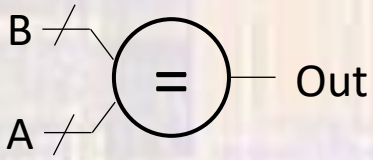
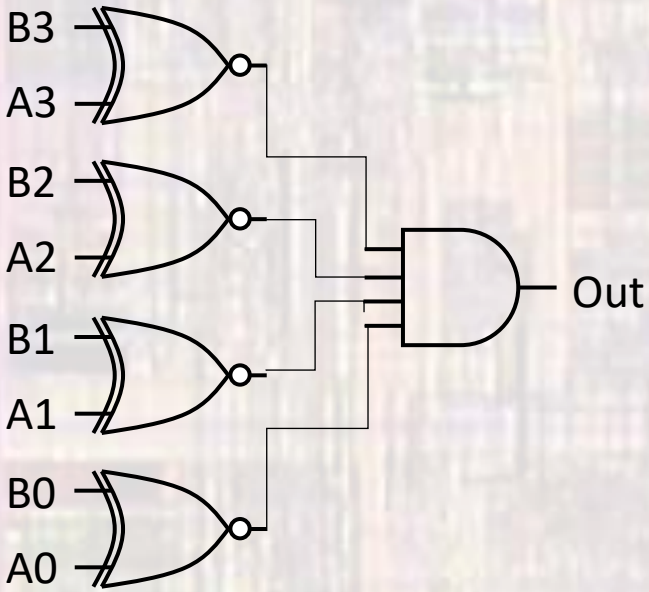
Comparators

Last updated 10/31/24

Comparators

- Equality Comparator
  - All bits match between 2 inputs





Comparators

- Magnitude Comparator
  - Unsigned numbers
  - 1 bit comparison

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

$A < B = \overline{A}\,B$

$A = B = A \odot B$

$A > B = A\,\overline{B}$

Comparators

- Magnitude Comparator
  - Unsigned numbers
  - 2 bit comparison

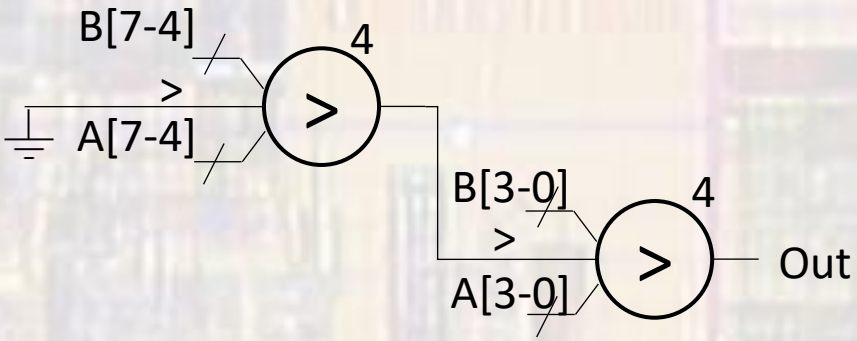
$$A < B = (A1 < B1) \text{ or } (A1 = B1 \text{ and } A0 < B0)$$
$$A = B = (A1 = B1) \text{ and } (A0 = B0)$$
$$A > B = (A1 > B1) \text{ or } (A1 = B1 \text{ and } A0 > B0)$$

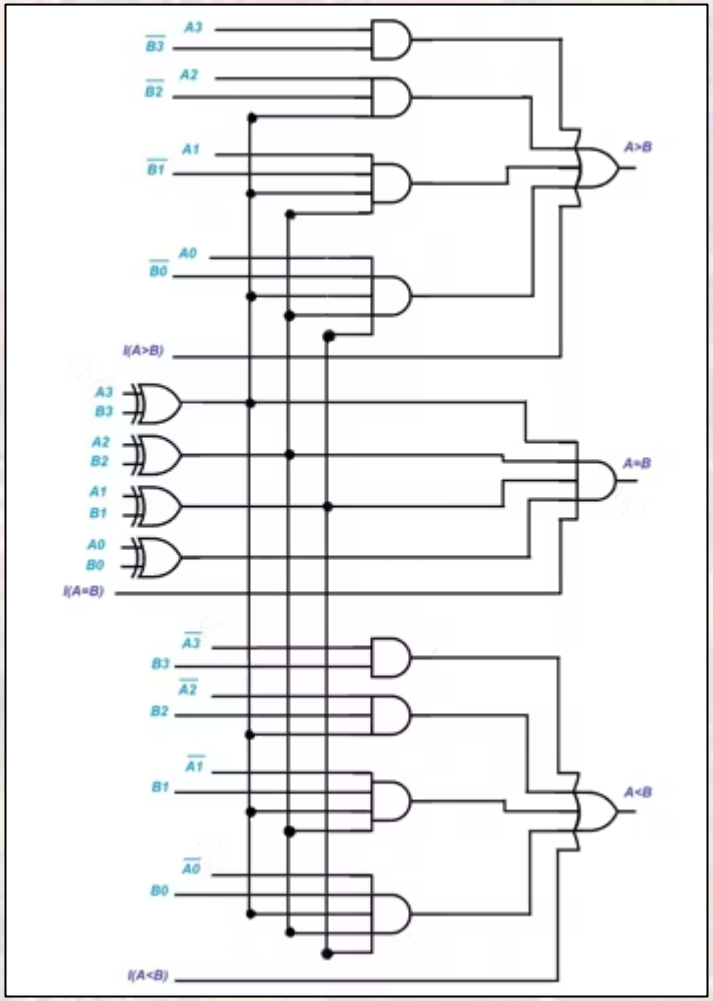
  - Expanding and putting into SOP form

$$A < B = \overline{A1}B1 + \overline{A0}B1B0 + \overline{A1}\,\overline{A0}B0$$
$$A = B = (A1 \odot B1)(A0 \odot B0)$$
$$A > B = A1\overline{B1} + A0\overline{B1}\,\overline{B0} + A1A0\overline{B0}$$

Comparators

- Magnitude Comparator
  - Unsigned numbers
  - 4 bit comparison with chain input
  - n-bit comparison
    - Chain 4 bit comparators





src: Electronic Design

Comparators

- Magnitude Comparator
  - Signed numbers
  - Subtract and check the sign bit (n bit)
    - $Z = A - B$
    - $Z[n-1] = 0 \rightarrow A \geq B$
    - $Z[n-1] = 1 \rightarrow A < B$
  - Fails if there is overflow
    - Overflow: $(A[n-1] \neq B[n-1])$ AND $(Z(n-1) \neq A[n-1])$
    - If there is overflow – flip the result of the comparison