Name of Experiment: Implementation of 4-bit Magnitude comperator

objective:

1. Realization of 1-bit comparator using logic gates.

2. Understanding and implementation of 2-bit comperator using logic gates on ~~breadboa~~ breadboards.

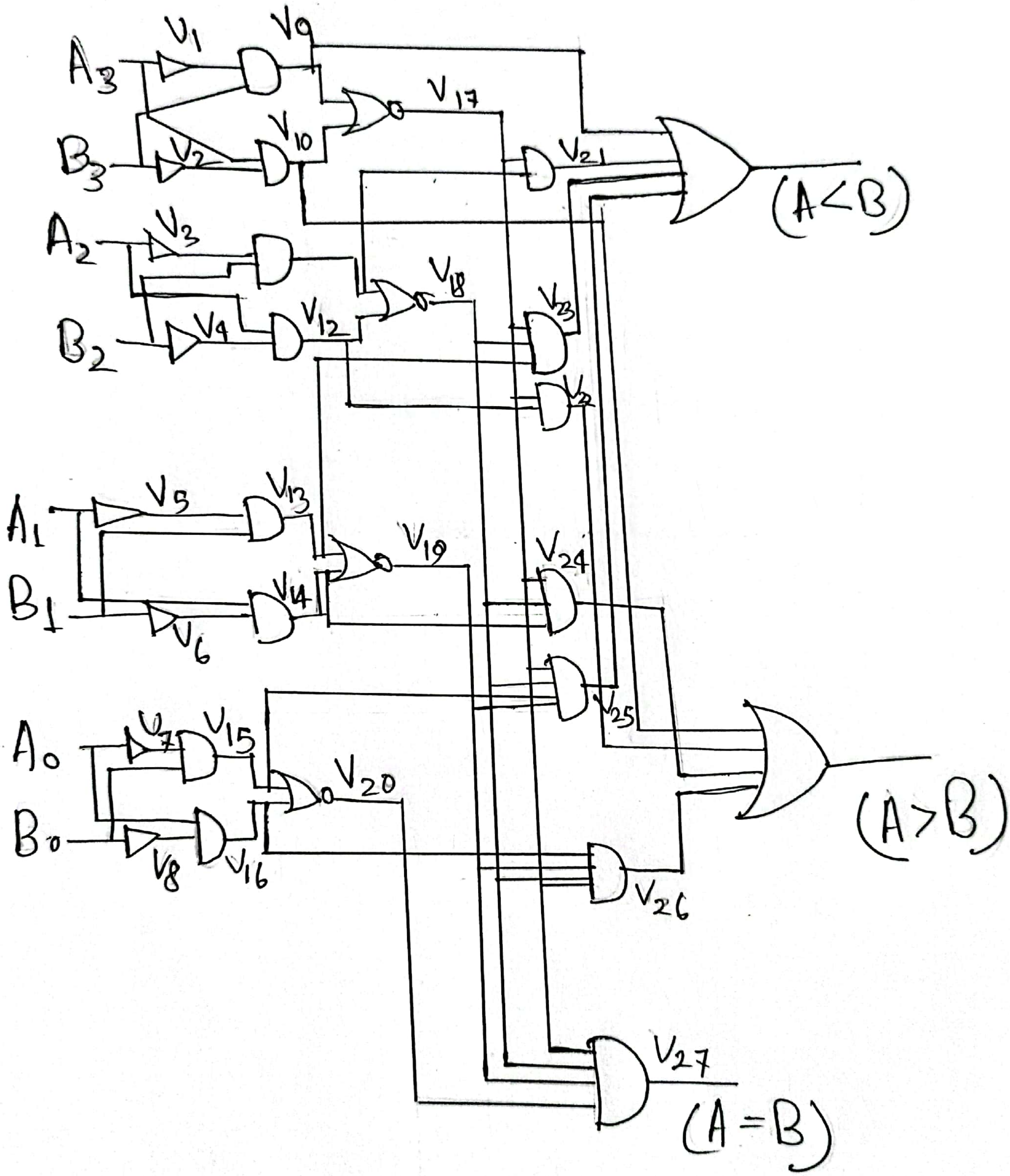
3. Implementation of 4-bit magnitude comperator using IC-7485

Required components and equipments:

Logicstate(8pcs), Logicprobe(Big)(3 pcs), An AND Gate(2) (10 pcs), AND(3)Gate(2 pcs), AND-4 Gate(3pcs), NOR-2(4 pcs), OR-4 Gate (2pcs), NOT Gate(8 pcs)

CamScanner

Experimental setup:



[I] Result and discussion:

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

[J] Discussion:

* One-bit magnitude comparator:

A comperator used to compare ~~two~~ 1bit binary numbers. It has two binary inputs A & B & 3 binary output which represents equal, less than and greater than relation.

When it is greater than, $(A>B) = AB'$

When it is less than, $(A<B) = A'B$

When it is equal $(A=B) = A'B' + AB$

$= (A+B)'$

* Two-bit Magnitude Comparator:

A two bit comaparator has 4 binary input which are $(A: A_1, A_0)$ & $(B: B_1, B_0)$ & where comes 3 binary outputs, which are greater than, less than & equal.

When it is greater then,

$(A>B) = A_1 B_1' + A_1' A_0 B_1' B_0' + A_1 A_0 B_1 B_0'$

$= A_1 B_1' + A_0 B_0' (A_1' B_1' + A_1 B_1)$

$= A_1 B_1 + A_0 B_0' (A_1 \oplus B_1)'$

When it is less than,

$(A<B) = A_1' B_1 + A_1' A_0' B_1' B_0 + A_1 A_0' B_1 B_0$

$= A_1' B_1 + A_1' B_0 (A_1' B_1' + A_1 B_1)$

$= (A_1' B_1) + A_0 B_0' (A_1 \oplus B_1)'$

when it is equal,

$$(A=B) = A_1'A_0'B_1'B_0' + A_1'A_0B_1'B_0 + A_1A_0B_1B_0$$

$$= (A_1'B_1' + A_1B_1)(A_0'B_0' + A_0B_0)$$

$$= (A_1 \oplus B_1)'(A_0 \oplus B_0)'$$

* Three-bit magnitude comparator:

A three-bit magnitude comparator has 6 inputs $A(A_2, A_1, A_0)$ & $B(B_2, B_1, B_0)$ & 3 outputs which are, less than, greater than & equal.

All inputs & outputs are binary.

when it is greater than,

$$(A>B) = A_2B_2 + [(A_2'B_2' + A_2B_2) \cdot A_1B_1'] + [(A_2'B_2' + A_2B_2) \cdot [A_1'B' + B_1A_1) \cdot A_0B_0']]$$

when it is less than,

$$(A<B) = A_2'B_2 + [(A_2'B_2' + A_2B_2) \cdot A_1'B_1] + [(A_2'B_2' + A_2B_2) \cdot (A_1'B_1' + A_1B_1) \cdot A_0B_0$$

when it is equal,

$$(A=B) = (A_0'B_0' + A_0B_0) \cdot (A_1'B_1' + A_1B_1) \cdot (A_2'B_2' + A_2B_2)$$

* 4-bit magnitude operator:

4-bit magnitude operators have 8 inputs & 3 outputs. 4 inputs are $A(A_3, A_2, A_1, A_0)$, $B(B_3, B_2, B_1, B_0)$. Outputs are $(A>B)$, $(A<B)$, $(A=B)$. All are boolean inputs & outputs.

for $(A>B) = A_3B_3 + (A_3 \oplus B_3) \cdot A_2B_2 + (A_3 \oplus B_3)$
$(A_2 \oplus B_2) A_1B_1' + (A_3 \oplus B_3)(A_2 \oplus B_2)(A_1 \oplus B_1)$
$(A_0 B_0')$

for $(A<B) = A_3'B_3 + (A_3 \oplus B_3) A_2'B_2 + (A_3 \oplus B_3)$
$(A_2 \oplus B_2) A_1'B_1 (A_3 \oplus B_3)(A_2 \oplus B_2)(A_1 \oplus B_1)$
$(A_0' B_0)$

for $(A=B) = (A_3 \oplus B_3)(A_2 \oplus B_2)(A_1 \oplus B_1)(A_0 \oplus B_0)$

* working procedure of 4bit magnitude comperator–

when it is equal, $A_3 = B_3$, $A_2 = B_2$, $A_1 = B_1$ & $A_0 = B_0$

(ii) During Inequality:

① If $A_3 = 1$ & $B_3 = 0$ than $A > B$. or

② If A_3 & B_3 are equal & $A_2 = 1$ & $B_2 = 0$ then $A > B$. or

③ If A_3 & B_3 are equal & A_2 & B_2 are equal & if $A_1 = 1$ & $B_1 = 0$ than $A > B$, or

④ If A_3 & B_3 are equal, A_2 & B_2 are equal & A_1 & B_1 are equal & $A_0 = 1$, $B_0 = 0$ then $A > B$.

⑤ If $A_3 = 0$ & $B_3 = 1$ then $(A < B)$. or

⑥ If A_3 & B_3 are equal & if $A_2 = 0$ & $B_2 = 1$ then $A < B$, or

⑦ If A_3 & B_3 are equal & A_2 & B_2 are equal & if $A_1 = 0$ & $B_1 = 1$ then $A < B$ or

⑧ If A_3 & B_3 are equal, A_2 & B_2 are equal & A_1 & B_1 are equal & if $A_0 = 0$ & $B_0 = 1$ then $A < B$