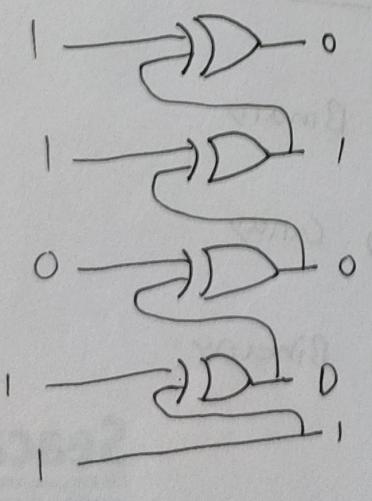
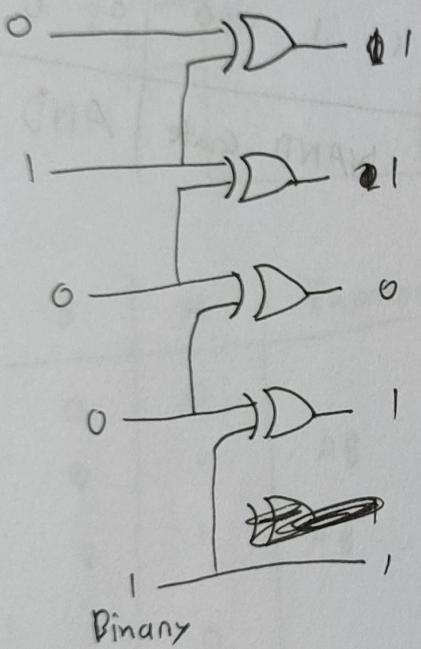


\* T.I

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

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



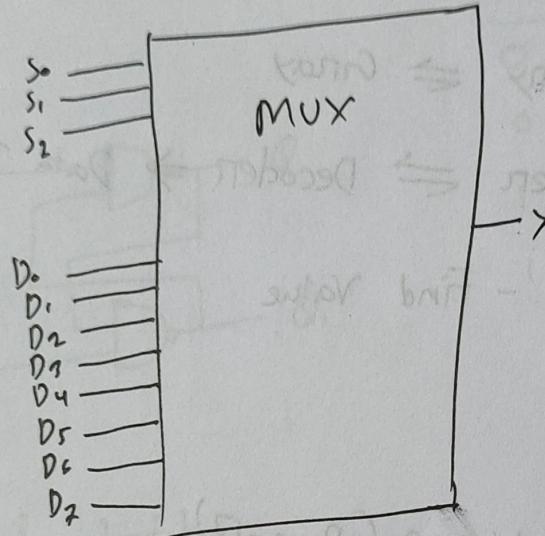
Carry      Binary

L-16 / 27. 03. 2023/

## Multiplexer

1 of 8 MUX

8 input MUX



## Review Class

Chapten - 5  $\Rightarrow$  2 Question

$\Rightarrow$  Multiplexer (991.)

$\Rightarrow$  Binary  $\Leftrightarrow$  Gray

$\Rightarrow$  Encoder  $\Leftrightarrow$  Decoder  $\Rightarrow$  Data Table

$\Rightarrow$  Adder - Find Value

Chapten - 4  $\Rightarrow$

$\Rightarrow$  Standard SOP (Page - 17)

$\Rightarrow$  TT of SOP & POS

$\Rightarrow$  k-map (28 page) - Display Segment

Chapten - 3

Page - 20, 21  $\Rightarrow$  Application of NAND

Chapten - 2

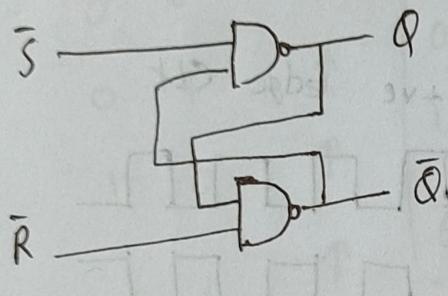
Floating point Convention.

L-18 / 03.04.2023

Midterm Exam

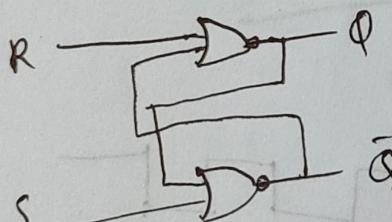
L-19 / 05.04.2023

$\bar{S}\bar{R}$  Latch



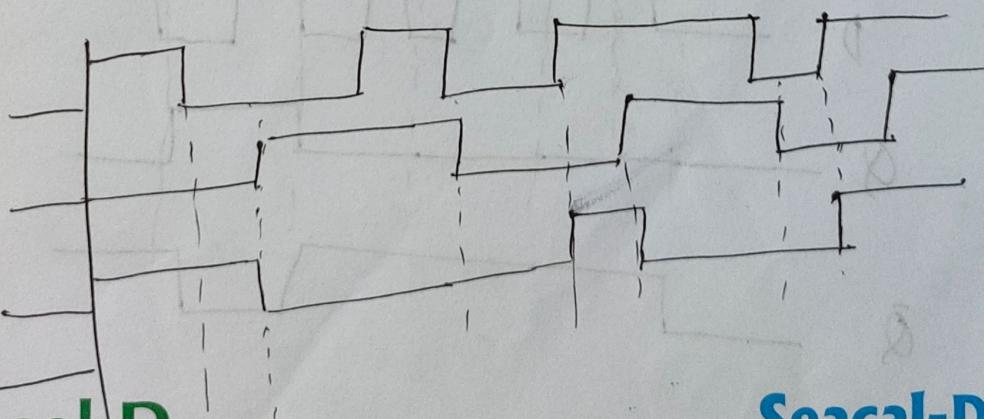
$\bar{S}\bar{R}$	$Q\bar{Q}$	Comment
0 0	1 1	Invalid
0 1	1 0	SET
1 0	0 1	RESET
1 1	NC NC	NC

RS Latch



S	R	$Q\bar{Q}$	Comment
0 0	NC NC	NC	
0 1	0 1		RESET
1 0	1 0		SET
1 1	0 0		Invalid

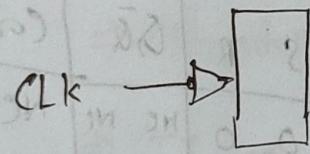
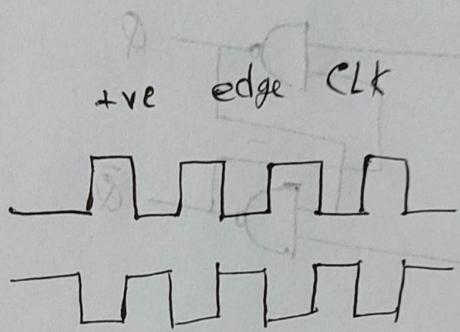
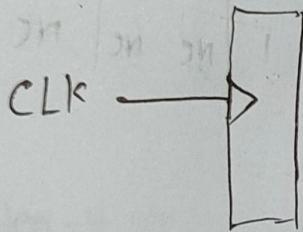
Quiz Must



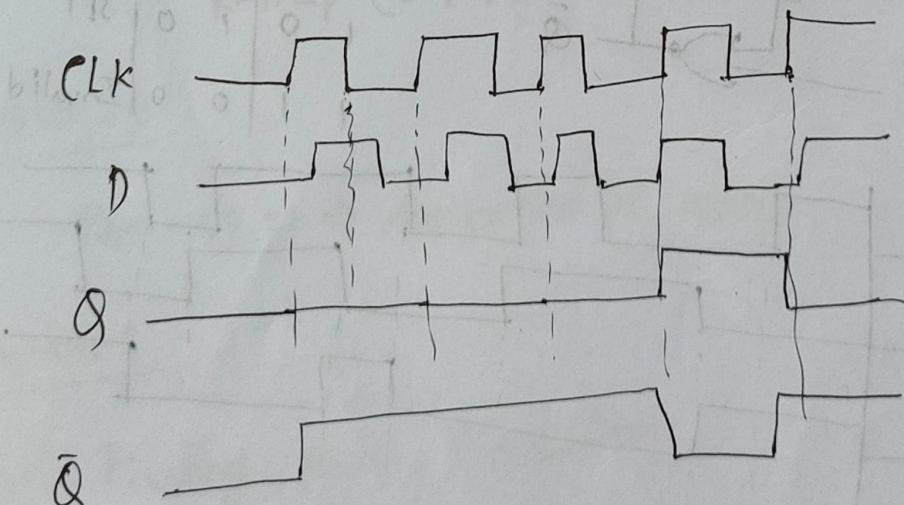
L-20 / 10.04.2023 /

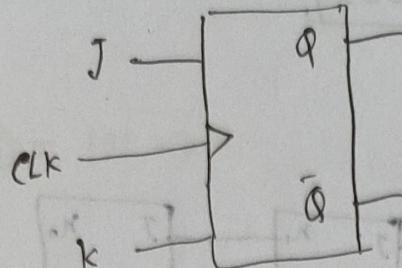
gate realization

S	R	Q	$\bar{Q}$
0	0	NC	NC
0	1	0	1
1	0	1	0
1	1	Invalid	0



-ve edge CLK





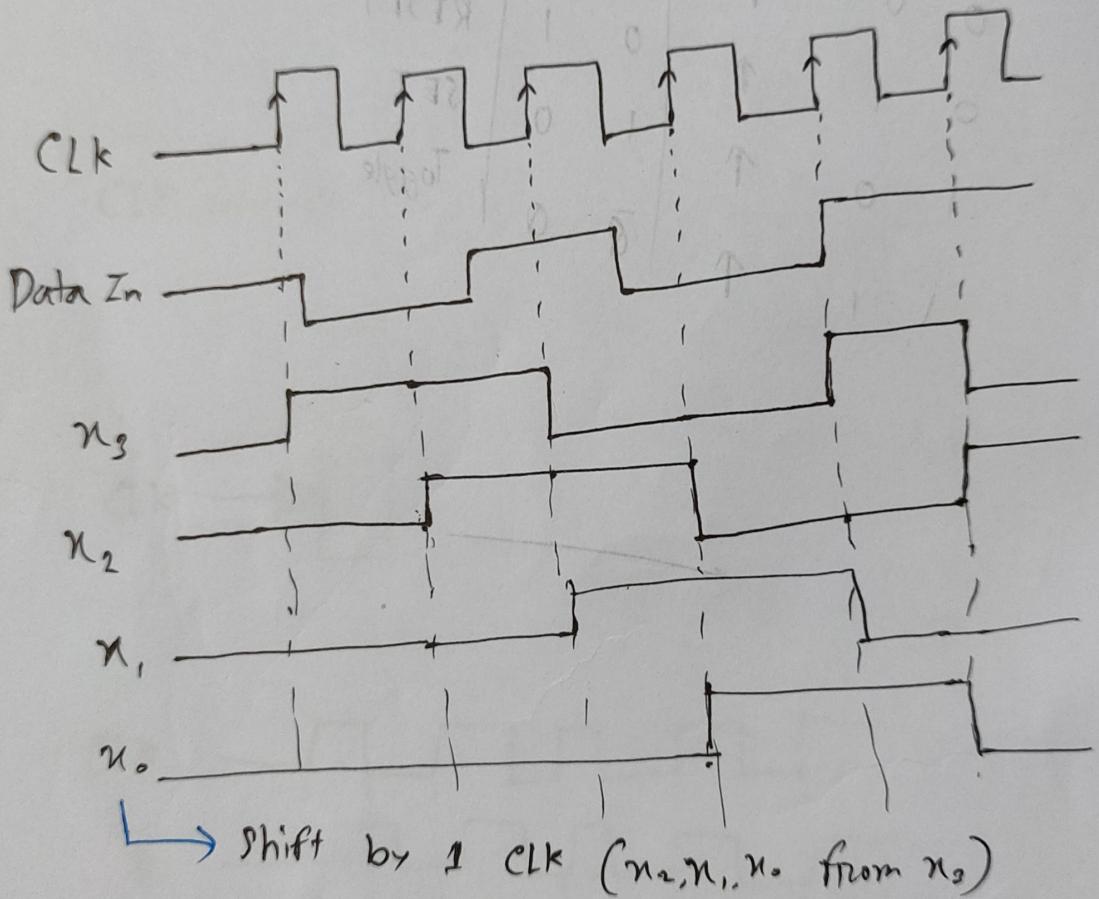
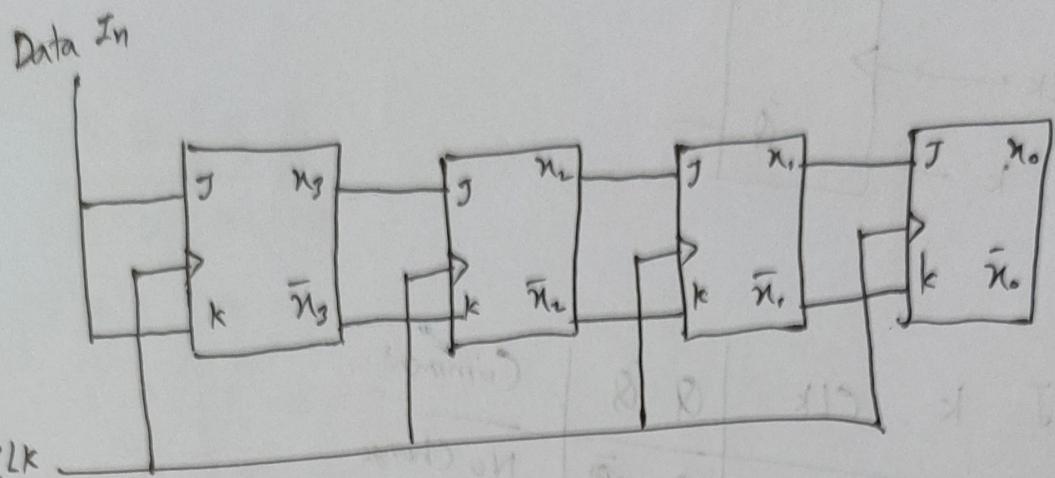
J	K	CLK	Q	$\bar{Q}$	Comment
0	0	↑	0	1	No Change
0	1	↑	1	0	RESET
1	0	↑	0	1	SET
1	1	↑	0	0	Toggle

(Clock width requirement)  $\geq 10$  ns and Pulse  $\leq 10$  ns

X	X	1	0
X	X	0	0
1	0	1	0
0	1	0	1

**Seacal-D**  
Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**  
Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)

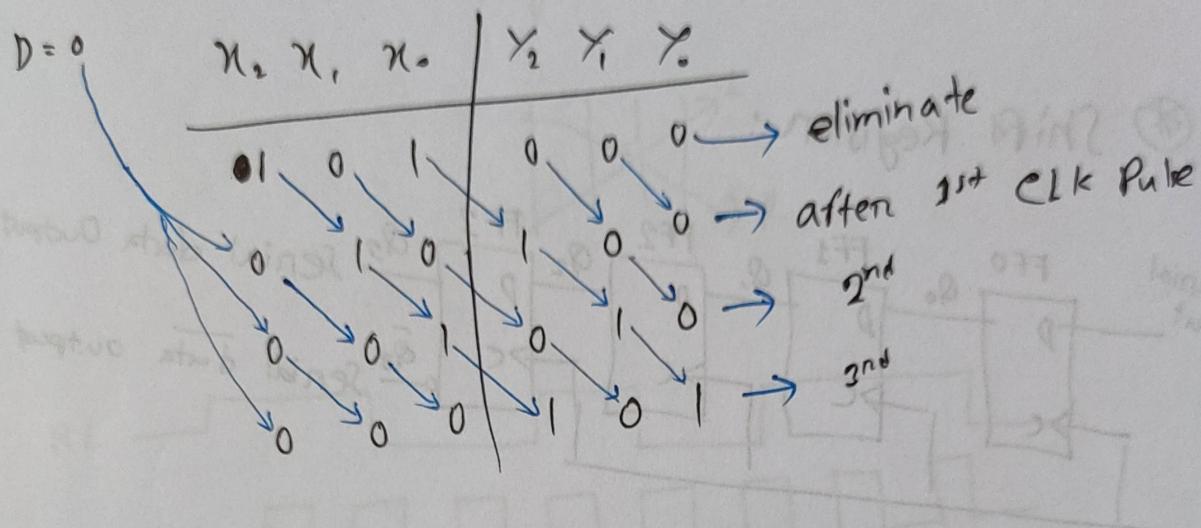


J	k	$x$	$\bar{x}$
0	0	x	$\bar{x}$
0	1	0	1
1	0	1	0
1	1	$\bar{x}$	x

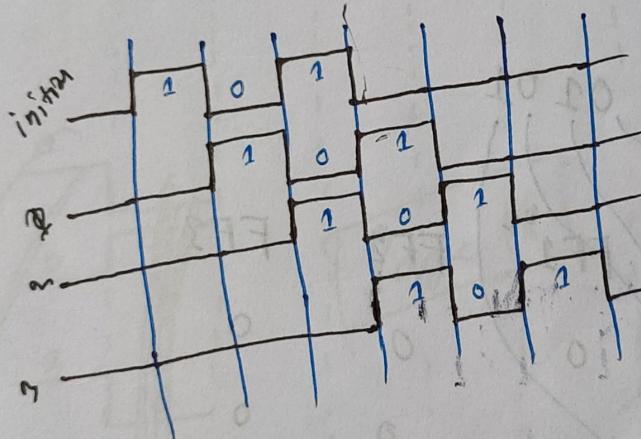
As data in is same for j and k.  
So, 00 and 11 will valid  
Others invalid.

(\*)

$$D = 101 \rightarrow 0$$



(\*)



# Seacal-D

Calcium Carbonate (From Coral Source) and Vitamin D<sub>3</sub> (Colecalciferol)

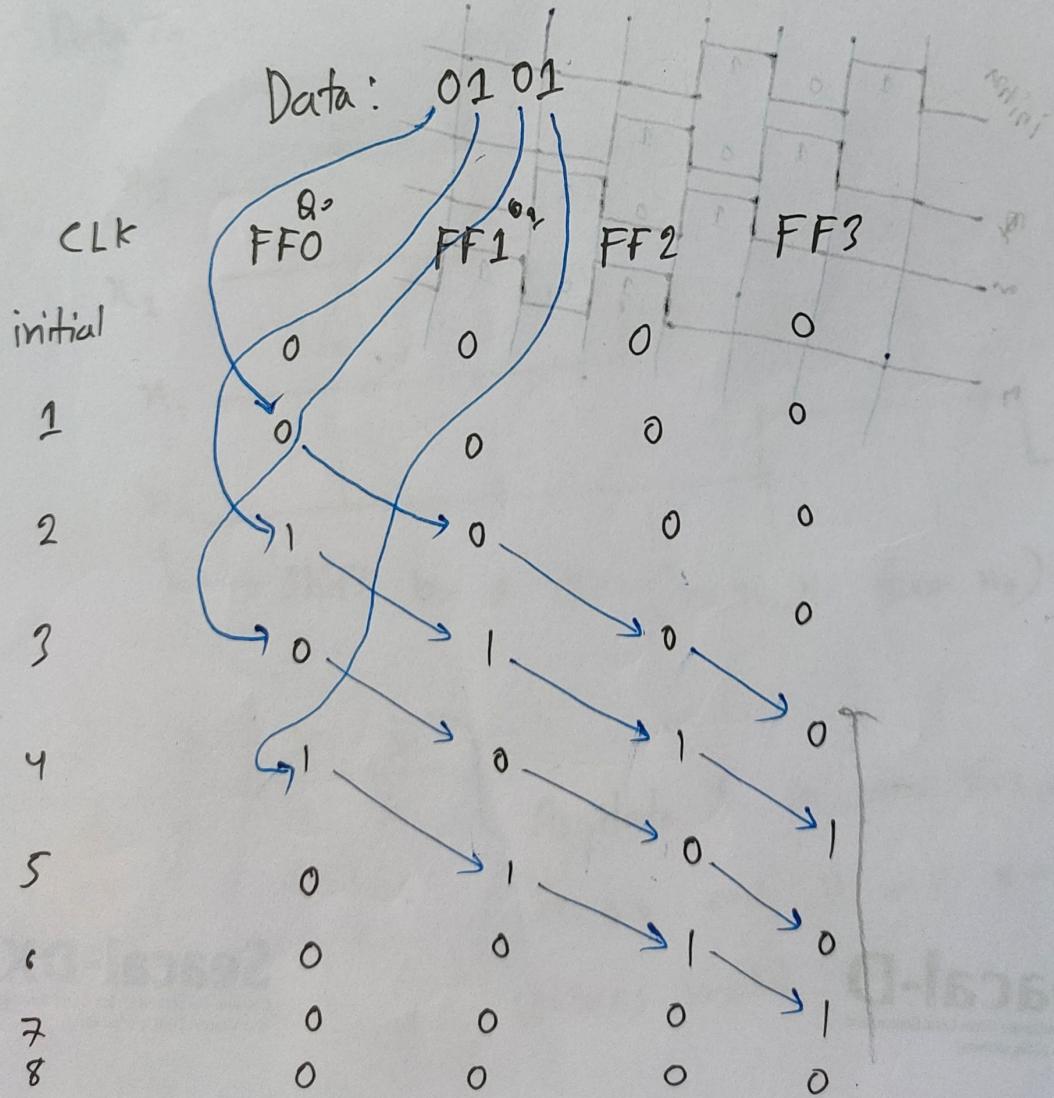
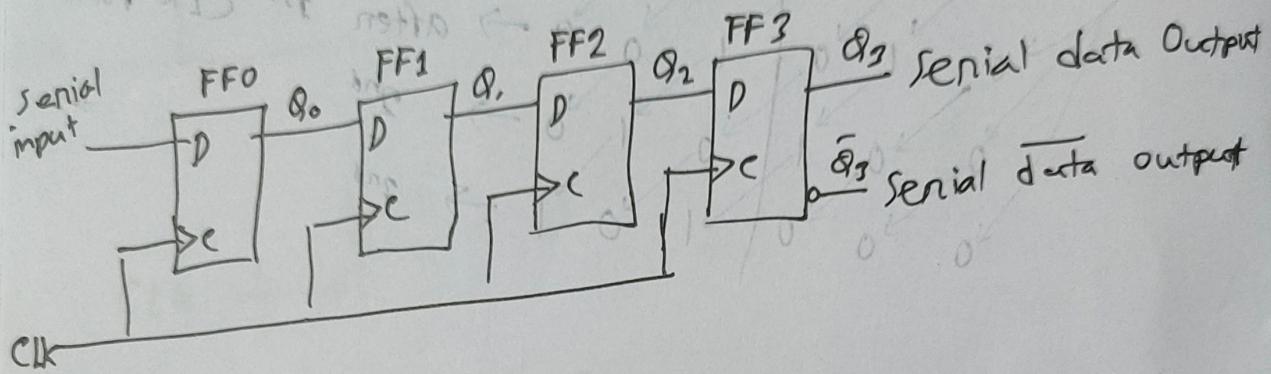
# Seacal-DX

Calcium Carbonate (From Coral Source) and Vitamin D<sub>3</sub> (Colecalciferol)

L-22

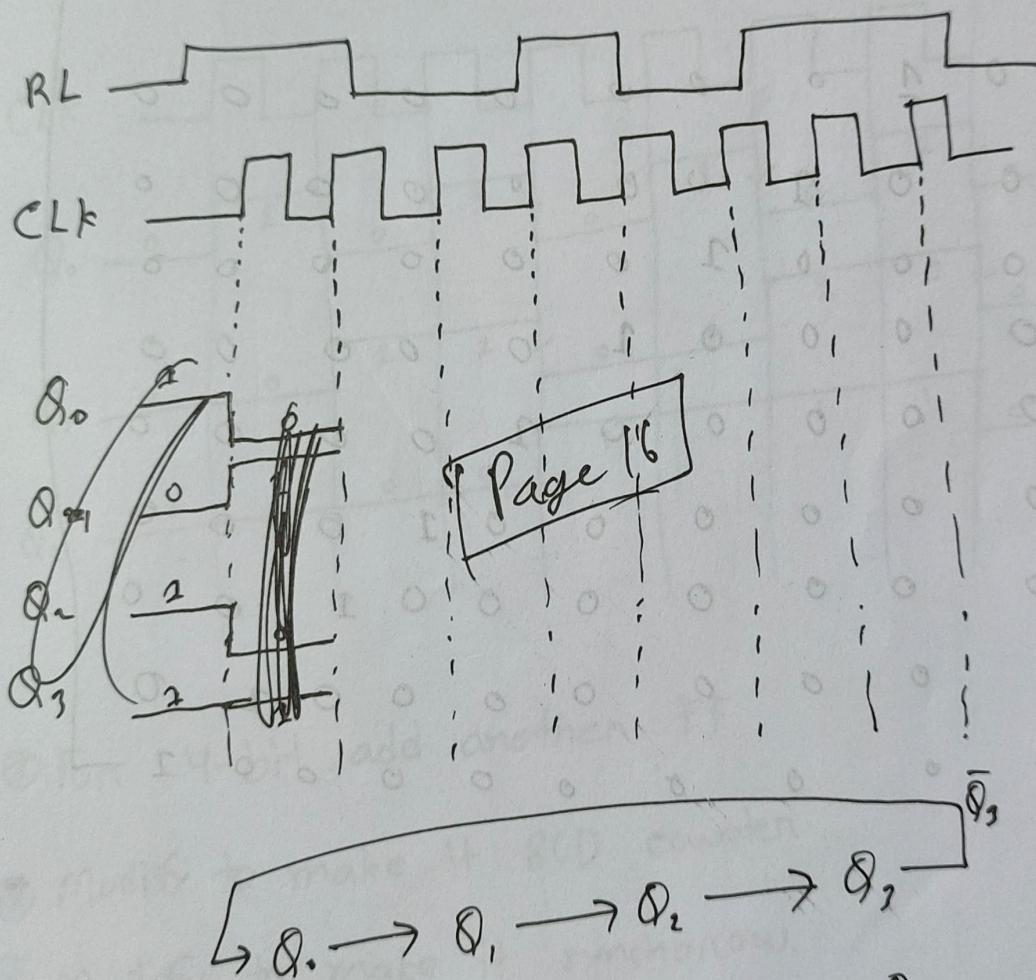
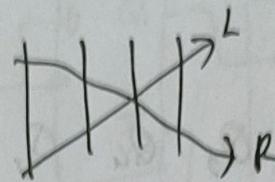
L-23 / 03.05.2023

## Shift Register:



L-24 / 08.05.2023 /

$R/L = 0 \rightarrow \text{Left shift} \rightarrow \text{Up}$   
 $= 1 \rightarrow \text{Right shift} \rightarrow \text{Down}$



initial      0      0      0      0  
①            1      0      0      0  
②            1      1      0      0  
③            1      1      1      0  
④            1      1      1      1

**Seacal-D**  
Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**  
Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)

⑤ 0 1 1 1

⑥ 0 0 1 1

⑦ 0 0 0 1

⑧ 0 0 0 0 0

✗

Q<sub>0</sub>, Q<sub>1</sub>, Q<sub>2</sub>, Q<sub>3</sub>, Q<sub>4</sub>, Q<sub>5</sub>, Q<sub>6</sub>, Q<sub>7</sub>, Q<sub>8</sub>, Q<sub>9</sub>,

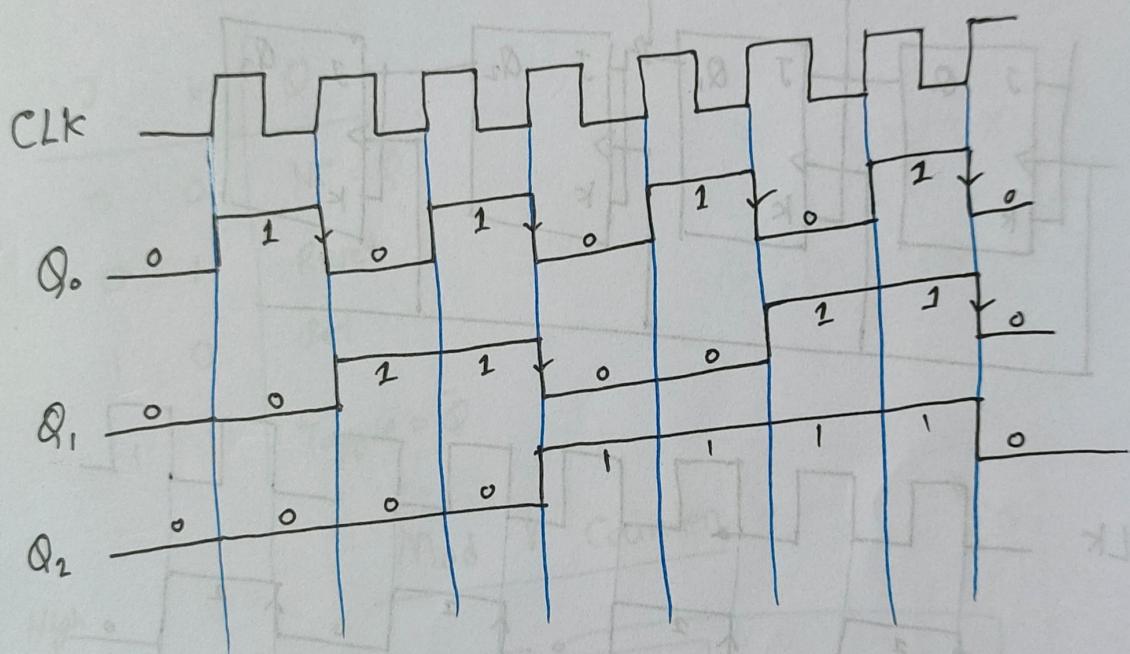
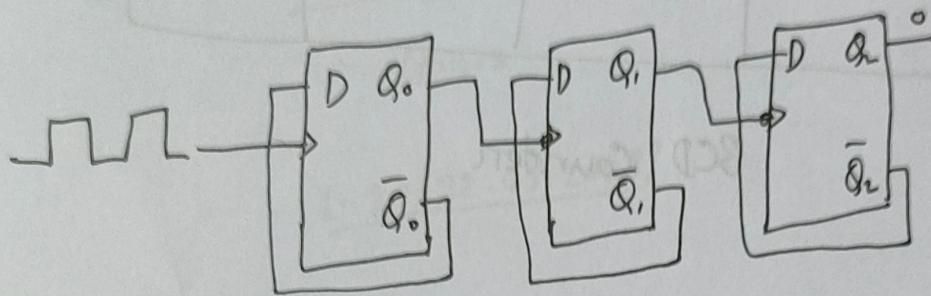
initial

	1	0	0	0	0	0	0	0	0	0	0	0
①	0	1	0	0	0	0	0	0	0	0	0	0
②	0	0	1	0	0	0	0	0	0	0	0	0
③	0	0	0	1	0	0	0	0	0	0	0	0
④	0	0	0	0	1	0	0	0	0	0	0	0
⑤	0	0	0	0	0	1	0	0	0	0	0	0
⑥	0	0	0	0	0	0	1	0	0	0	0	0
⑦	0	0	0	0	0	0	0	0	1	0	0	0
⑧	0	0	0	0	0	0	0	0	0	1	0	0
⑨	0	0	0	0	0	0	0	0	0	0	1	0

0 0 0 0  
0 0 0 1  
0 0 1 1  
0 1 1 1  
1 1 1 1  
lastini

L-25 / 10-05-2023 /

⊗ 2-bit asynchronous binary counter:



⊗ For 4-bit add another FF.

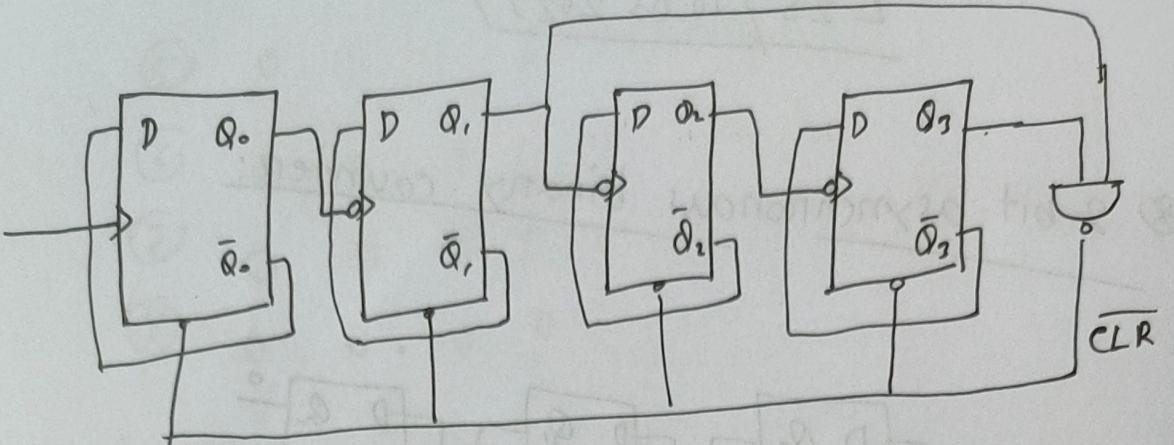
- ⊗ Modify to make it BCD counter
- ⊗ Modify to make it synchronous.

**Seacal-D**

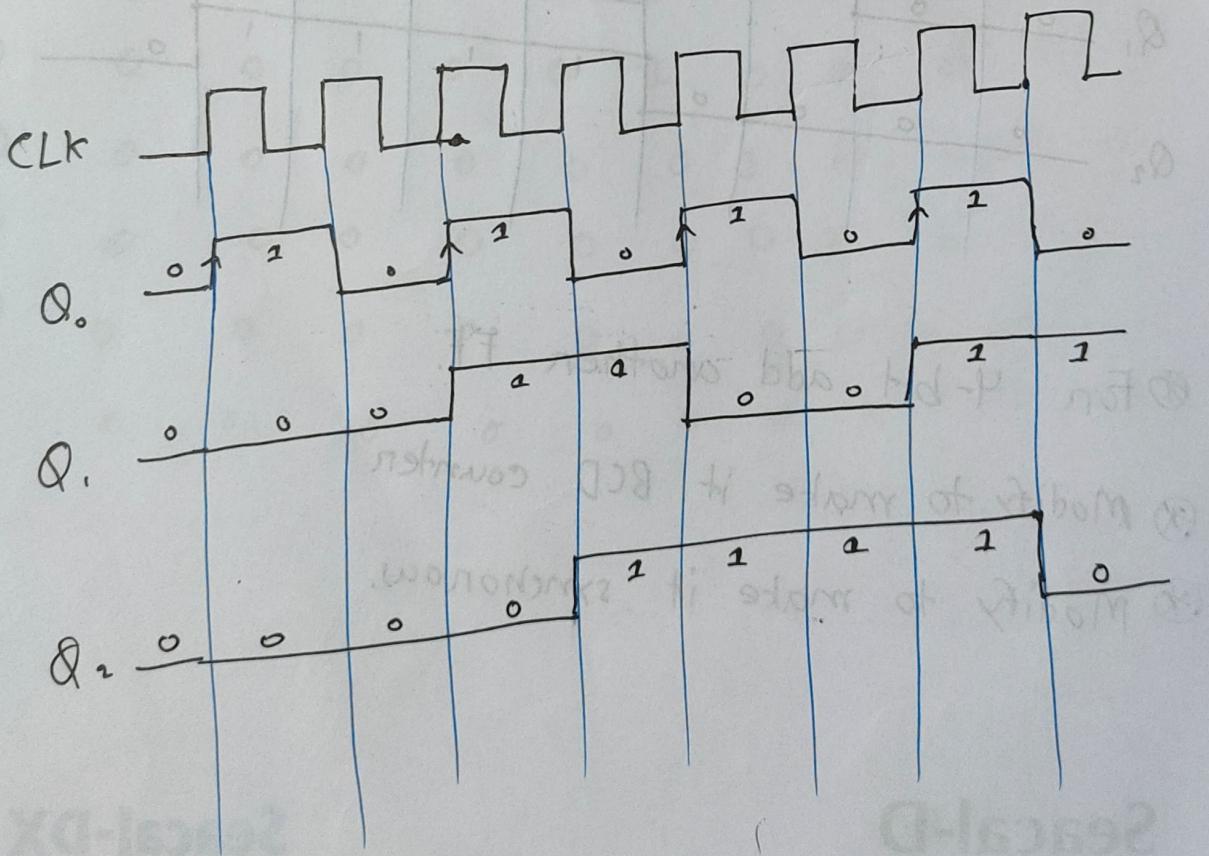
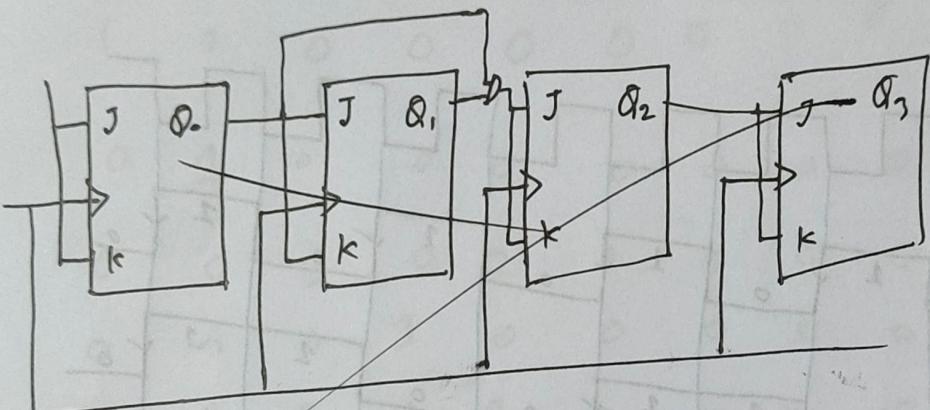
Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**

Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)



BCD Counter



L-26 / 15.05.2023 /

Review for Quiz-2

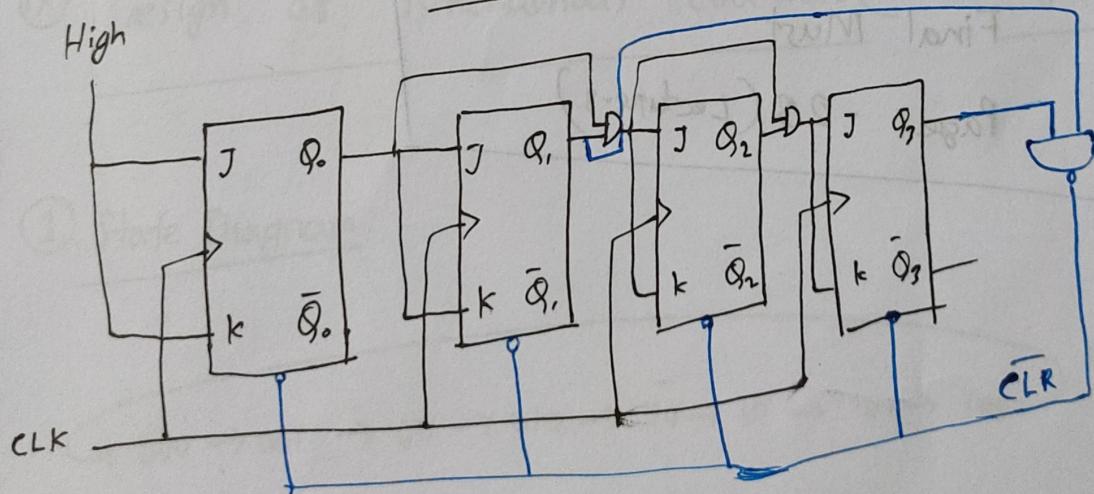
L-27 / 17.05.2023 /

Quiz-2

L-28 / 22.05.2023 /

J	K	Q
0	0	NC = Q
0	1	Reset
1	0	Set
1	1	Toggle = $\bar{Q}$

Mod 8 Counter

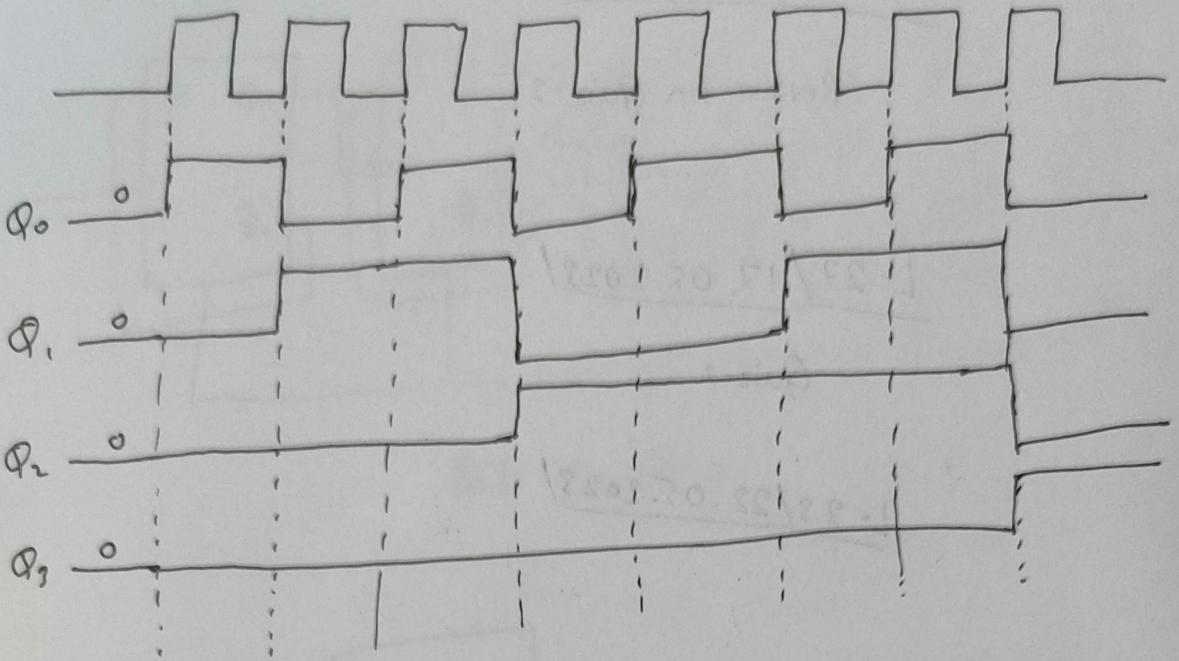


**Seacal-D**

Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**

Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)



⊗ Modify to make this BCD counter.

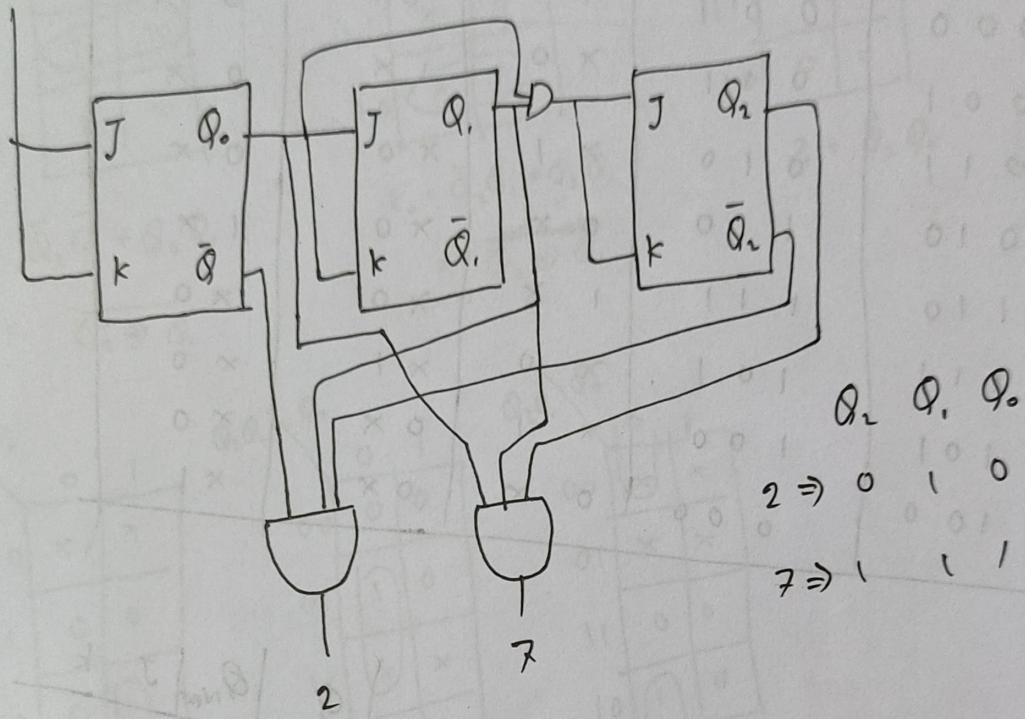
$\Rightarrow Q_3 \ Q_2 \ Q_1 \ Q_0$   
1 0 1 0

⊗ Design of Synchronous Counter

Final Must

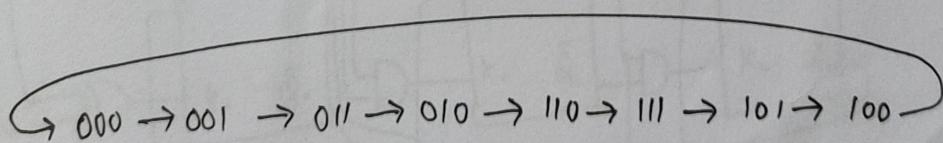
Page - 23 (Lecture-8)

④ Counter decoding : decoding of state 2 and 7



⑤ Design of Synchronous Counter (3 bit gray)

① State Diagram:



**Seacal-D**

Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**

Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)

②+③: State Table and Flip Fbp transition table

Current State $Q_2 Q_1 Q_0$	Next State $Q_2 Q_1 Q_0$	$J_0 \ k_0$	$J_1 \ k_1$	$J_2 \ k_2$	
0 0 0	0 0 1	1 x	0 x	0 x	
0 0 1	0 1 1	x 0	1 x	0 x	
0 1 1	0 1 0	x 1	x 0	0 x	
0 1 0	1 1 0	0 x	x 0	1 x	
1 1 0	1 1 1	1 x	x 0	x 0	
1 1 1	1 0 1	x 0	x 1	x 0	
1 0 1	1 0 0	x 1	0 x	x 0	
1 0 0	0 0 0	0 x	0 x	x 1	

$Q$	$Q_{\text{New}}$	$J$	$k$
0	0	0	x
0	1	1	x
1	0	x	x
1	1	x	0

001 → 101 ← 111 ← 011 ← 010 ← 110 ← 100 ← 000 ←

#### ④ K-Map

$\bar{Q}_2 Q_1$	$Q_0$
00	1
01	0
11	1
10	0

$$J_0 = \bar{Q}_2 \bar{Q}_1 + Q_2 Q_1 \\ = \overline{Q_2 \oplus Q_1}$$

$\bar{Q}_2 Q_1$	$Q_0$
00	0
01	1
11	0
10	1

$$k_0 = \bar{Q}_2 \bar{Q}_1 + Q_2 \bar{Q}_1 \\ = \cancel{\bar{Q}_2} \oplus \cancel{Q_1}$$

$\bar{Q}_2 Q_1$	$Q_0$
00	0
01	1
11	0
10	0

$$J_1 = \bar{Q}_2 Q_1.$$

$\bar{Q}_2 Q_1$	$Q_0$
00	x
01	0
11	1
10	x

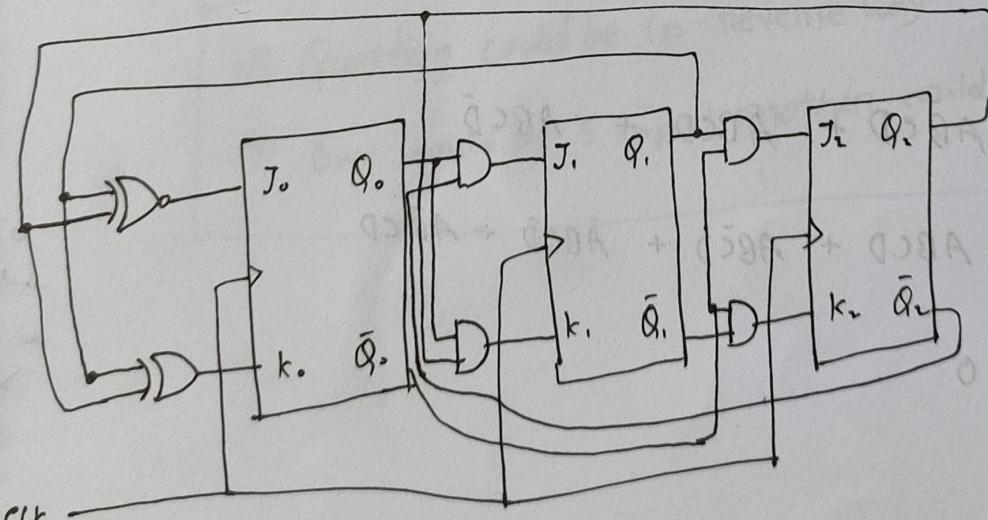
$$k_1 = Q_2 Q_0.$$

$\bar{Q}_2 Q_1$	$Q_0$
00	0
01	1
11	x
10	x

$$J_2 = Q_1 \bar{Q}_0.$$

$\bar{Q}_2 Q_1$	$Q_0$
00	x
01	x
11	0
10	1

$$k_2 = \bar{Q}_1 \bar{Q}_0.$$



**Seacal-D**

Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

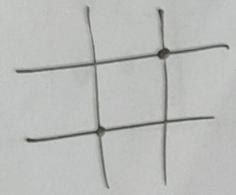
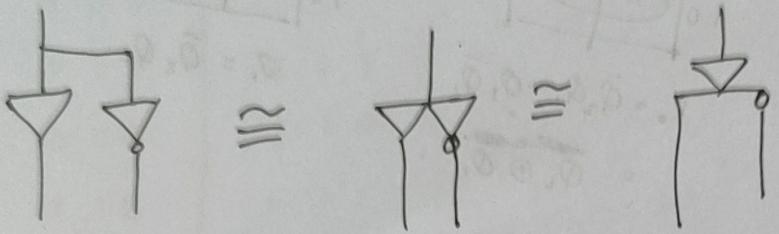
**Seacal-DX**

Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)

L-30 / 29. 05. 2023 /

Previous Class Repeat

L-31 / 31. 05. 2023 /



Hand Wiring

→ input limit 3  
3 → multiple input

(\*)

$$\text{Output} \Rightarrow A\bar{B} + \bar{A}B = A \oplus B$$

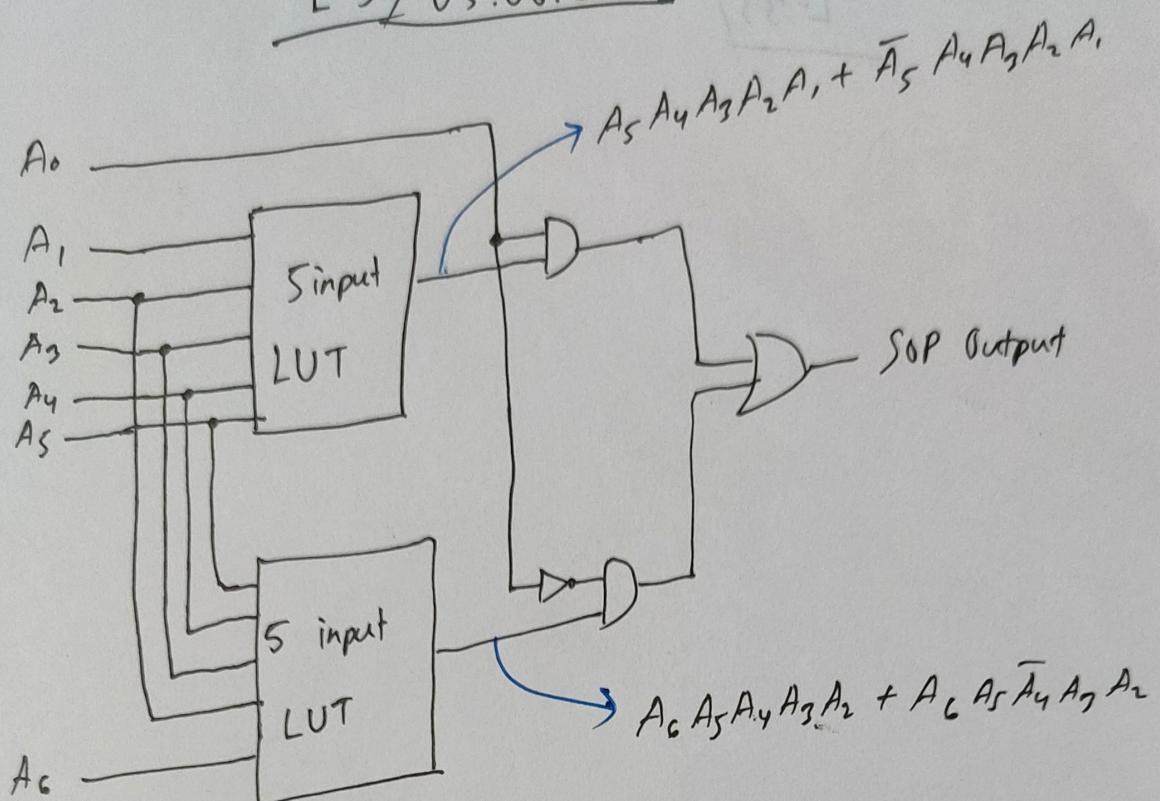
(\*)

$$x_1 = A\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}D + A\bar{B}C\bar{D}$$

$$x_2 = ABCD + AB\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}CD$$

$$x_{16} = 0$$

L-32/05.06.2023/



Slide Page - 28 → Must in Final

$$X = A_5 A_4 A_3 A_2 A_1 A_0 + \bar{A}_5 A_4 A_3 A_2 A_1 A_0 + A_6 A_5 A_4 A_3 A_2 \bar{A}_0 \\ + A_6 A_5 \bar{A}_4 A_3 A_2 \bar{A}_0$$

- ⊗ Question could be in reverse way
- ⊗ One could be 5 input. another could be 3.

**Seacal-D**

Calcium Carbonate (From Coral Source) and  
Vitamin D<sub>3</sub> (Colecalciferol)

**Seacal-DX**

Calcium Carbonate (From Coral Source)  
and Vitamin D<sub>3</sub> (Colecalciferol)