CSE 260

LAB - 6

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2010402

Section: 11

Name of the Experiment: Implementation of 4 bit magnitude

Objective:

- Draw the circuit that will acts as a magnitude comparator. Your circuit should be able to compare two 4bit numbers.
- implement your circuit

Required equipments:

(I) AND
(II) OR
(III) NOT
(IV) NOR
(V) LOGICPROBE
(VI) LOGICSTATE
(VII) WIRE

Experimental Setup:

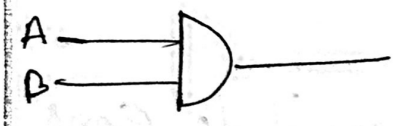

Fig 1: AND Gate

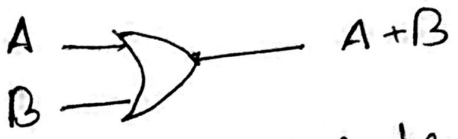

Fig 2: OR Gate

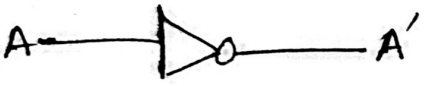

Fig 3: NOT Gate

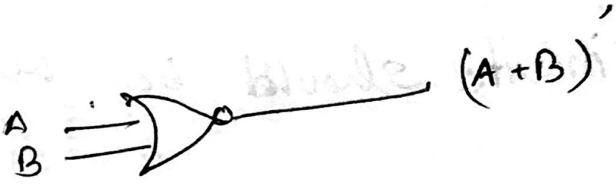

Fig 4: NOR Gate

Result and Discussion:

Case 1: if $A = B$,

$A_1 = B_1$ and $A_2 = B_2$ and $A_3 = B_3$ and $A_4 = B_4$

$A_1 = B_1$ When $x_1 = A_1' B_1' + A_1 B_1 = A_1 \odot B_1$

$A_2 = B_2$ " $x_2 = A_2' B_2' + A_2 B_2 = A_2 \odot B_2$

$A_3 = A_3$ " $x_3 = A_3' B_3' + A_3 B_3 = A_3 \odot B_3$

$A_4 = A_4$ " $x_4 = A_4' B_4' + A_4 B_4 = A_4 \odot B_4$

$\therefore (A == B) = x_1 \cdot x_2 \cdot x_3 \cdot x_4$

Case 2: $A > B$:

* (A_4 is 1 and B_4 is 0): $A_4 B_4'$ OR
* ($A_4 = B_4$) and (A_3 is 1, B_3 is 0): $x_4 \cdot A_3 B_3'$ OR
* ($A_4 = B_4$) and ($A_3 = B_3$) and ($A_2 = 1$, $B_2 = 0$): $x_4 \cdot x_3 \cdot A_2 B_2'$ OR
* ($A_4 = B_4$) and ($A_3 = B_3$) and ($A_2 = B_2$) and (A_1 is 1 and B_1 is 0):

$$x_4 \cdot x_3 \cdot x_2 \cdot A_1 B_1'$$

$$\therefore A > B = A_4 B_4' + x_4 A_3 B_3' + x_4 x_3 \cdot A_2 B_2' + x_4 x_3 x_2 \cdot A_1 B_1'$$

Case 3: $A < B$

* A_4 is 0, B_4 is 1: $A_4' \cdot B_4$ OR
* ($A_4 = B_4$) and ($A_3 = 0$ and $B_3 = 1$): $x_4 \cdot A_3' B_3$ OR
* ($A_4 = B_4$) and ($A_3 = B_3$) and ($A_2 = 0$, $B_2 = 0$): $x_4 \cdot x_3 A_2' B_2$
* ($A_4 = B_4$) and ($A_3 = B_3$) and ($A_2 = B_2$) and ($A_1 = 0$, $B_1 = 1$): $x_4 \cdot x_3 \cdot x_2 \cdot A_1'$

$$A < B : A_4' B_4 + x_4 A_3' B_3 + x_4 x_3 A_2' B_2 + x_4 x_3 x_2 A_1' B_1$$

for example,

A = 1110 , B = 0111

A_4	A_3	A_2	A_1
1	1	1	0

B_4	B_3	B_2	B_1
0	1	1	1

in this case, $A_4 = 1$ and $B_4 = 0$;

$\therefore \quad A > B$

Know that,

$A == B : \quad M = x_1 x_2 x_3 x_4$

$A > B : \quad N = A_4 B_4' + x_4 A_3 B_3' + x_4 x_3 A_2 B_2' + x_4 x_3 x_2$

$A < B : \quad O = A_4' B_4 + x_4 A_3' B_3 + x_4 x_3 A_2' B_2 + x_4 x_3 x_2$

We can write,

$A < B$ as $E'G'$

$\therefore \quad O = E'G'$

$= (E + G)'$