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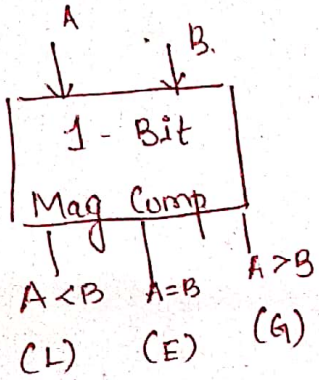
Magnitude Comparator.

Taking two inputs A, B.

Outputs are

* $A < B$.
* $A = B$
* $A > B$

1. 1 Bit Magnitude Comparator



Case 1

$A < B$

When

$A = 0$

$B = 1$

$L = \bar{A}B \rightarrow (1)$.

Case 2

$A = B$,

When

$A = 0$, $B = 0$ or $A = 1$, $B = 1$

$E = \bar{A}\bar{B} + AB \rightarrow (2)$.

Case 3

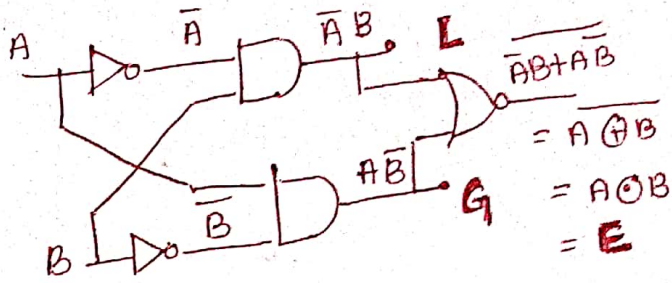
$A > B$,

When

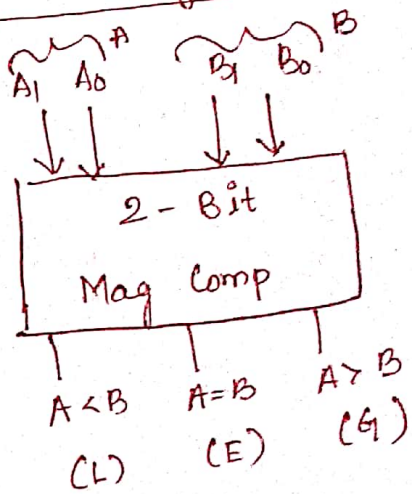
$A = 1$

$B = 0$

$G = A\bar{B} \rightarrow (3)$.



2. 2 Bit Magnitude Comprator.



Case 1.

$A = B$

When,

$A_1 = B_1$ and $A_0 = B_0$

$A_1 = B_1$ is denoted by x_1

$x_1 = A_1B_1 + \bar{A}_1\bar{B}_1 = A_1 \odot B_1$

$A_0 = B_0$ is denoted by x_0.

$x_0 = A_0B_0 + \bar{A}_0\bar{B}_0 = A_0 \odot B_0$

$$E = x_1 \cdot x_0 \rightarrow (1)$$

Case 2.

$A < B$, when.

$A_1 < B_1$

Or

if $A_1 = B_1$, then $A_0 < B_0$.

$$L = \bar{A}_1 B_1 + x_1 \bar{A}_0 B_0 \rightarrow (2)$$

Case 3

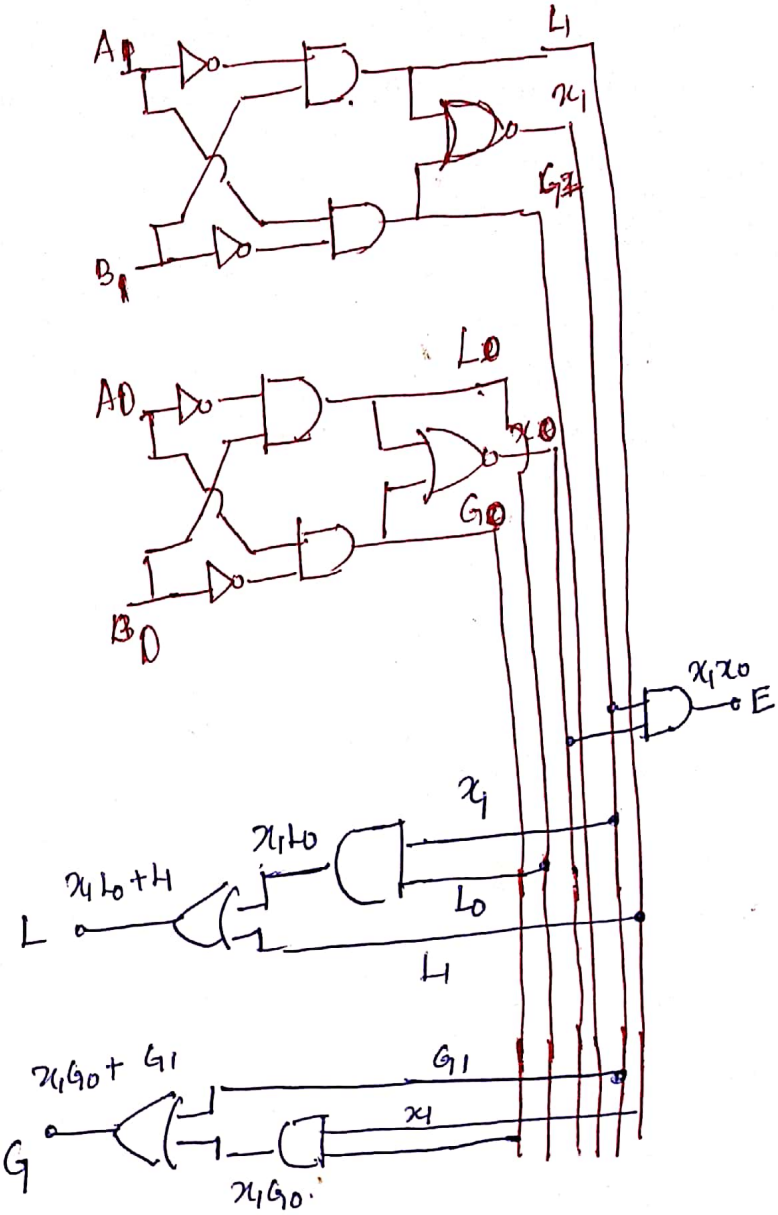
$A > B$, when.

$A_1 > B_1$

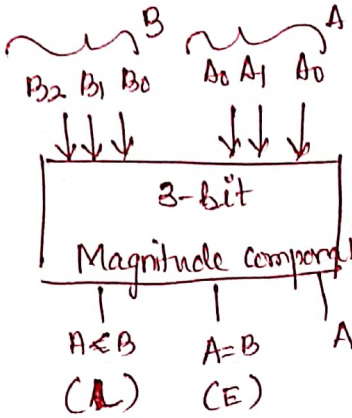
Or

if $A_1 = B_1$, $A_0 > B_0$

$$G = A_1 \bar{B}_1 + x_1 A_0 \bar{B}_0 \rightarrow (3)$$



3-bit Magnitude Comparator:



Case 1

$A = B$, when

$A_2 = B_2$, $A_1 = B_1$, $A_0 = B_0$.

$A_2 = B_2$; $x_2 = \overline{A_2}\,\overline{B_2} + A_2 B_2$.

$A_1 = B_1$; $x_1 = \overline{A_1}\,\overline{B_1} + A_1 B_1$

$A_0 = B_0$; $x_0 = \overline{A_0}\,\overline{B_0} + A_0 B_0$.

$$E = x_2 \cdot x_1 \cdot x_0 \quad \rightarrow (1)$$

Case 2

$A < B$, when.

$A_2 < B_2$

Or

if, $A_2 = B_2$, $A_1 < B_1$

Or

if, $A_2 = B_2$ and $A_1 = B_1$, $A_0 < B_0$.

$$L = \overline{A_2} B_2 + x_2 \overline{A_1} B_1 + x_2 x_1 \overline{A_0} B_0 \quad \rightarrow (2)$$

Case 3

$A > B$, when

$A_2 > B_2$

Or

if $A_2 = B_2$, $A_1 > B_1$

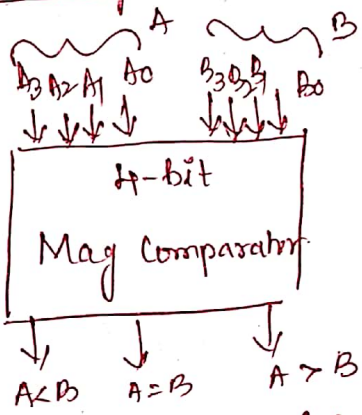
Or

if $A_2 = B_2$ and $A_1 = B_1$, $A_0 > B_0$

$$L = A_2 \overline{B_2} + x_2 \cdot A_1 \overline{B_1} + x_2 x_1 A_0 B_0$$

↳ equ no (3).

4-bit Magnitude Comparator



Case 1

$A = B$, when

$A_3 = B_3$, $A_2 = B_2$,

$A_1 = B_1$, $A_0 = B_0$.

$x_3 = A_3 \odot B_3$

$x_2 = A_2 \odot B_2$

$x_1 = A_1 \odot B_1$

$x_2 = A_0 \odot B_0$

$$E = x_3 x_2 x_1 x_0 \rightarrow \text{equ}$$

Case 2

$A < B$, when

$A_3 < B_3$

or

if $A_3 = B_3$ then $A_2 < B_2$

or

if $A_3 = B_3$ and $A_2 = B_2$ then

$A_1 < B_1$

or

if $A_3 = B_3$ and $A_2 = B_2$ and $A_1 = B_1$

then $A_0 < B_0$

$$L = \overline{A_3} B_3 + x_3 \overline{A_2} B_2 + x_3 x_2 \overline{A_1} B_1 + x_3 x_2 x_1 \overline{A_0} B_0$$

equ (2)

Case 3

$$G = A_3 \overline{B_3} + x_3 A_2 \overline{B_2} + x_3 x_2 A_1 \overline{B_1} + x_3 x_2 x_1 A_0 B_0$$

equ (3)