AKTU

GATEWAY CLASSES

Digital System Design

B.Tech. 3rd Sem

EC & Allied



Exam/Result Oriented Content

- ✓ Recorded Video Lectures
- ✓ Pdf Notes
- ✓ PYQs

DIGITAL SYSTEM DESIGN

UNIT 2 : Combinational circuits

Today's Target

- Magnitude Comparator
- 1 Bit, 2 Bit, 3 Bit, 4 Bit Comparator
- DPP
- University Questions

Digital Comparator

- A **digital comparator** or magnitude **comparator** is a hardware **electronic** device that takes two numbers as input in binary form and determines whether one number is greater than, less than or equal to the other number.
- **Comparators** are used in central processing units (CPUs) and microcontrollers (MCUs).
- One bit Comparator:

A	B	A=B	A>B	A<B
0	0	1	0	0
0	1	0	0	1
1	0	0	1	0
1	1	1	0	0

A=	0	1	0	1
B=	1	0	0	1
	A<B	A>B	A=B	$\bar{A}=B$

$A<B: y_1 = \bar{A}B$

$A>B: y_2 = A\bar{B}$

$A=B: y_3 = \bar{A}\bar{B} + AB = A \odot B$

$$y_3 = \overline{y_1 + y_2}$$

$$= \bar{A}B + A\bar{B}$$

$$= \overline{\bar{A}B} \cdot \overline{A\bar{B}}$$

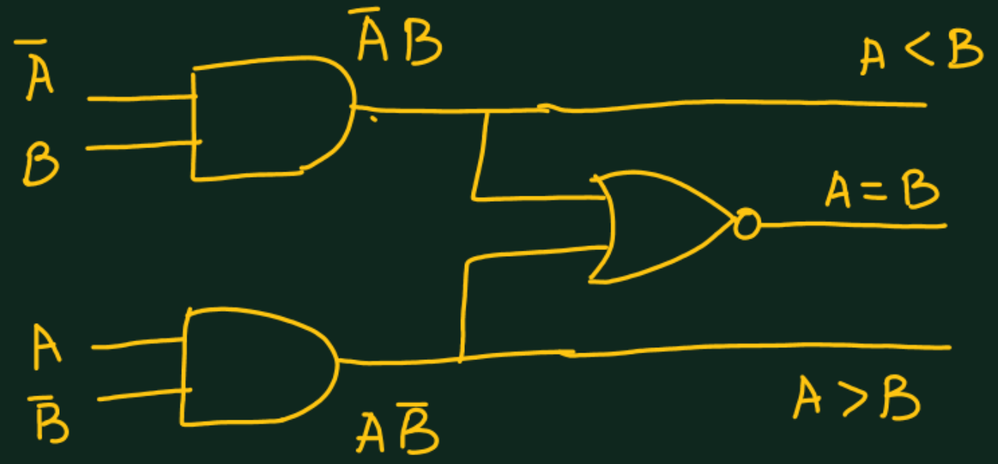
$$= (\bar{\bar{A}} + \bar{B})(\bar{A} + \bar{\bar{B}})$$

$$= (A + \bar{B})(\bar{A} + B)$$

$$= A(\bar{A} + B) + \bar{B}(\bar{A} + B)$$

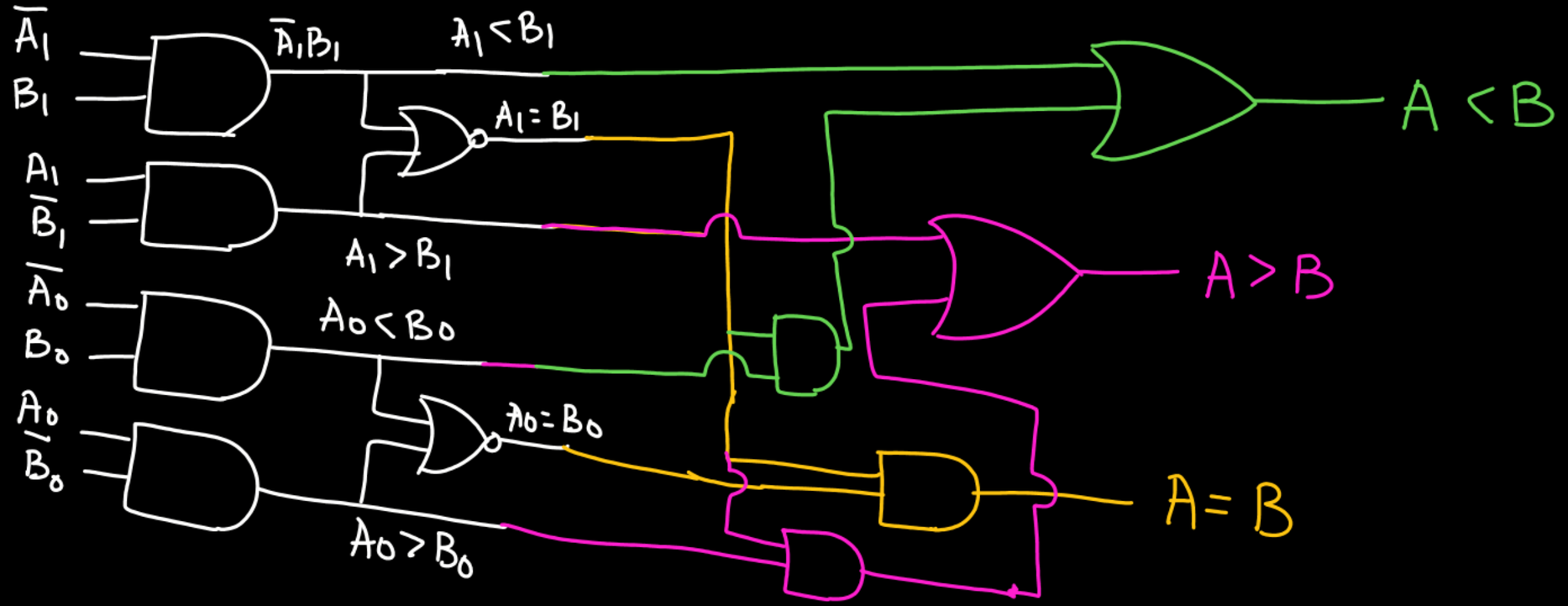
$$= A\bar{A} + AB + \bar{A}\bar{B} + B\bar{B}$$

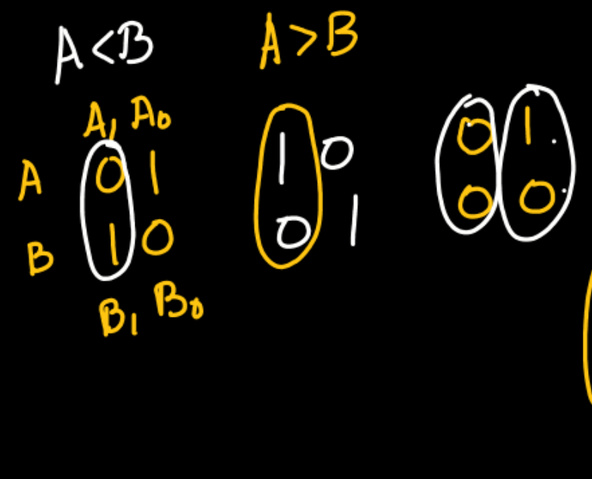
$$= AB + \bar{A}\bar{B}$$


$\bar{A}$
B
$\bar{A}B$
A < B
A = B
A
$\bar{B}$
$A\bar{B}$
A > B

2 BIT Digital Comparator

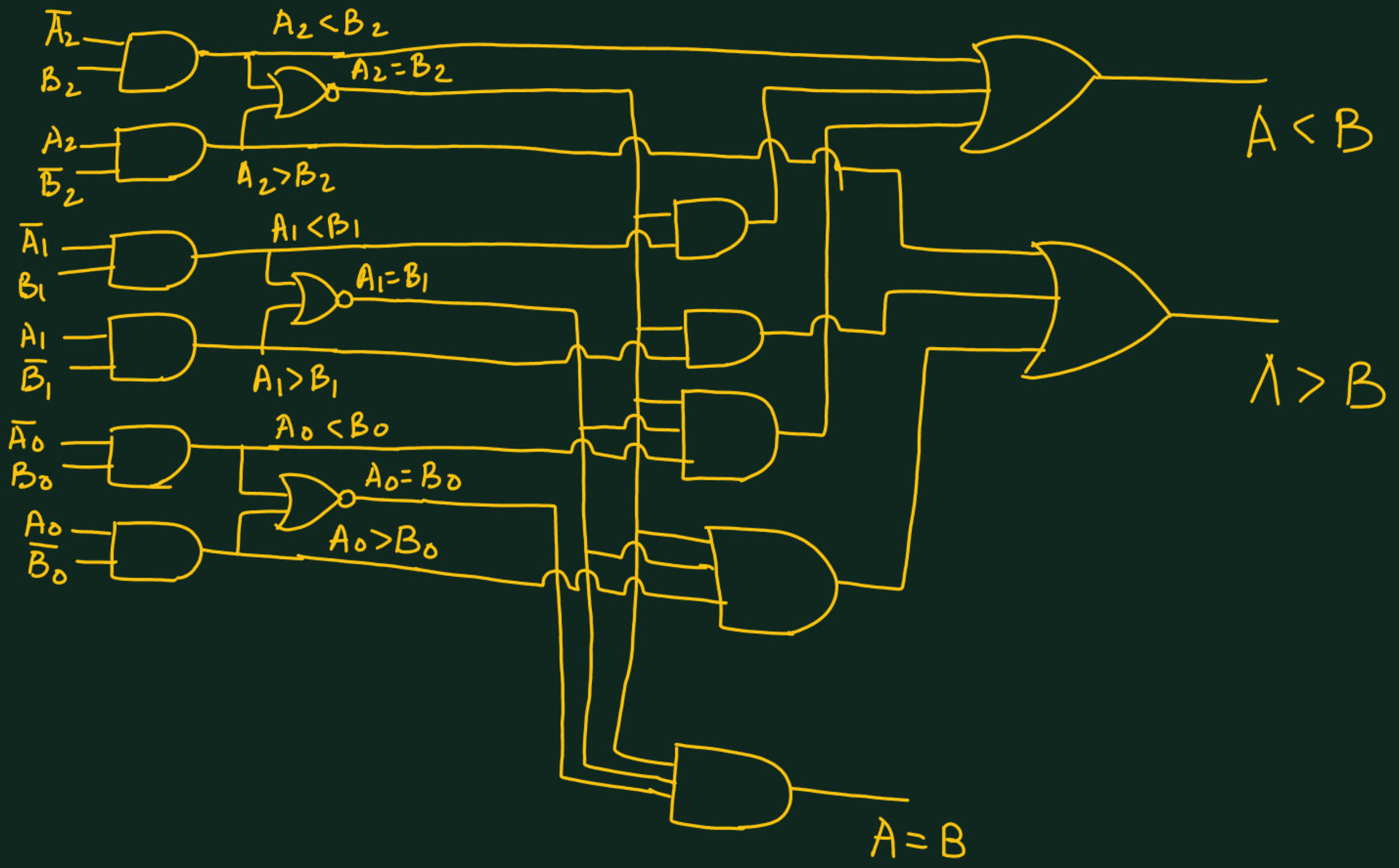
- Consider two 2-bit binary numbers A and B as; $A_1\ A_0$ & $B_1\ B_0$
- A=B if ; $A_1 = B_1$ AND $A_0 = B_0$
- A> B if ; $A_1 > B_1$ OR $A_1 = B_1$ AND $A_0 > B_0$
- A< B if ; $A_1 < B_1$ OR $A_1 = B_1$ AND $A_0 < B_0$





3 BIT Digital Comparator

- Consider two 3-bit binary numbers A and B as; $A_2\ A_1\ A_0$ & $B_2\ B_1\ B_0$
- A=B if ; $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 = B_0$
- A> B if ; $A_2 > B_2$ OR $A_2 = B_2$ AND $A_1 > B_1$ OR $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 > B_0$
- A< B if ; $A_2 < B_2$ OR $A_2 = B_2$ AND $A_1 < B_1$ OR $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 < B_0$


$\overline{A}_2$
B_2
$A_2 < B_2$
$A_2 = B_2$
A_2
$\overline{B}_2$
$A_2 > B_2$
$\overline{A}_1$
B_1
$A_1 < B_1$
$A_1 = B_1$
A_1
$\overline{B}_1$
$A_1 > B_1$
$\overline{A}_0$
B_0
$A_0 < B_0$
$A_0 = B_0$
A_0
$\overline{B}_0$
$A_0 > B_0$
A < B
A > B
A = B

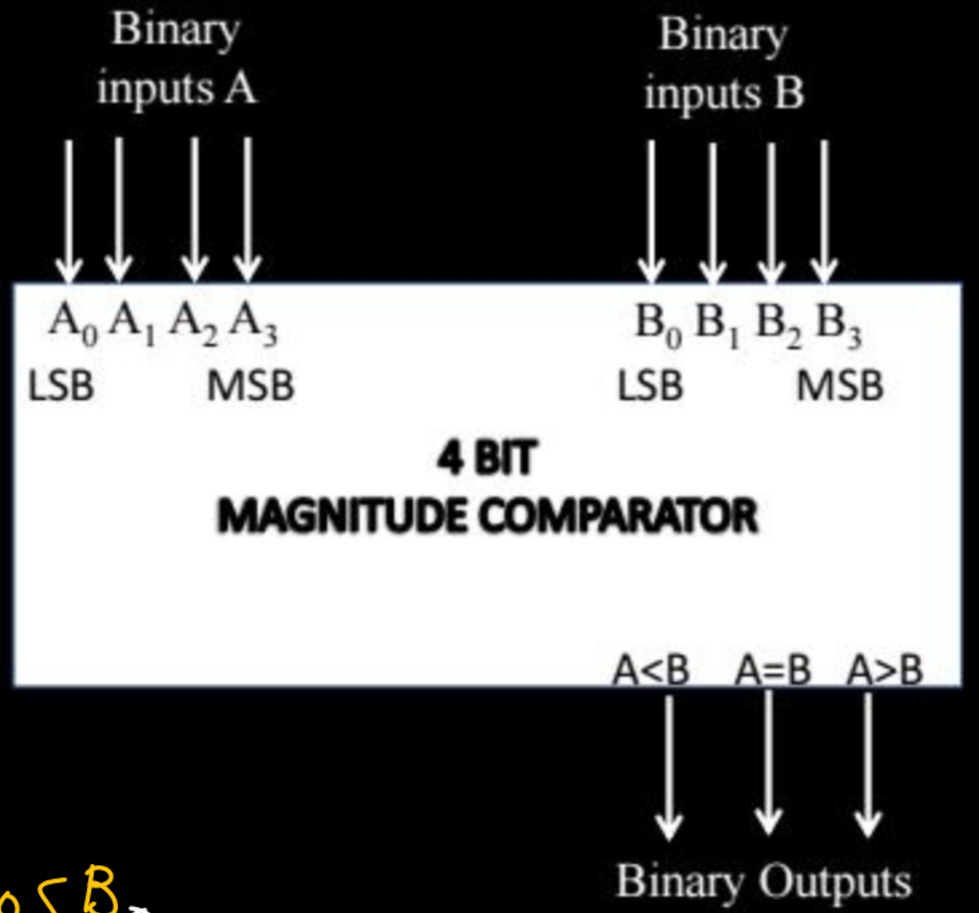
4 BIT Digital Comparator

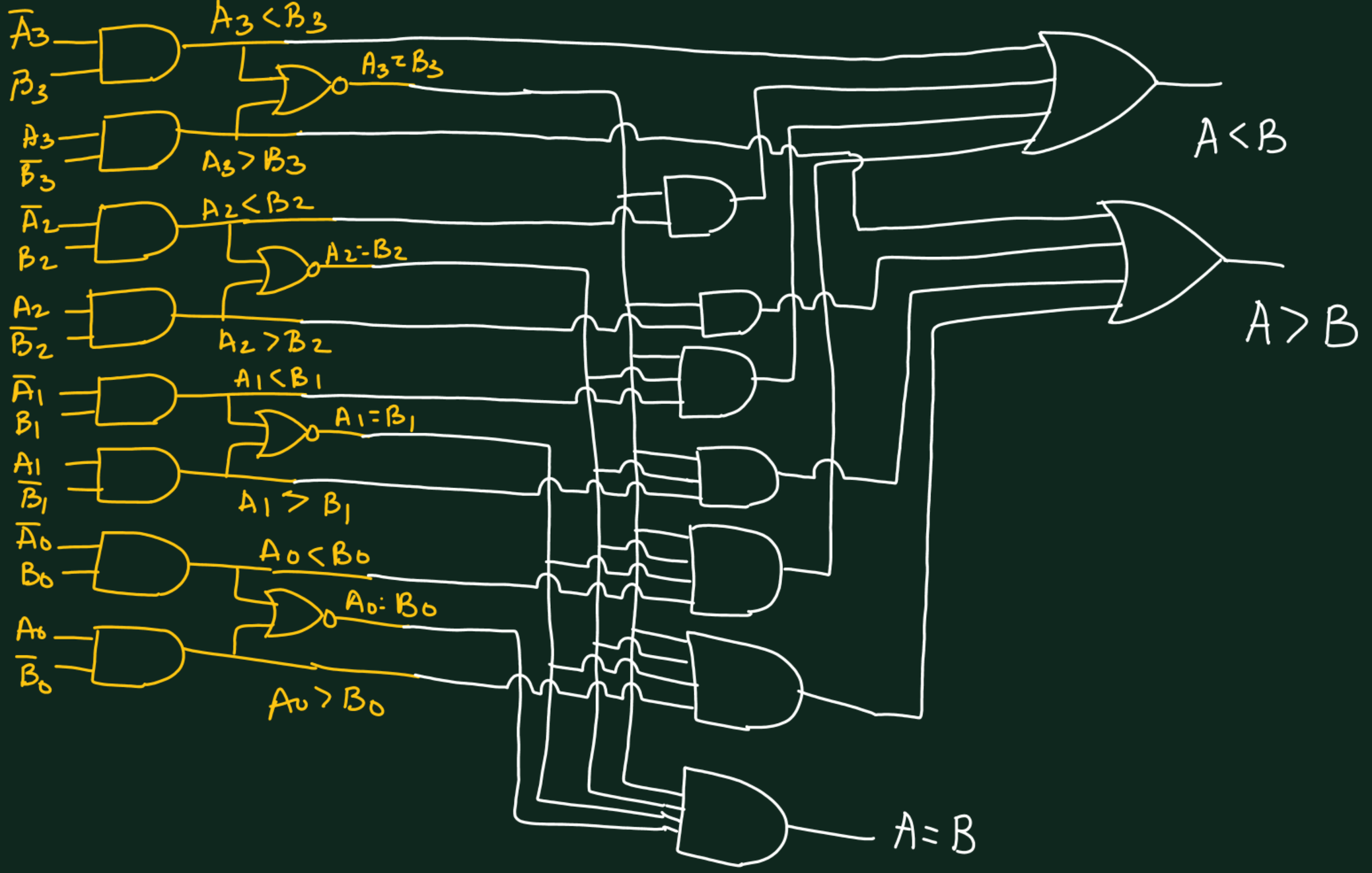
- Consider two 4-bit binary numbers A and B as; $A_3\ A_2\ A_1\ A_0$ & $B_3\ B_2\ B_1\ B_0$

- A=B if ; $A_3 = B_3$ AND $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 = B_0$

- A> B if ; $A_3 > B_3$ OR $A_3 = B_3$ AND $A_2 > B_2$
  OR $A_3 = B_3$ AND $A_2 = B_2$ AND $A_1 > B_1$
  OR $A_3 = B_2$ AND $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 > B_0$

- A< B if ; $A_3 < B_3$ OR $A_3 = B_3$ AND $A_2 < B_2$
  OR $A_3 = B_3$ AND $A_2 = B_2$ AND $A_1 < B_1$
  OR $A_3 = B_3$ AND $A_2 = B_2$ AND $A_1 = B_1$ AND $A_0 < B_0$




$\overline{A}_3$
B_3
$A_3 < B_3$
$A_3 = B_3$
A_3
$\overline{B}_3$
$A_3 > B_3$
$\overline{A}_2$
B_2
$A_2 < B_2$
$A_2 = B_2$
A_2
$\overline{B}_2$
$A_2 > B_2$
$\overline{A}_1$
B_1
$A_1 < B_1$
$A_1 = B_1$
A_1
$\overline{B}_1$
$A_1 > B_1$
$\overline{A}_0$
B_0
$A_0 < B_0$
$A_0 = B_0$
A_0
$\overline{B}_0$
$A_0 > B_0$
A<B
A>B
A=B

DPP

GW
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a) Design a 1 bit Magnitude Comparator.

b) Design a 2 bit Magnitude Comparator.

c) Design a 3 bit Magnitude Comparator.

d) Design a 4 bit Magnitude Comparator.

UNIVERSITY QUESTIONS

YEAR	QUESTION	MARKS
22-23	What is magnitude comparator? Design a Single-bit comparator circuit using logic gates.	7 marks
21-22	Design 2-bit magnitude comparator.	7 marks
19-20	Design a 4-bit comparator circuit using logic gates	7 marks

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All Subjects

Link in Description

Thank You

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