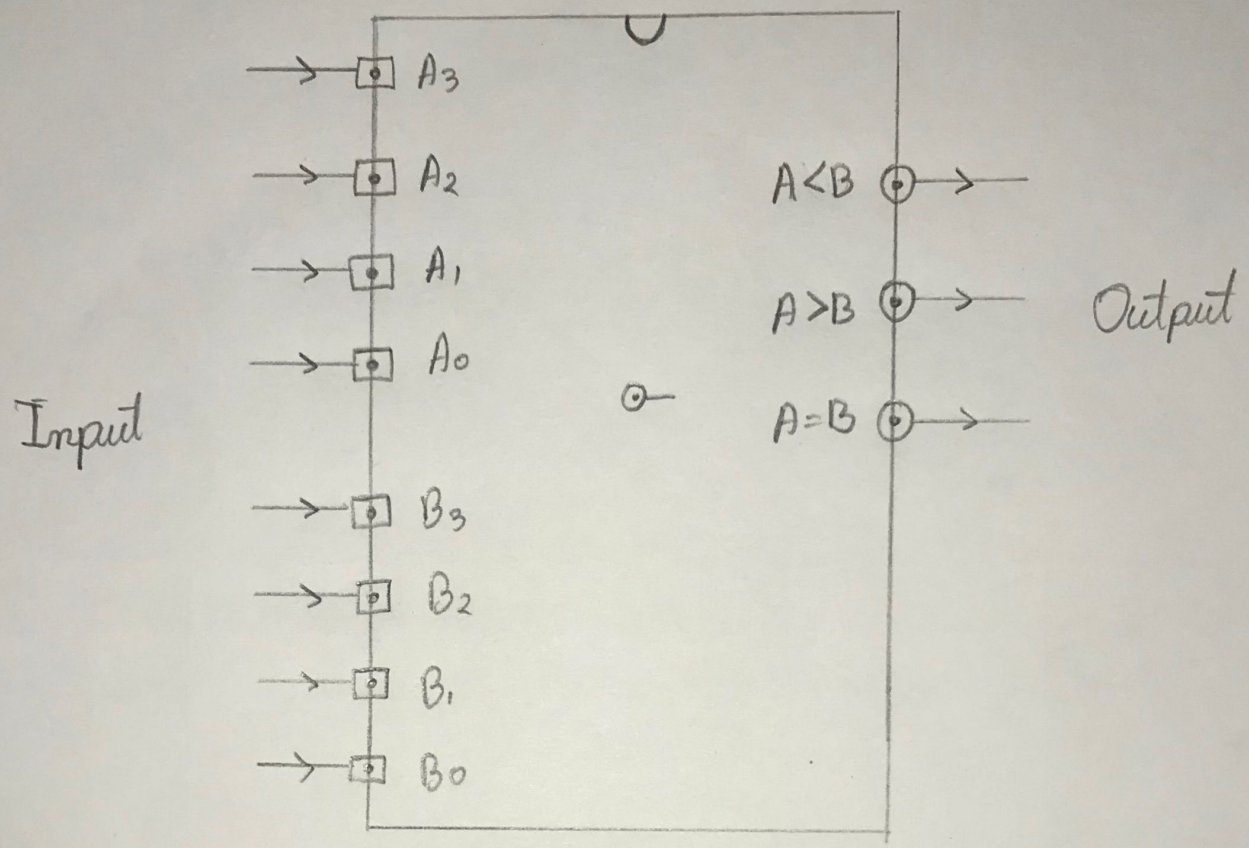
Block diagram of 4-bit Magnitude Comparator



Truth Table of 4-bit Magnitude Comparator

Inputs								Outputs		
A_3	A_2	A_1	A_0	B_3	B_2	B_1	B_0	A<B	A>B	A=B
0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	1	1	0	0
0	0	0	0	0	0	1	0	1	0	0
0	0	0	0	0	0	1	1	1	0	0
0	0	0	0	0	1	0	0	1	0	0
0	0	0	0	0	1	0	1	1	0	0
0	0	0	0	0	1	1	0	1	0	0
0	0	0	0	0	1	1	1	1	0	0
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	1	0	0	1	1	0	0
0	0	0	0	1	0	1	0	1	0	0
0	0	0	0	1	0	1	1	1	0	0
0	0	0	0	1	1	0	0	1	0	0
0	0	0	0	1	1	0	1	1	0	0
0	0	0	0	1	1	1	0	1	0	0
0	0	0	0	1	1	1	1	1	0	0
0	0	0	1	0	0	0	0	0	1	0
0	0	0	1	0	0	0	1	0	0	1
0	0	0	1	0	0	1	0	1	0	0
0	0	0	1	0	0	1	1	1	0	0
⋮			⋮		⋮					⋮
1	1	1	1	1	1	1	1	0	0	1

Functions of 4-bit Magnitude Comparator

$A = A_3\ A_2\ A_1\ A_0$

$B = B_3\ B_2\ B_1\ B_0$

if $A < B \rightarrow A_3 < B_3$ $[A_3 = 0, B_3 = 1]$

$\rightarrow A_3 = B_3, A_2 < B_2$

$\rightarrow A_3 = B_3, A_2 = B_2, A_1 < B_1$

$\rightarrow A_3 = B_3, A_2 = B_2, A_1 = B_1, A_0 < B_0$

$\therefore A < B = \bar{A}_3 B_3 + x_3 \bar{A}_2 B_2 + x_3 x_2 \bar{A}_1 B_1 + x_3 x_2 x_1 \bar{A}_0 B_0$

$$\begin{bmatrix} x_3 = \bar{A}_3 B_3 \\ x_2 = \bar{A}_2 B_2 \\ x_1 = \bar{A}_1 B_1 \end{bmatrix}$$

if $A > B \rightarrow A_3 > B_3$ $[A_3 = 1, B_3 = 0]$

$\rightarrow A_3 = B_3, A_2 > B_2$

$\rightarrow A_3 = B_3, A_2 = B_2, A_1 > B_1$

$\rightarrow A_3 = B_3, A_2 = B_2, A_1 = B_1, A_0 > B_0$

$\therefore A > B = A_3 \bar{B}_3 + x_3 A_2 \bar{B}_2 + x_3 x_2 A_1 \bar{B}_1 + x_3 x_2 x_1 A_0 \bar{B}_0$

$$\begin{bmatrix} x_3 = A_3 \bar{B}_3 \\ x_2 = A_2 \bar{B}_2 \\ x_1 = A_1 \bar{B}_1 \end{bmatrix}$$

and if $A = B \rightarrow A_3 = B_3, A_2 = B_2, A_1 = B_1, A_0 = B_0$

$\rightarrow x_3 + x_2 + x_1 + x_0$

$$\begin{bmatrix} x_3 \Rightarrow A_3 = B_3 \\ x_2 \Rightarrow A_2 = B_2 \\ x_1 \Rightarrow x_1 = x_2 \\ x_0 \Rightarrow x_0 = x_0 \end{bmatrix}$$