$	$I_{A=B}$	$O_{A>B}$	$O_{A<B}$	$O_{A=B}$
$A_3>B_3$	X	X	X	X	X	X	H	L	L
$A_3<B_3$	X	X	X	X	X	X	L	H	L
$A_3=B_3$	$A_2>B_2$	X	X	X	X	X	H	L	L
$A_3=B_3$	$A_2<B_2$	X	X	X	X	X	L	H	L
$A_3=B_3$	$A_2=B_2$	$A_1>B_1$	X	X	X	X	H	L	L
$A_3=B_3$	$A_2=B_2$	$A_1<B_1$	X	X	X	X	L	H	L
$A_3=B_3$	$A_2=B_2$	$A_1=B1$	$A_0>B_0$	X	X	X	H	L	L
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0<B_0$	X	X	X	L	H	L
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0=B_0$	H	L	L	H	L	L
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0=B_0$	L	H	L	L	H	L
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0=B_0$	X	X	H	L	L	H
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0=B_0$	H	H	L	L	L	L
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0=B_0$	L	L	L	H	H	L

H = HIGH Level
L = LOW Level
X = IMMATERIAL

Implementation Details

Procedure:

1) Locate the IC 7485 on the trainer kit.
2) Connect 1st input no. to A3-A0 input slot and 2nd to B3-B0.
3) Connect the output $Y_{A>B}$, $Y_{A<B}$ and $Y_{A=B}$ to the output indicators.
4) Switch ON the power supply and monitor the output for various input combinations.

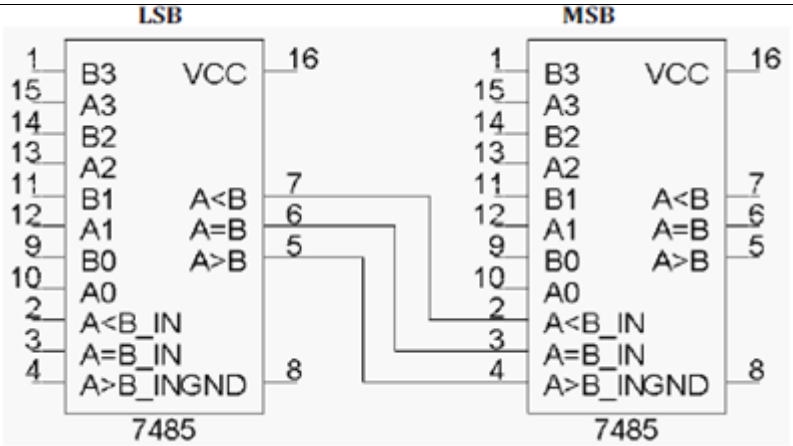
Post Lab Subjective/Objective type Questions:

1. Give some applications of magnitude comparator.
   Ans:

   Some applications of magnitude comparator are: -
   1. **CPU and MCU Operations**: Magnitude comparators find applications within Central Processing Units (CPUs) and Microcontrollers (MCUs) where they are essential for various data comparison tasks.
   2. **Control Systems**: They are employed in control applications where binary representations of physical variables such as temperature, position, etc., need to be compared with a predefined reference value to make control decisions.
   3. **Process Control**: Magnitude comparators play a crucial role in process control systems, ensuring that parameters are within specified limits and triggering actions based on these comparisons.
   4. **Servo Motor Control**: In applications involving servo motors, magnitude comparators are used to compare desired and actual positions, enabling precise motor control.
   5. **Security and Authentication**: They are utilized in password verification and biometric authentication systems to determine if input data matches stored reference values.
   6. **Address Decoding in Computers**: In computer architecture, magnitude comparators are used in address decoding circuits, aiding in the selection of specific memory locations or peripherals based on the address provided.

2. Explain with the help of the logic diagram how an 8-bit comparator can be implemented using IC 7485.

   An 8-bit comparator can be implemented by cascading of two 4-bit comparators (IC 7485). The outputs of the lower-order comparator are connected to the corresponding cascading inputs of the higher-order comparator.



In the lower order comparator, the cascading input (A=B) needs to be connected HIGH, and A, B needs to be connected to LOW. The result of the 8-bit comparator is the output of the higher-order comparator.

Conclusion:

Thus, in this experiment, we learned about binary comparators and how to implement them using IC 7485. We learned about 1-bit, 2-bit, 4-bit and 8-bit comparators. We also learned how to build an 8-bit comparator using two 4-bits comparators.

Signature of faculty in-charge with Date: