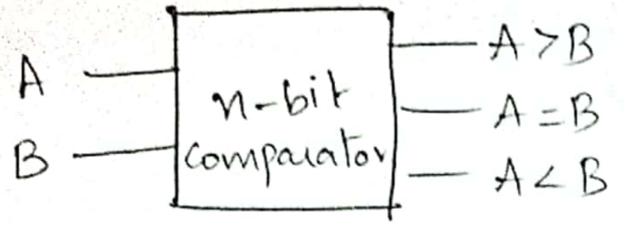
Magnitude Comparator:



step1:
No. of i/ps = 2

No. of o/ps = 3

2-bit Magnitude Comparator:

Step 2: Truth table

A	A_1	A_0	B_1	B_0	B	A > B	A = B	A < B
0	0	0	0	0	0	0	1	0
0	0	0	0	1	1	0	0	1
0	0	0	1	0	2	0	0	1
0	0	0	1	1	3	0	0	1
1	0	1	0	0		1	0	0
1	0	1	0	1		0	1	0
1	0	1	1	0		0	0	1
1	0	1	1	1		0	0	1
2	1	0	0	0		1	0	0
2	1	0	0	1		1	0	0
2	1	0	1	0		0	1	0
2	1	0	1	1		0	0	1
	1	1	0	0		1	0	0
	1	1	0	1		1	0	0
	1	1	1	0		1	0	0
	1	1	1	1		0	1	0

Step 3: Simplification of Boolean fn.

K-Map for A > B F_1

$A_1A_0 \backslash B_1B_0$	00	01	11	10
00	0	1	3	2
01	4: 1	5	7	6
11	12: 1	13: 1	15	14: 1
10	8: 1	9: 1	11	10

$$F_1 = A_1B_1' + A_0B_1'B_0' + A_1A_0B_0'$$

K-Map for A = B

$A_1A_0 \backslash B_1B_0$	00	01	11	10
00	0: 1	1	3	2
01	4	5: 1	7	6
11	12	13	15: 1	14
10	8	9	11	10: 1

$$F_2 = (A_1 \odot B_1)(A_0 \odot B_0)$$

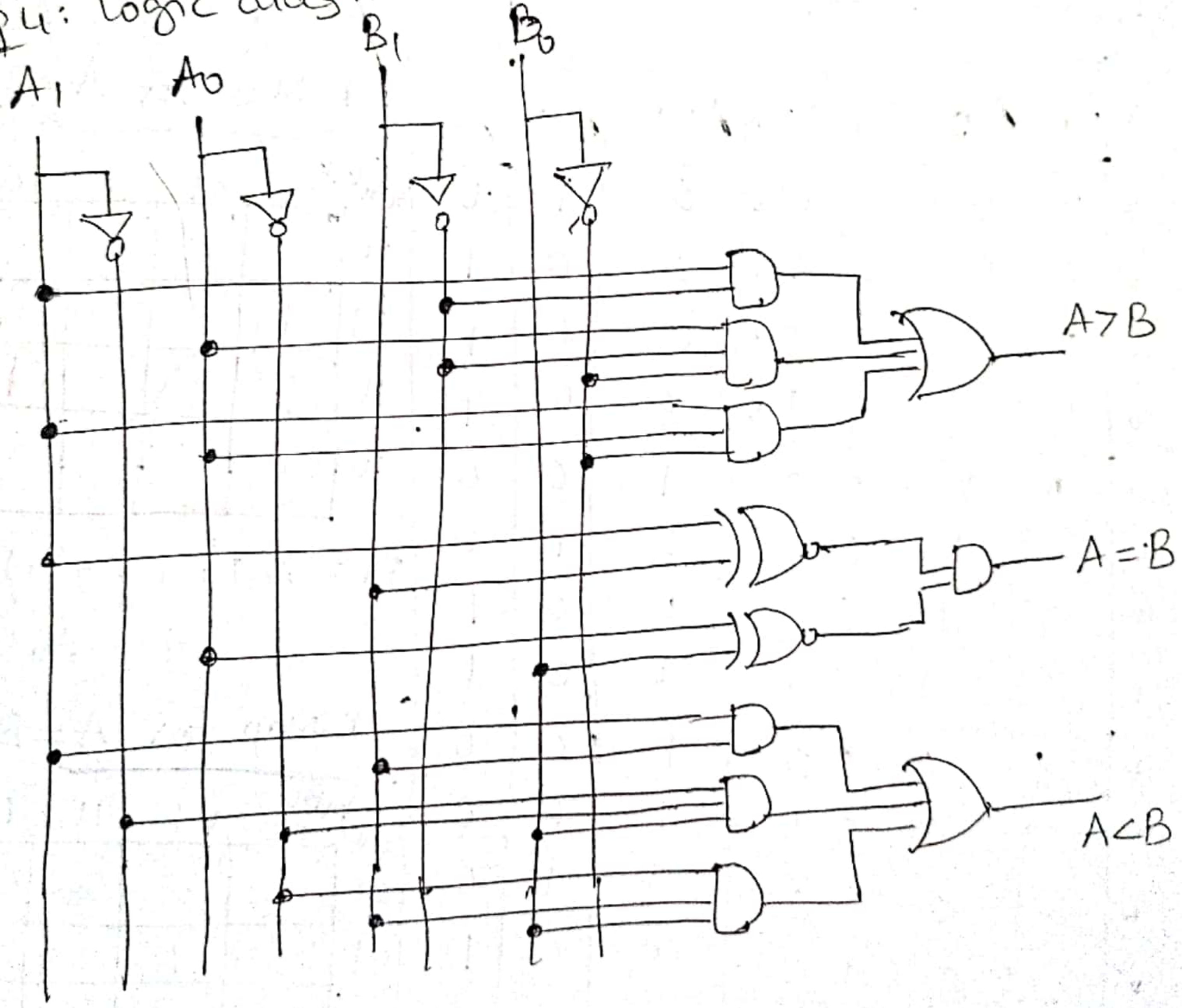
K-Map for A<B

F_3

$A_1A_0 \backslash B_1B_0$	00	01	11	10
00	0	1: 1	3: 1	2: 1
01	4	5	7: 1	6: 1
11	12	13	15	14
10	8	9	11: 1	10

$$F_3 = A_1' B_1 + A_1' A_0' B_0 + A_0' B_1 B_0$$

Step 4: logic diagram



4-bit Magnitude Comparator:

Definition of Magnitude Comparator

A magnitude Comparator is a Combinational circuit that compares two nos and determines their relative magnitudes. The out-come of the Comparison is specified by three binary variables that indicate whether $A > B$, $A = B$ or $A < B$.

NOTE: For n-bit nos., Truth table will have 2^{2n} entries.

EX: $n=2$; No. of entries or i/p possible combinations $= 2^4 = 16$.

$n=4$, No. of entries $= 2^8 = 256$

03-02-2020

267, 70, 74, 77, 82, 83

88, 93, 95, 98, Le-208,

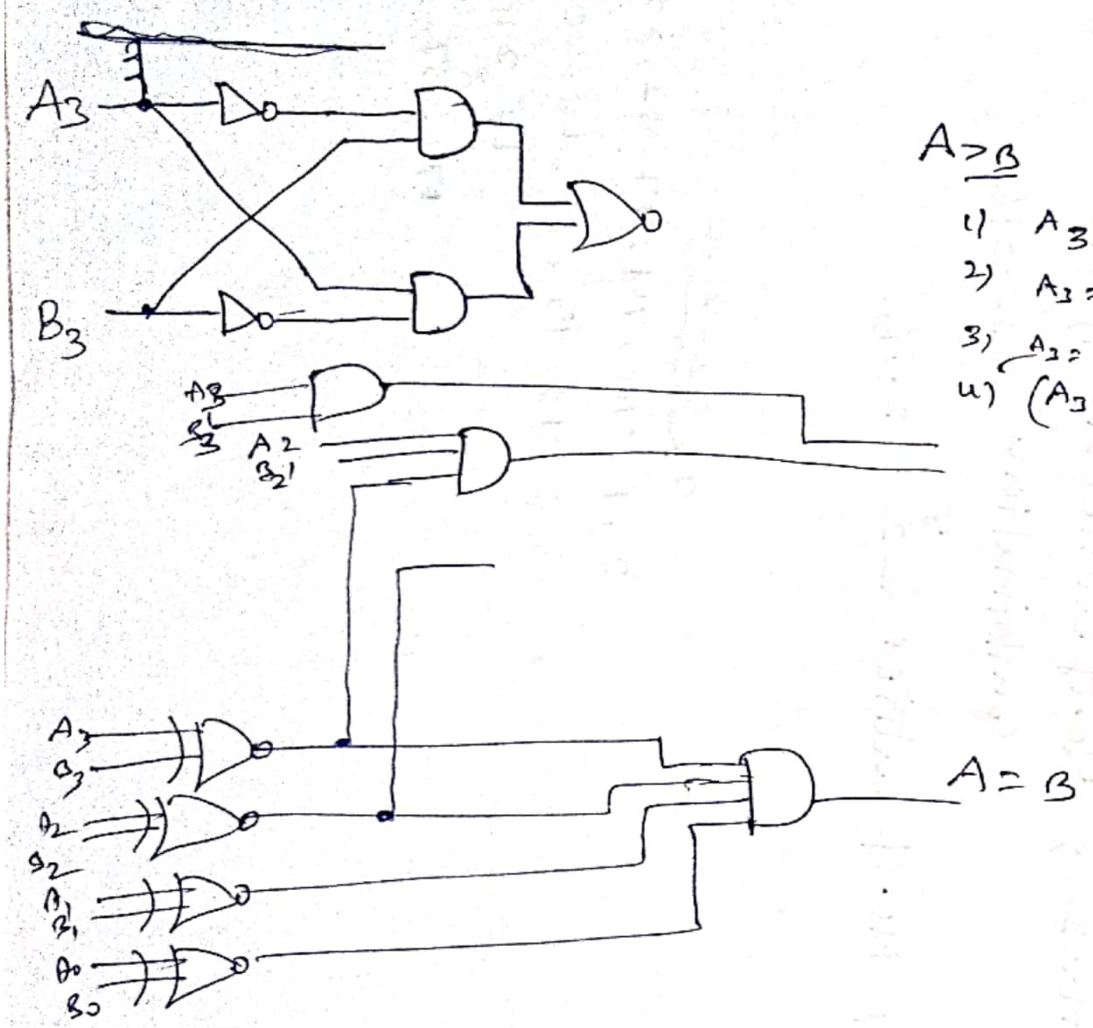
Le-210,

17-237.

$A \rightarrow A_3 A_2 A_1 A_0$

$B \rightarrow B_3 B_2 B_1 B_0$

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



$A > B$

1) $A_3 = 1$ B_3 $A_3 B_3'$

2) $A_3 = B_3$, $A_2 = 1$, $B_2 = 0$ $(A_3 \odot B_3)(A_2 B_2')$

3) $A_3 = B_3$, $A_2 = B_2$ $A_1 = 1, B_1 = 0$ $(A_3 \odot B_3)(A_2 \odot B_2)$,

4) $(A_3 \odot B_3)(A_2 \odot B_2)(A_1 \odot B_1) A_0 B_0'$

$A > B \rightarrow$ ⓐ $A_3 > B_3$

↳ ⓑ $A_3 = B_3$, $A_2 > B_2$

↳ ⓒ $A_3 = B_3$, $A_2 = B_2$, $A_1 > B_1$

↳ ⓓ $A_3 = B_3$, $A_2 = B_2$, $A_1 = B_1$, $A_0 > B_0$

$A < B \rightarrow$ ⓐ $\cancel{A_3} B_3 > A_3$

↳ ⓑ $A_3 = B_3$, $B_2 > A_2$

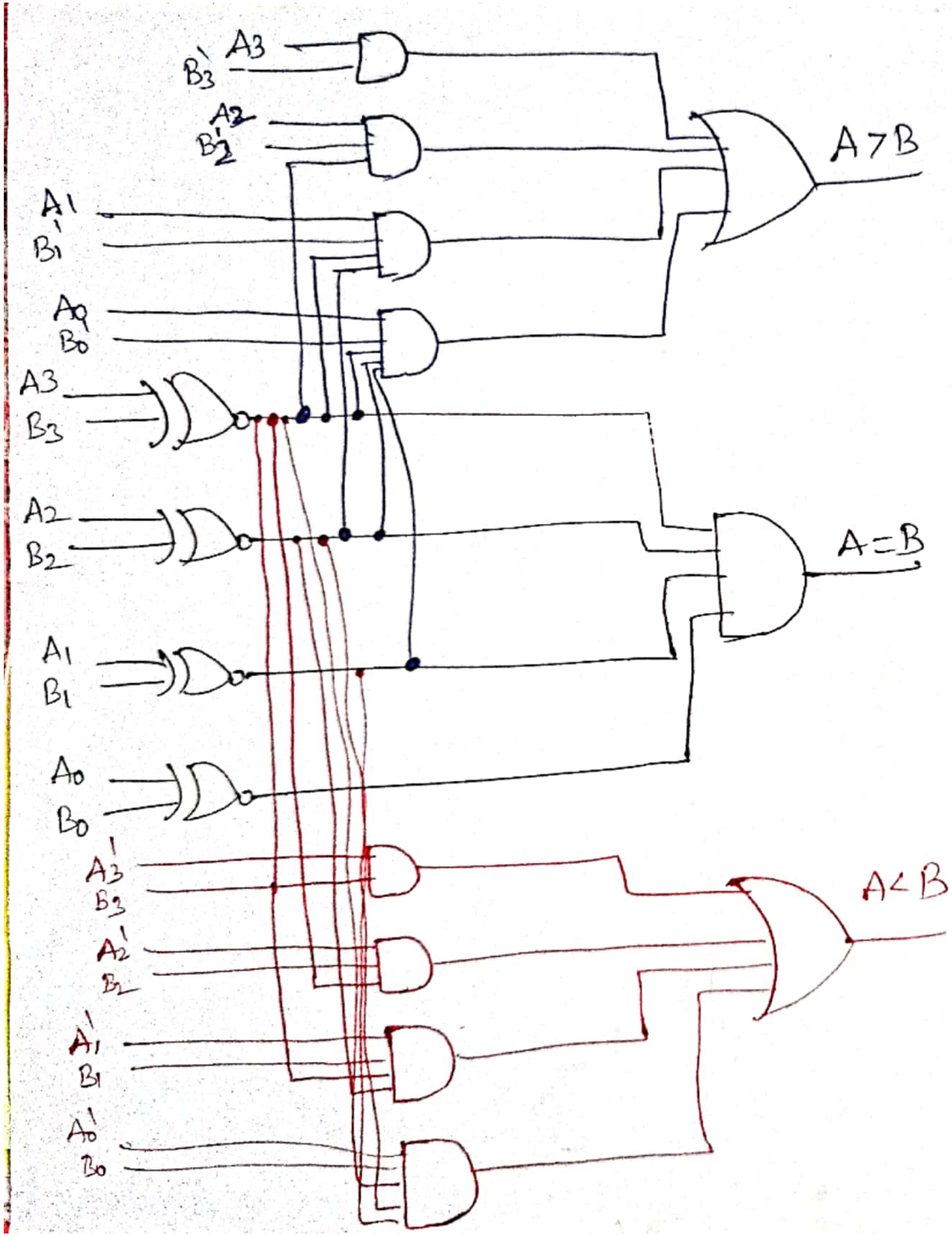
↳ ⓒ $A_3 = B_3$, $A_2 = B_2$, $B_1 > A_1$

↳ ⓓ $A_3 = B_3$, $A_2 = B_2$, $A_1 = B_1$, $B_0 > A_0$

EXOR

x . Y	↓	x NOR
0 0	0	1
0 1	1	0
1 0	1	0
1 1	0	1

$\rightarrow \overline{x'y + xy'}$



$A \to A_3 A_2 A_1 A_0$

$B \to B_3 B_2 B_1 B_0$

$A = B \to A_3 = B_3,\ A_2 = B_2,\ A_1 = B_1,\ A_0 = B_0$

$(A_3 \odot B_3)(A_2 \odot B_2)(A_1 \odot B_1)(A_0 \cdot B_0)$

$A > B \to A_3 > B_3 \quad 1>0,\ A_3 B_3'$

$\hookrightarrow A_3 = B_3,\ A_2 > B_2 \to (A_3 \odot B_3) \cdot (A_2 B_2')$

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

$\hookrightarrow (A_3 \odot B_3)(A_2 \odot B_2)(A_1 B_1')$

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

$\hookrightarrow (A_3 \odot B_3)(A_2 \odot B_2)(A_1 \odot B_1)(A_0 B_0')$

$A < B \to B_3 > A_3 \quad 1>0 \quad A_3' B_3$

$\hookrightarrow B_3 = A_3,\ B_2 > A_2\ (A_3 \odot B_3)(A_2' B_2)$

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

$(A_3 \odot B_3)(A_2 \odot B_2)(A_1' B_1)$

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

$(A_3 \odot B_3)(A_2 \odot B_2)(A_1 \odot B_1) \cdot (A_0' B_0)$