ASSIGNMENT NO: 04

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SEMESTER/YEAR: Sem-3 / 2022-23	**ROLL NO:** 015
DATE OF PERFORMANCE: / /2022	**DATE OF SUBMISSION:** / /2022
EXAMINED BY: Prof. G. B. Aochar	**EXPERIMENT NO: 4**

TITLE: Magnitude Comparator

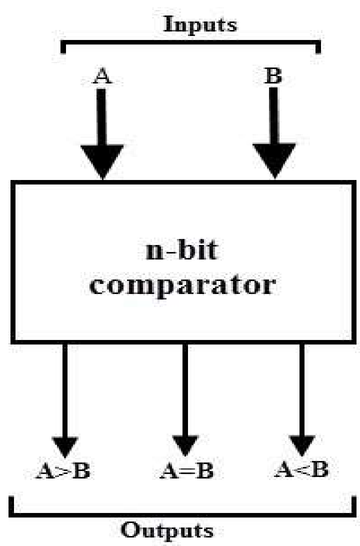
PROBLEM STATEMENT: To Verify the truth table of one bit and two bit comparators using logic gates and four bit and eight bit comparators using IC 7485.

PRE-REQUESITE:

Digital trainer kit, ICs- 7485, 74LS08, 7404 Probs

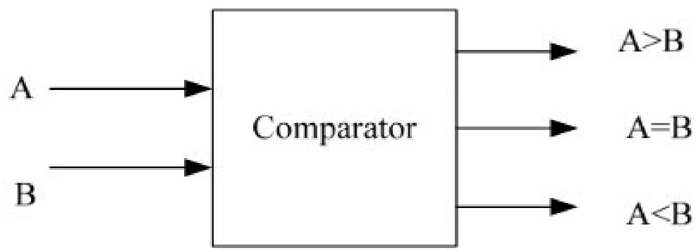
THEORY:

A **digital comparator** or **magnitude comparator** is a hardware electronic device that takes two numbers as input in binary form and determines whether one number is greater than, less than or equal to the other number. Comparators are used in Central Processing Units (CPUs) and microcontroller (MCUs).



One Bit Comparator: - a magnitude *comparator* of two *1-bits*, (A and B) inputs would produce the following three output conditions when compared to each other.

Logic Diagram:



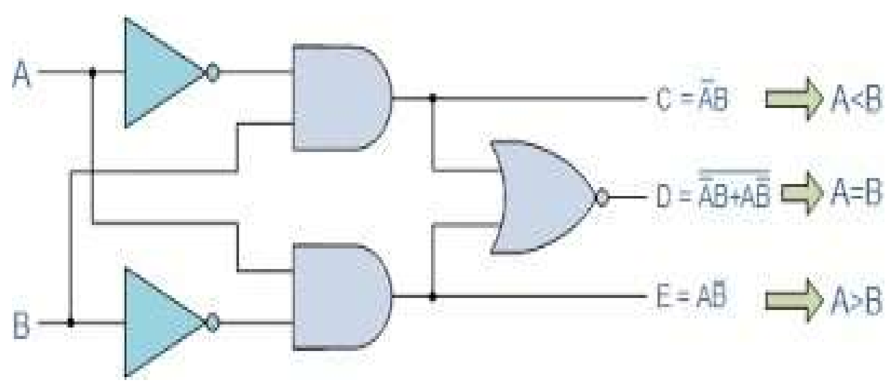
Truth Table:

A	B	A>B	A<B	A=B
0	0	0	0	1
0	1	0	1	0
1	0	1	0	0
1	1	0	0	1

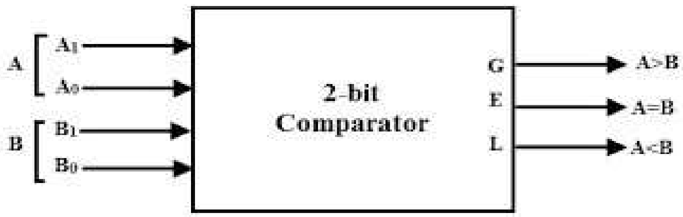
A>B = AB'

A<B = A'B

(A=B) = A'B' + AB = A EXOR B



Two Bit Comparator: - a magnitude *comparator* of two 2-*bits*, (A and B) inputs would produce the following three output conditions when compared to each other.

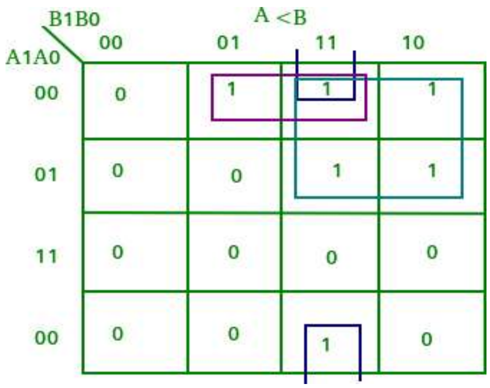


Truth Table:

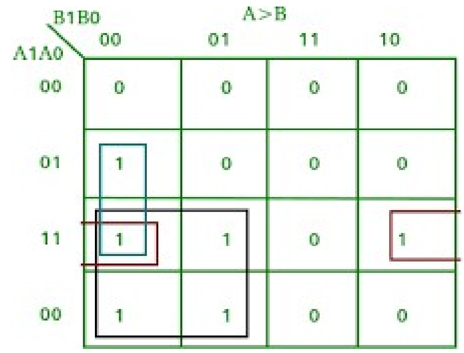
A1	A0	B1	B0	A>B	A<B	A=B
0	0	0	0	0	0	1
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	0	1	0
0	1	0	0	1	0	0
0	1	0	1	0	0	1
0	1	1	0	0	1	0
0	1	1	1	0	1	0
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	0	1
1	0	1	1	0	1	0
1	1	0	0	1	0	0
1	1	0	1	1	0	0
1	1	1	0	1	0	0
1	1	1	1	0	0	1

Kmap:

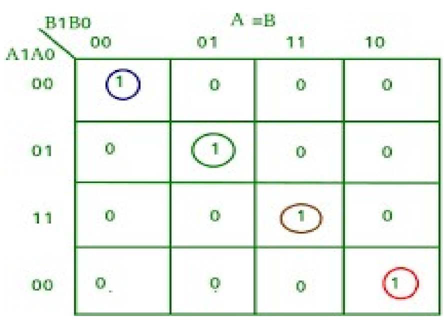
Kmap for A<B



Kmap for A>B



Kmap A=B



$$A>B: G = A0\,\overline{B1}\;\overline{B0} + A1\,\overline{B1} + A1\;A0\,\overline{B0}$$

$$A = B: E = \overline{A1}\;\overline{A0}\;\overline{B1}\;\overline{B0} + \overline{A1}\;A0\;\overline{B1}\;B0 + A1\;A0\;B1\;B0 + A1\,\overline{A0}\;B1\;\overline{B0}$$

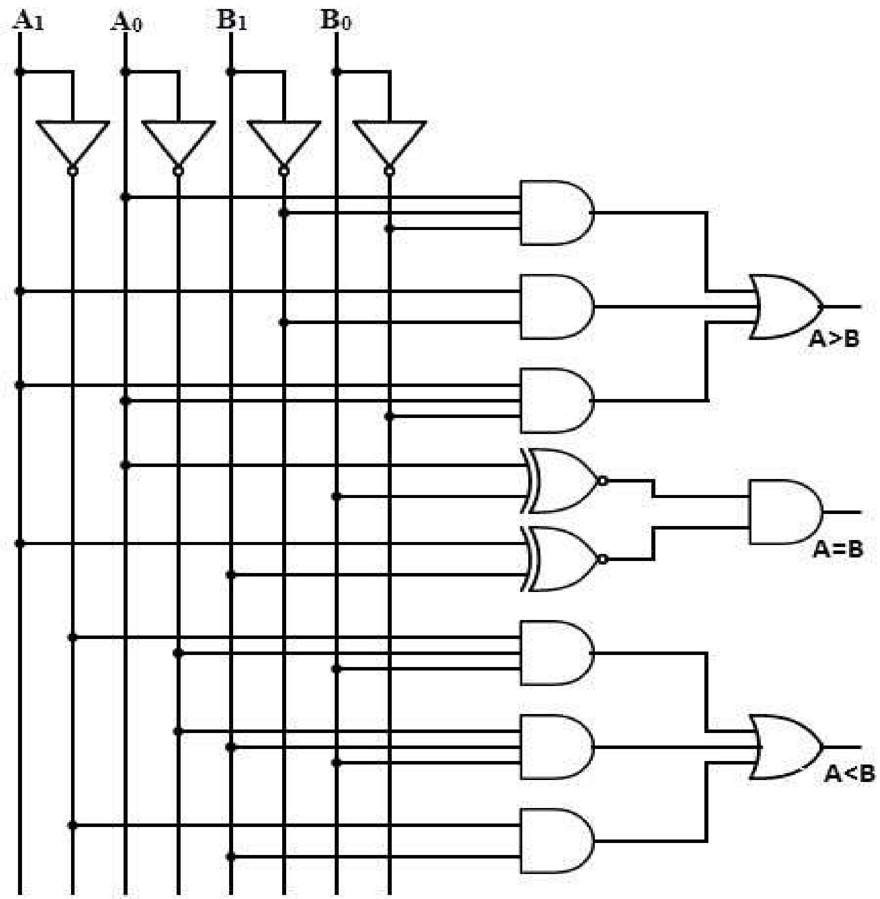
$$= \overline{A1}\;\overline{B1}\;(\overline{A0}\;\overline{B0} + A0\;B0) + A1\;B1\;(A0\;B0 + \overline{A0}\;\overline{B0}\,)$$

$$= (A0\;B0 + \overline{A0}\;\overline{B0})\;(A1\;B1 + \overline{A1}\;\overline{B1})$$

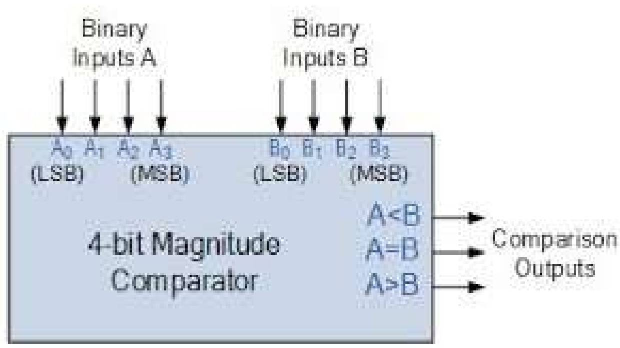
$$= (A0\text{ Ex-NOR }B0)\;(A1\text{ Ex-NOR }B1)$$

$$A < B: L = \overline{A1}\;B1 + \overline{A0}\;B1\;B0 + \overline{A1}\;\overline{A0}\;B0$$

Circuit Diagram:



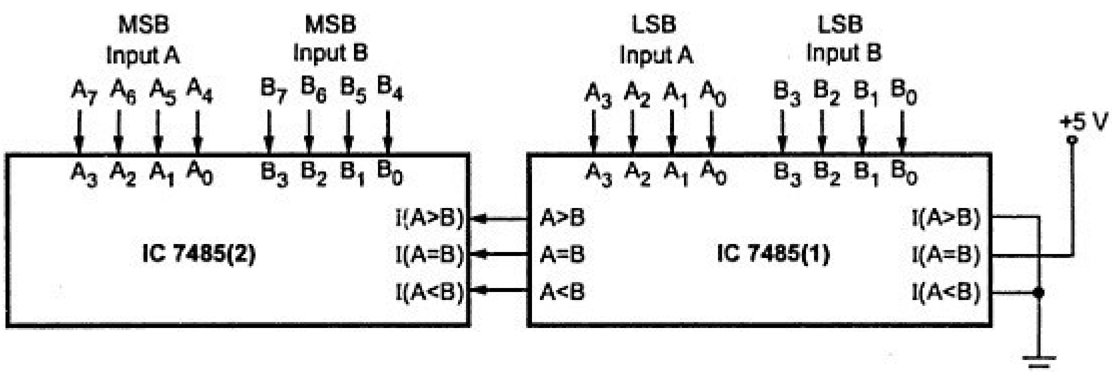
4 Bit Comparator IC 7485



The 4-bit comparator is mostly available in IC form and common type of this IC is 7485. This IC can be used to compare two 4-bit binary words by grounding I (A>B), I (A<B) and I (A=B) connector inputs to Vcc terminal. In addition to the normal comparator, this IC is provided with cascading inputs in order to facilitate the cascading several comparators. Any number of bits can be compared by cascading several of these comparator ICs.

COMPARING INPUTS				OUTPUT		
A3, B3	**A2, B2**	**A1, B1**	**A0, B0**	**A > B**	**A < B**	**A = B**
A3 > B3	X	X	X	H	L	L
A3 < B3	X	X	X	L	H	L
A3 = B3	A2 >B2	X	X	H	L	L
A3 = B3	A2 < B2	X	X	L	H	L
A3 = B3	A2 = B2	A1 > B1	X	H	L	L
A3 = B3	A2 = B2	A1 < B1	X	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 > B0	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 < B0	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	H	L	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	H	L
A3 = B3	A2 = B2	A1 = B1	A0 = B0	L	L	H
H = High Voltage Level, L = Low Voltage, Level, X = Don't Care						

8-Bit Comparator using IC 7485



Applications of Comparators

1. These are used in the address decoding circuitry in computers and microprocessor based devices to select a specific input/output device for the storage of data.

2. 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. Then the outputs from the

comparator are used to drive the actuators so as to make the physical variables closest to the set or reference value.

3. Process controllers
4. Servo-motor control

QUESTIONS:

1. What is comparator?

2. It is combinational circuit or sequential circuit?

3. Which IC used as Magnitute comparator?