180204142

03-03-20

Chapter - 05

⊛ Binary Parallel Adder / Ripple Carry Adder :

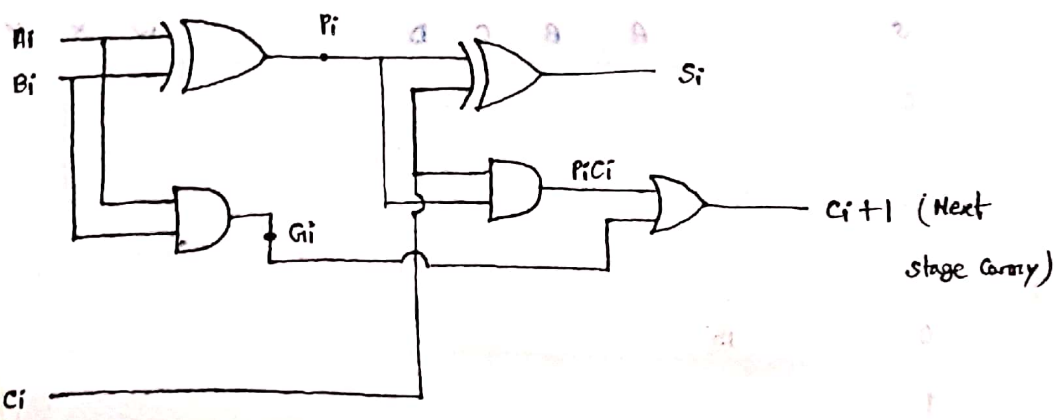
A_3	A_2	A_1
B_3	B_2	B_1

⊛ Carry Look-ahead adder :

$$S = \overbrace{A \oplus B}^{\text{carry propogate}} \oplus C_{in}$$

$$C_{out} = \underbrace{AB}_{\text{Carry generate}} \oplus C_{in}(A \oplus B)$$

From truth table of 1 bit Full Adder



here, $P_i = A_i \oplus B_i$ $\quad S_i = P_i \oplus C_i$

$G_i = A_iB_i$ $\quad C_{i+1} = G_i + P_iC_i$

→ G_i is called a carry generate and it produces an output carry.

→ P_i is called a carry propogation which propogates the carry from previous stage.

For 3 bit Binary :

$$A = A_3 A_2 A_1 \quad \longrightarrow C_1 = 0$$

$$B = B_3 B_2 B_1$$

$$\boxed{C_3 \quad S_3 S_2 S_1} \longrightarrow \text{output}$$

Simplification :

1st bit : $P_1 = A_1 \oplus B_1$

$i = 1$ $G_1 = A_1 B_1$

$$\boxed{C_1 = 0}$$

$$\boxed{S_1 = P_1 \oplus C_1} = A_1 \oplus B_1$$

2nd bit :

$$P_2 = A_2 \oplus B_2$$

$$G_2 = A_2 B_2$$

$$C_2 = G_1 + P_1 C_1$$

$$= A_1 B_1 + (A_1 \oplus B_1) . 0$$

$$= A_1 B_1$$

$$s_2 = P_2 \oplus C_2$$

$$= \boxed{(A_2 \oplus B_2) \oplus A_1 B_1}$$

<u>3rd bit :</u>

$$P_3 = A_3 \oplus B_3$$

$$G_3 = A_3 B_3$$

$$C_3 = G_2 + P_2 C_2$$

$$= \boxed{A_2 B_2 + (A_2 \oplus B_2) A_1 B_1}$$

$$S_3 = P_3 \oplus C_3$$

$$= \boxed{(A_3 \oplus B_3) \oplus A_2 B_2 + (A_2 \oplus B_2) A_1 B_1}$$

<u>4th bit</u>

7.5

<u>Quiz # 1 :</u>

$$F = A \oplus B$$

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

Apply duality Principle

$F = (\bar{A}+B) \cdot (A+\bar{B}) = \bar{A}\bar{B} + AB = \overline{A \oplus B} \rightarrow$ which is complement of $A \oplus B$

05-03-20

⊛ BCD Adder :

$$
\begin{array}{cccccc}
 & & 1 & 1 & 1 & 1 \\
A = & & A_3 & A_2 & A_1 & A_0 \\
B = & & B_3 & B_2 & B_1 & B_0 \\
 & & 1 & 1 & 1 & 1 \\
\hline
 & C_3 & S_3 & S_2 & S_1 & S_0 \\
 & 1 & 1 & 1 & 1 & 0
\end{array}
$$

$1111 \to 15$

$1111 \to 15$

$A = 0 - \boxed{9}$

$B = 0 - 9$

+18

Cin = 1 = 19

sum ⇒ 0 – 9 – 19

10 ⟶ 16

11 ⟶ 17

12 ⟶ 18

19 ⟶ 25

Sum

C	S_4	S_3	S_2	S_1	
0	1	0	1	0	— 10
0	1	0	1	1	— 11
0	1	1	0	0	— 12
0	1	1	0	1	— 13
0	1	1	1	0	— 14
0	1	1	1	1	— 15
1	0	0	0	0	— 16
1	0	0	0	1	— 17
1	0	0	1	0	— 18
1	0	0	1	1	— 19

Uncorrected sum :

S_4S_3 \ S_2S_1	$\bar{S_2}\bar{S_1}$	$\bar{S_2}S_1$	S_2S_1	$S_2\bar{S_1}$
$\bar{S_4}\bar{S_3}$				
$\bar{S_4}S_3$				
S_4S_3	1	1	1	1
$S_4\bar{S_3}$			1	1

BCD Adder :

⇒ Each input digit does not exceed 9

⇒ the output digit $9+9+1 = 19$ and does not exceed 19.

$\uparrow$ Cin

⇒ Take input bits to the 4 bit adder

⇒ Check if result > 9

⇒ if it is not then return as it is

⇒ if it is, add 6 to it and return.

$$F = S_4 S_3 + S_2 S_4$$
$$= S_4(S_3 + S_2)$$

To add 6, equation is,

$$F' = C + F$$
$$= C + S_4(S_3 + S_2)$$

৯ এর জন্য

C	S_4	S_3	S_2	S_1
	1	0	0	1

$F = S_4(S_3 + S_2) + C$

$= 1 \quad 0 \quad 0 \quad 0 \quad = 0$

10 এর জন্য

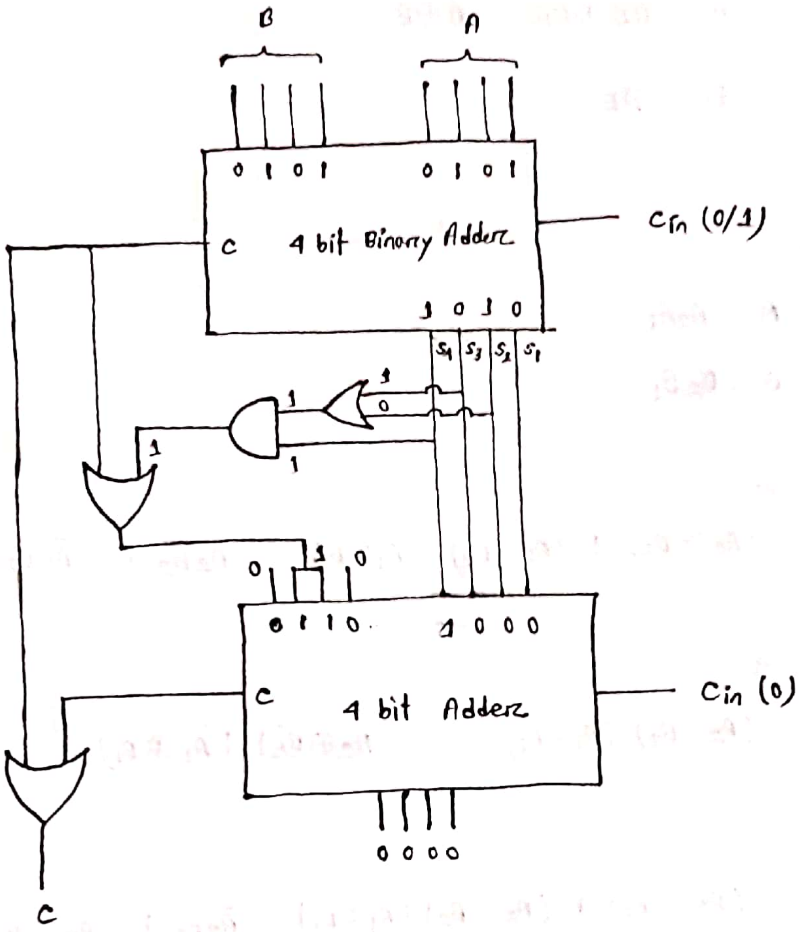
S_4	S_3	S_2	S_1
1	0	1	0

$F = S_4(S_3 + S_2) + C$

$= 1 \quad 0 \quad 1$

$= 1$

Block Diagram :



⊛ Magnitude Comparator :

Truth Table for 1 bit Comparator

A	B	F1 (A>B)	F2 (A=B)	F3 (A<B)
0	0	0	1	0
0	1	0	0	1
1	0	1	0	0
1	1	0	1	0

$A>B, \quad F_1 = A\overline{B}$

$A=B, \quad F_2 = \overline{A}\,\overline{B} + AB = \overline{A \oplus B}$

$A<B, \quad F_3 = \overline{A}B$

For 2 bit:

$A = A_2A_1$

$B = B_2B_1$

$A>B \Rightarrow$

$(A_2>B_2) + (A_2=B_2)\cdot(A_1>B_1) = A_2\overline{B_2} + (\overline{A_2 \oplus B_2})\,A_1\overline{B_1}$

$A=B \Rightarrow$

$(A_2=B_2)\,(A_1=B_1) = (\overline{A_2 \oplus B_2})\,(\overline{A_1 \oplus B_1})$

$A<B \Rightarrow$

$(A_2<B_2) + (A_2=B_2)\,(A_1<B_1) = \overline{A_2}B_2 + (\overline{A_2 \oplus B_2})\,\overline{A_1}B_1$

For 3 bit:

$A = A_3A_2A_1$

$B = B_3B_2B_1$

$A>B \Rightarrow$

$(A_3>B_3) + (A_3=B_3)\,(A_2>B_2) + (A_3=B_3)\,(A_2=B_2)\,(A_1>B_1)$

$A=B \Rightarrow$

$(A_3=B_3)\,(A_2=B_2)\,(A_1=B_1)$

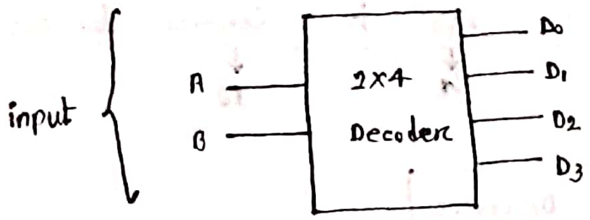
$A<B \Rightarrow$

$(A_3<B_3) + (A_3=B_3)\,(A_2<B_2) + (A_3=B_3)\,(A_2=B_2)$

10-03-20

⊛ Decoder:

2 to 4 line Decoder (2X4 Decoder):



00
01
10
11

Truth Table:

Input		Output			
A	B	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

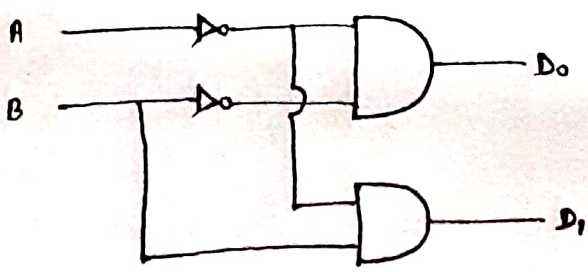
0 এর জন্য D_0 তে 1

1 এর জন্য D_1 তে 1

2 এর জন্য D_2 তে 1

3 এর জন্য D_3 তে 1

Logic Diagram:



ii) 3 to 8 line Diagram (3×8 Decoder)

iii) 4 to 16 line Diagram (4×16 Decoder)

⊛ Draw logic Diagram of a BCD to - decimal decoder :

BCD ↓ 4 ; decimal ↓ 10

$\boxed{\text{4 to 10 line Decoder}}$

Truth Table :

Input				Output									
A	B	C	D	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9

Expression :

$D_0 = \bar{A}\bar{B}\bar{C}\bar{D}$

$D_1 = \bar{A}\bar{B}\bar{C}D$

$D_2 = \bar{A}\bar{B}C\bar{D}$

|
|
|
|

$D_9 = A\bar{B}\bar{C}D$

⊛ Decoder:

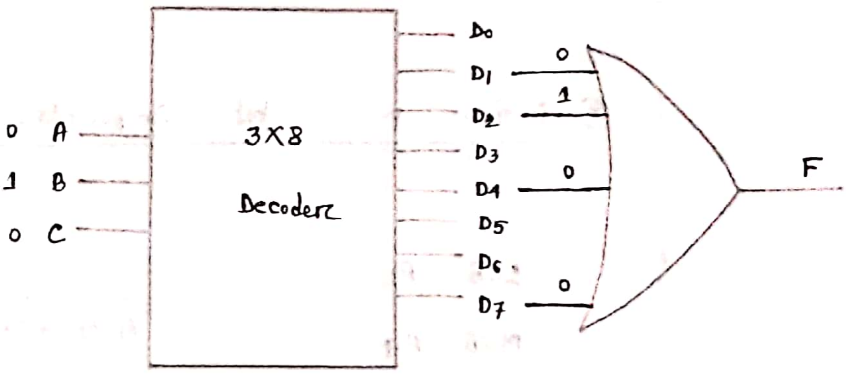
$F(A,B,C) = \Sigma(1,2,4,7)$

↓

output 1

Truth Table:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1



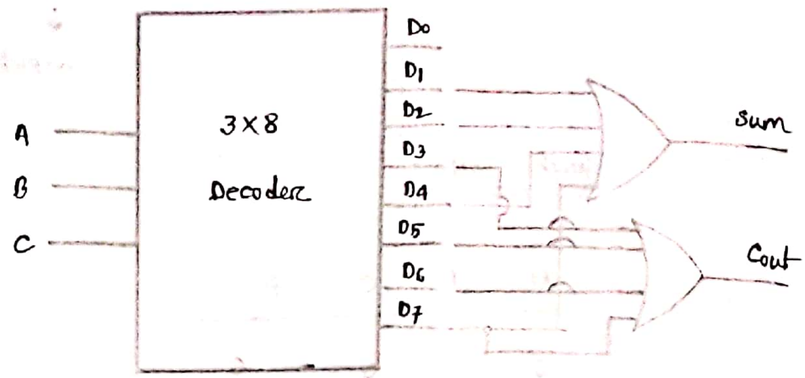
⊛ Design a 1 bit full adder using a decoder and or gates.

Truth Table:

Input			Output	
Cin	A	B	Carry	Sum
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$Sum = \Sigma(1,2,4,7)$

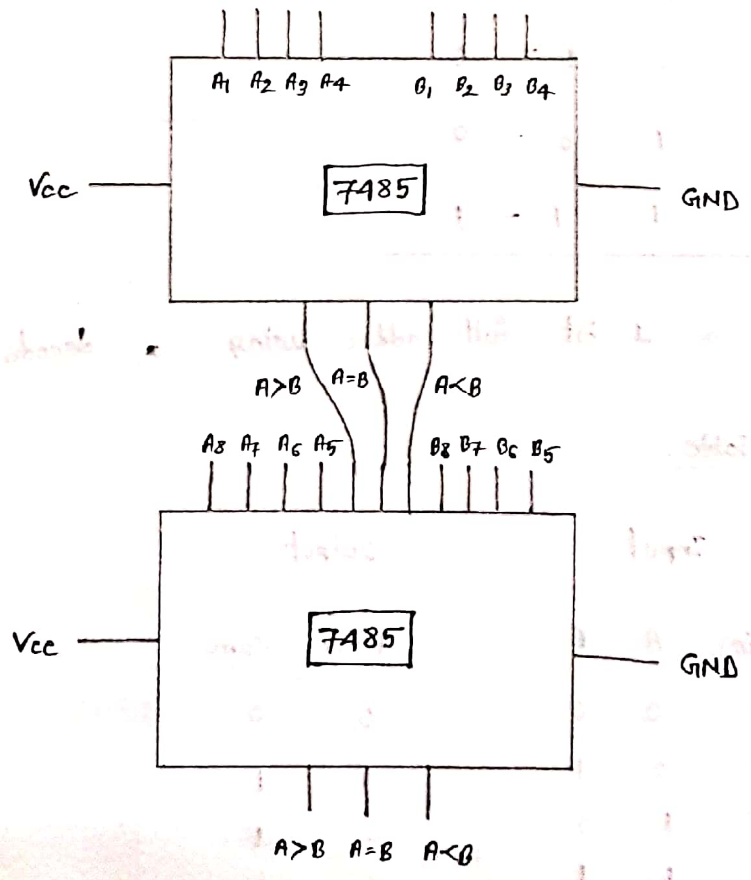
$C_{out} = \Sigma(3,5,6,7)$



⊛ Design a 8 bit Comparator ckt using 7485:

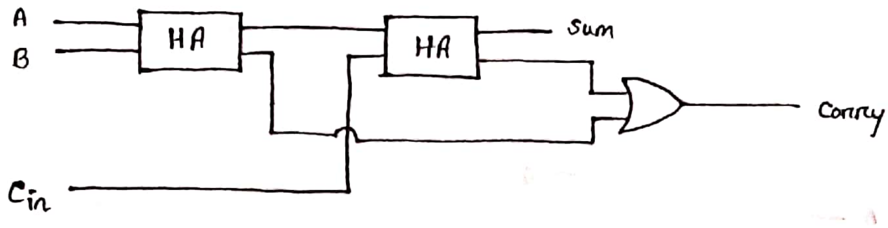
LSB = A_1

MSB = A_4



H.W
Substractor

* A full adder using two half adder and other basic gates.

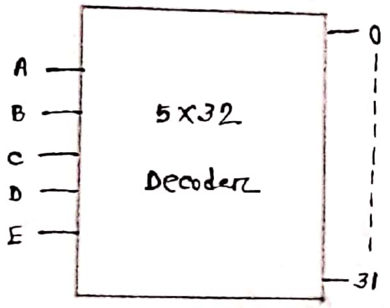


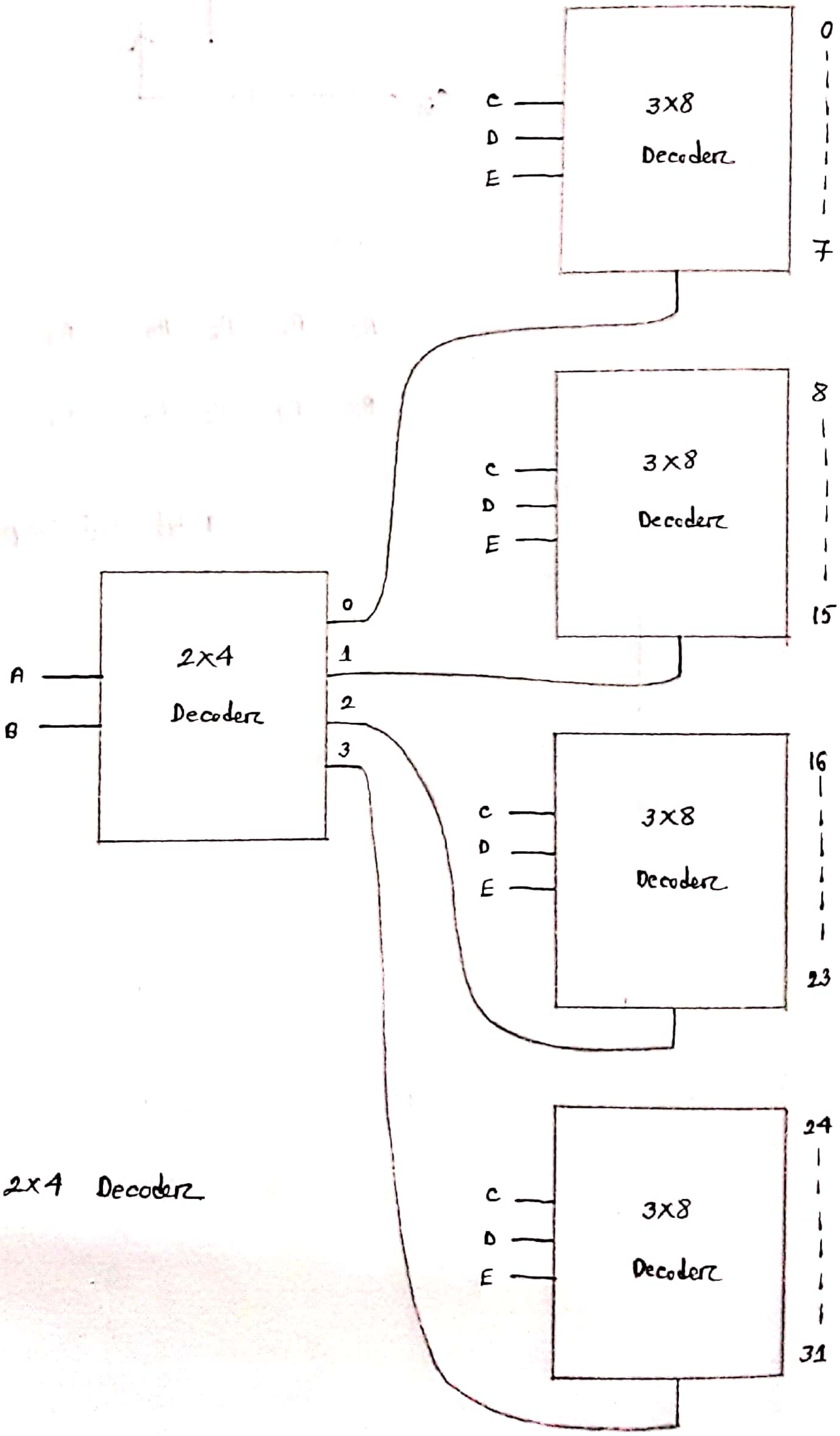
A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1
B_8	B_7	B_6	B_5	B_4	B_3	B_2	B_1

4 bit করে compare

12-03-20

⊛ construct a $\boxed{5 \times 32}$ decoder with four 3×8 decoder and a 2×4 decoder.



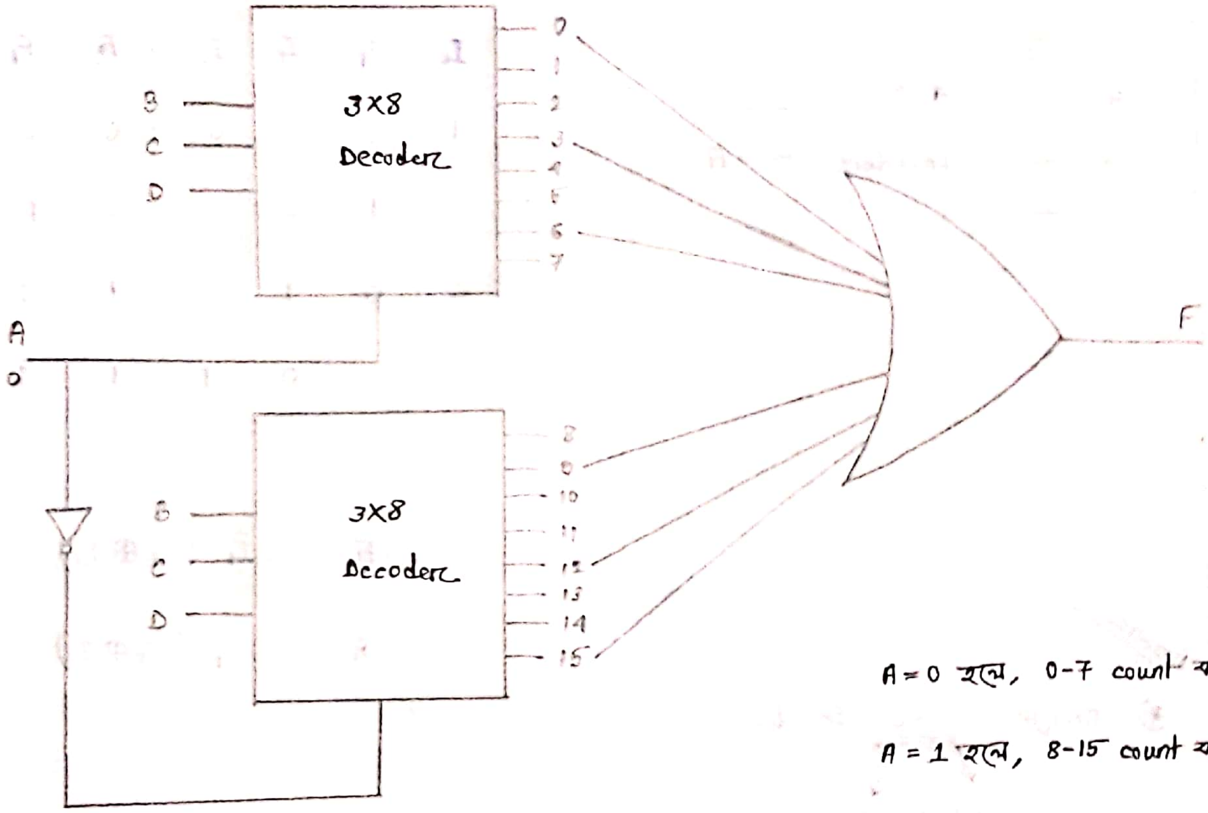


Practice H.W

4×16 decoder using 2×4 Decoder

⊛ Implement the following function using 3x8 decoder

$$F = \Sigma(0,3,6,9,12,15)$$

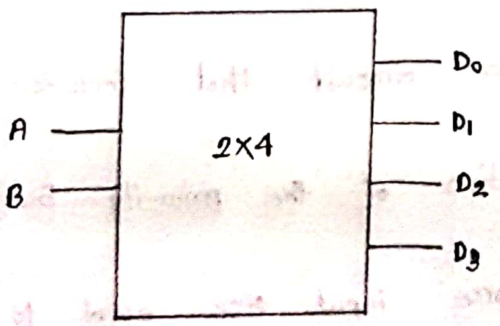


A = 0 হলে, 0-7 count করবে

A = 1 হলে, 8-15 count করবে

4 bit এর জন্য, 1st এ 0 দিয়ে 0-7 লিখা যায় & 1st এ 1 দিয়ে 8-15

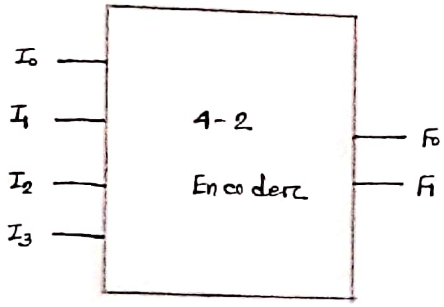
Decoder:



Truth Table:

A	B	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

Encoder :



Truth Table:

I_0	I_1	I_2	I_3	F_0	F_1
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1	0	1	0
0	0	0	1	1	1

$$F_0 = \bar{I_0}\bar{I_1}\,(I_1 \oplus I_3)$$

$$F_1 = \bar{I_0}\bar{I_1}\,(I_2 \oplus I_3)$$

Practice

⊛ Design 8 × 3 Encoder

Octal to Binary

⊛ Priority Encoder :

– A priority is an encoder circuit that includes the priority function. The operation of the priority Encoder is such that if two or more inputs are equal to 1 at the same time, the input having the highest priority will take precedence.

Scanned with CamScanner

*** Quiz + Final এ আসবে

$\boxed{3 > 2 > 1 > 0}$

I_3	I_2	I_1	I_0	F_0	F_1
0	0	0	1	0	0
0	0	1	X	0	1
0	1	X	X	1	0
1	X	X	X	1	1

$\boxed{2 > 3 > 1 > 0}$

I_2	I_3	I_1	I_0	F_0	F_1
0	0	0	1	0	0
0	0	1	X	0	1
0	1	X	X	1	0
1	X	X	X	1	1

$$F_0 = \bar{I}_2 I_3 + I_2$$