Course Name:	**Digital Design Laboratory**	**Semester:**	**III**
Date of Performance:	**21 / 08 / 2023**	**Batch No:**	**C-2**
Faculty Name:		**Roll No:**	**16010122266**
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:

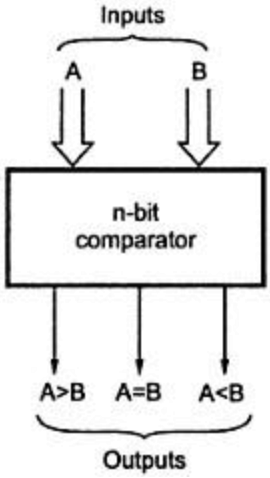
CO2: Use different minimization technique and solve combinational circuits.

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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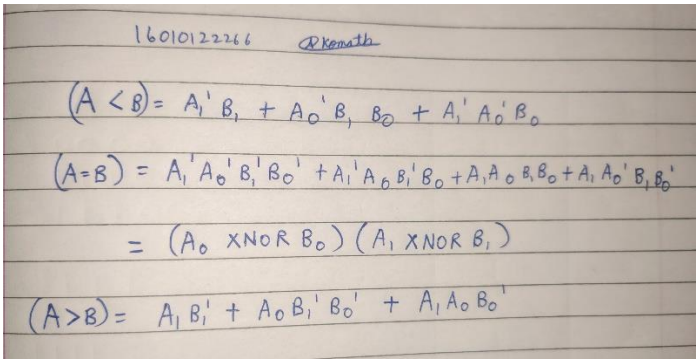
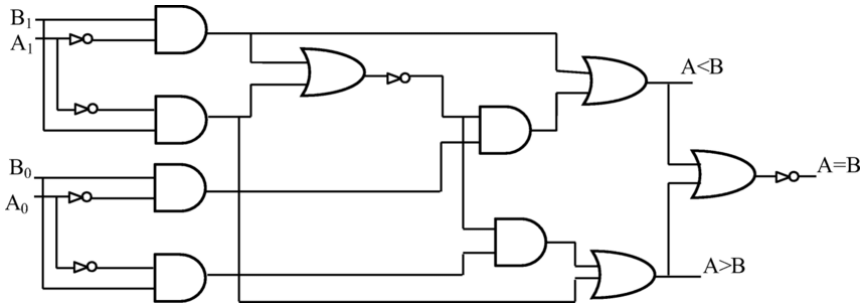
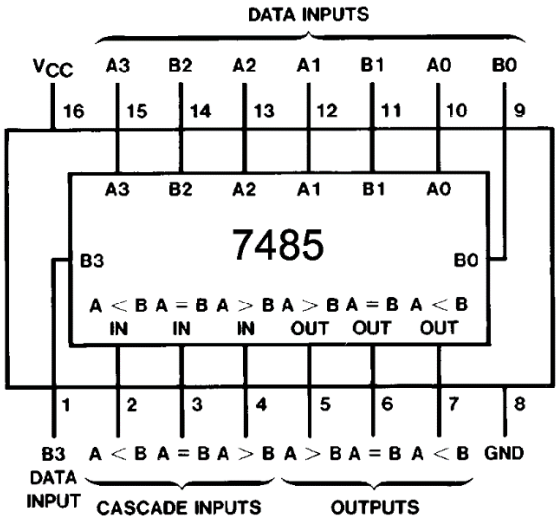


Logic Diagram of 2-bit Comparator

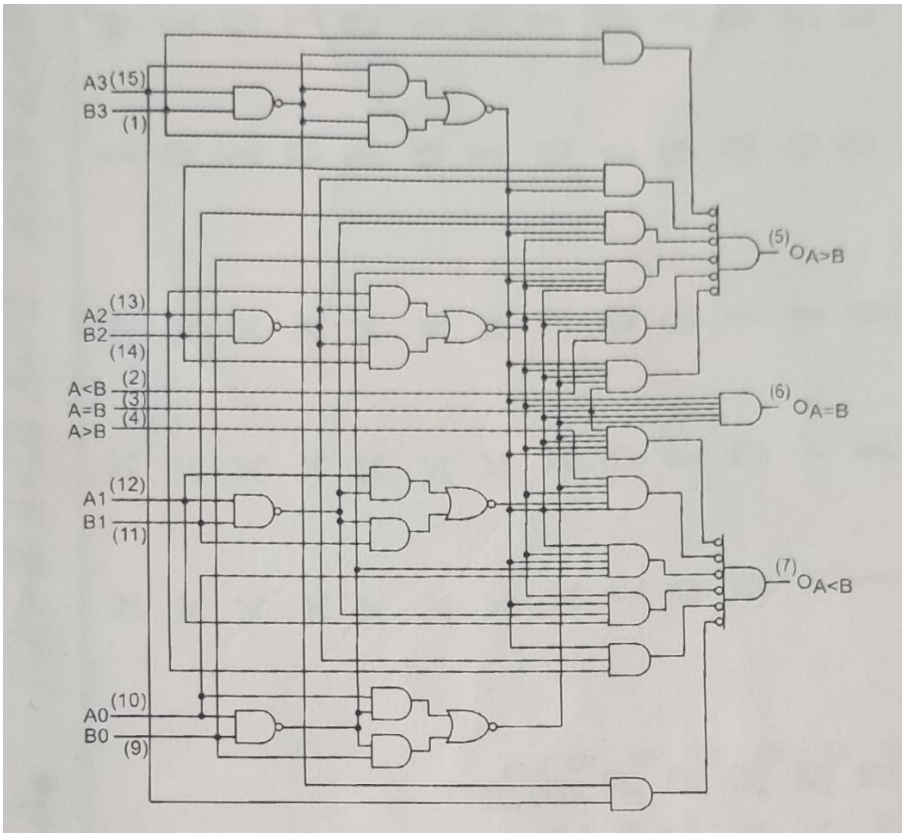


Four Bit Magnitude Comparator Implementation Details

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
$A_3=B_3$	$A_2=B_2$	$A_1=B_1$	$A_0>B_0$	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:

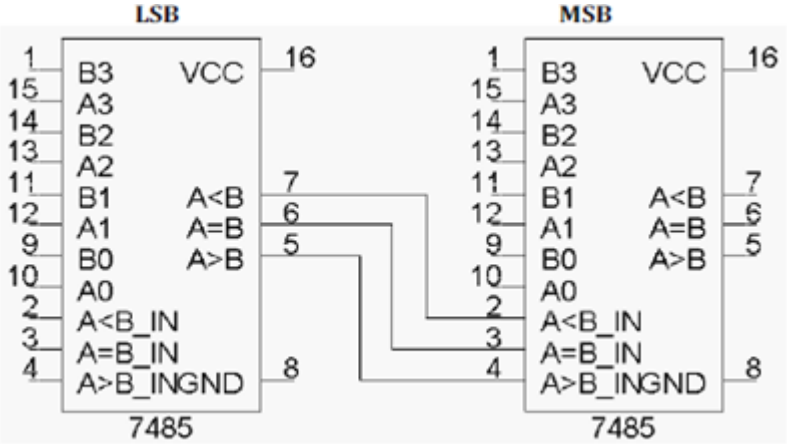
1. Give some applications of magnitude comparator.

Some applications of magnitude comparator are: -

- Comparators are used in central processing units (CPUs) and microcontrollers (MCUs).
- These are used in control applications in which the binary numbers representing physical variables such as temperature, position, etc. are compared with a reference value.
- Comparators are also used as process controllers and for Servo motor control.
- Used in password verification and biometric applications.
- Used to address decoding circuitry in computers.

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: