Experiment / Assignment / Tutorial No. 4

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Batch: A3	Roll No.: 16010121045	Experiment / assignment / tutorial No.: 4

Title: 4 bit Magnitude Comparator

Objective: Design a 2-bit comparator using logic gates and verify 4-bit magnitude comparator using IC 7485

Expected Outcome of Experiment:

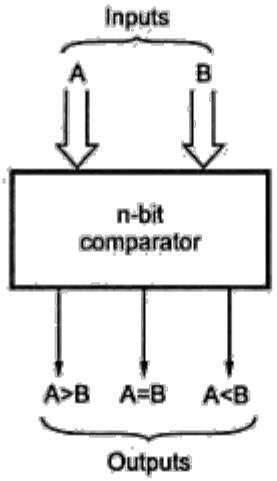
CO2: Use different minimization technique and solve combinational circuits, synchronous & asynchronous sequential circuits.

Books/ Journals/ Websites referred:

- VLab Link: http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/experimentlist.html
- R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill
- M .Morris Mano, "Digital Logic & computer Design", PHI
- http://elnsite.teilam.gr/ebooks/digital_design/lab/dataSheets_page/7485.pdf

Pre Lab/ Prior Concepts:

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

A1	A0	B1	B0	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
1	1	0	1	0	0	1
1	1	1	0	0	0	1
1	1	1	1	0	1	0

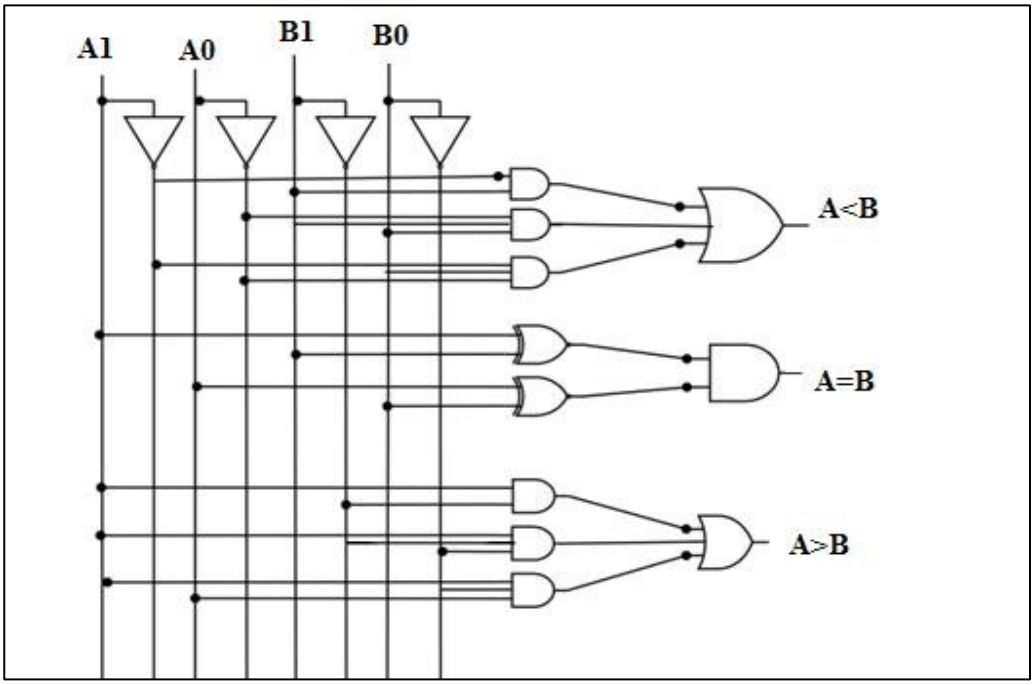
From the Truth Table:

(A<B) = $A1'B1 + A_0'B_1B_0 + A_1'A_0'B_0$

(A=B) = $(A_1 XOR B_1).(A_0 XOR B_0)$

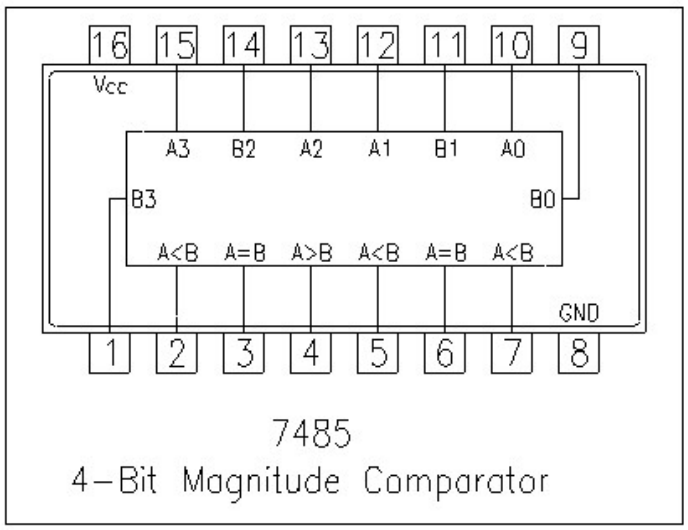
(A>B) = $A_1B_1' + A_0B_1'B_0' + A_1A_0B_0'$

Logic Diagram of 2 bit Comparator

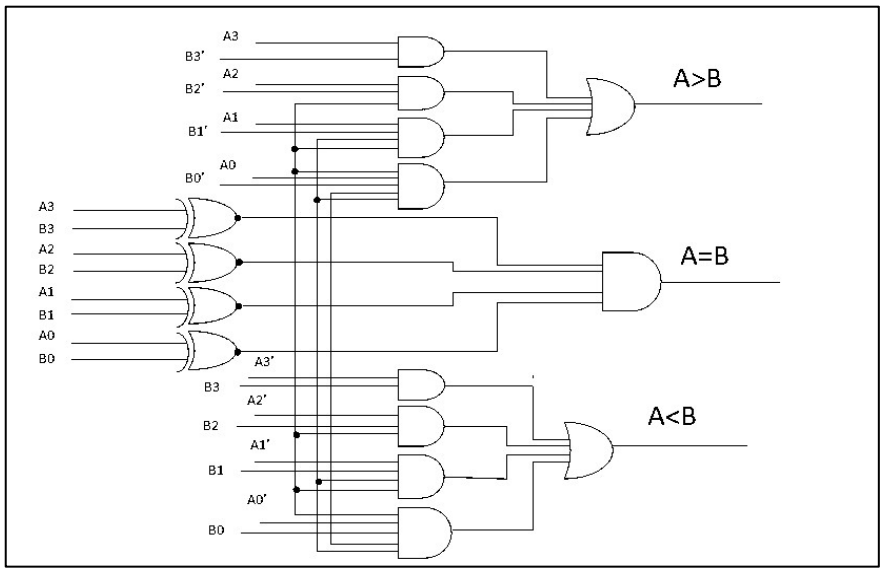


Four Bit Magnitude Comparator Implementation Details

Pin Diagram of IC 7485



Logic Diagram of IC 7485



Comparing Table

INPUTS of 4 bit Comparator				OUTPUT		
A3, B3	*A2, B2*	*A3, B3*	*A2, B2*	*A3, B3*	*A2, B2*	*A3, B3*
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

Where H = High Output, L = Low Output, X = Don't Care

Lab-Work:

Expt 4 a : Comparator 4 bit

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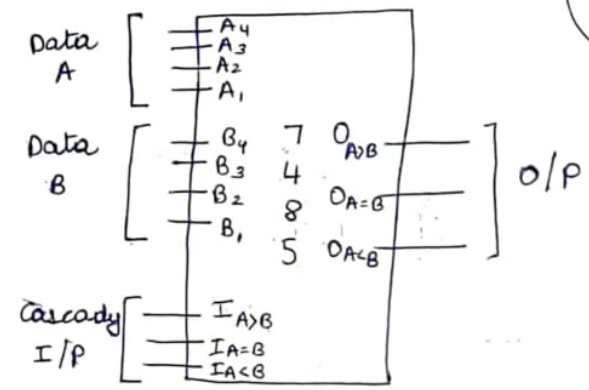
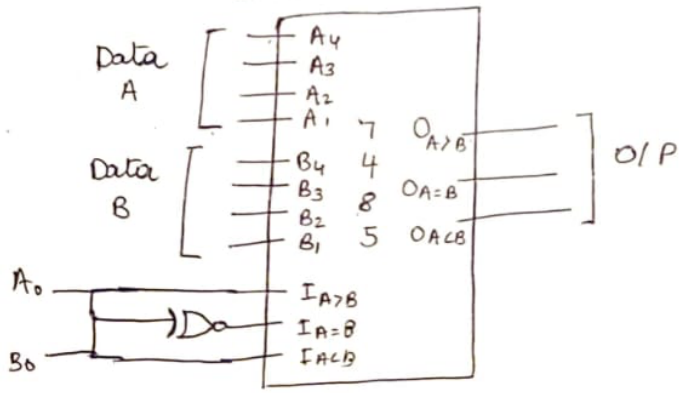


Comp O/P	Cascady I/P			O/P		
	$I_{A>B}$	$I_{A=B}$	$I_{A<B}$	$O_{A>B}$	$O_{A=B}$	$O_{A<B}$
A > B	X	X	X	1	0	0
A = B	1	0	0	1	0	0
	0	0	1	0	0	1
	X	1	X	0	1	0
	1	0	1	0	0	0
	0	0	0	1	0	1
A < B	X	X	X	0	0	1

Don't care



Conclusion: Through this experiment we learnt the concept of comparators – 1 bit, 2 bit and 4 bits. We also learnt to implement them through logic diagrams and truth tables.

Post Lab Descriptive Questions

1. Design a 1- bit magnitude comparator using logic gates.

A	B	f (A>B)	f (A=B)	f (A<B)
0	0	0	1	0
1	0	1	0	0
0	1	0	0	1
1	1	0	1	0

From the truth table:

Equation of A > B = A.B'

Equation of A < B = A'.B

Equation of (A = B) = A'.B' + A.B = A XNOR B = (A.B' + A'.B)' = (f(A>B)+f(A<B))'