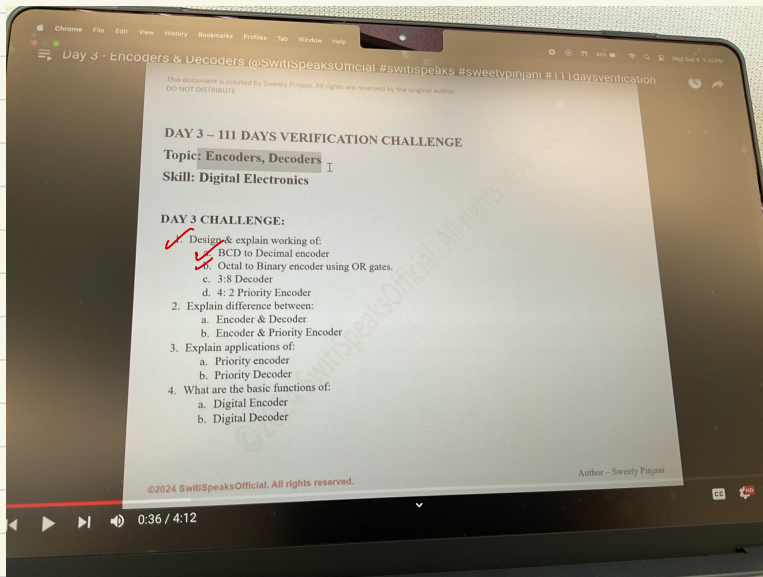


Day 3

3rd Sept / 4th Sept

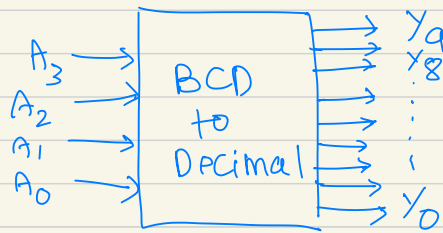


Encoder converts the binary inputs to unique binary codes.

1) (a) BCD to decimal encoder.

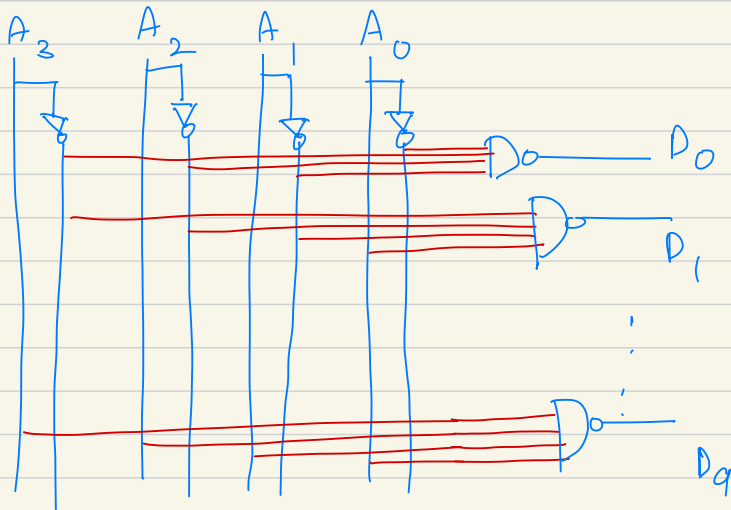
Decimal digits are from 0 to 9; whereas decimal numbers are all the numbers like 10, 11,

So in order to convert BCD to decimal encoder we need 4 bits. (\because 0-9 can be represented w/ 4 digits)



BCD				to				decimal							
A ₃	A ₂	A ₁	A ₀					D ₉	D ₈	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂ , D ₁ , D ₀
0	0	0	0					0	0	0	0	0	0	0	0
0	0	0	1					0	0	0	0	0	0	0	1
0	0	1	0					0	0	0	"	"	"	"	"
0	0	1	1					0	0	0	0	0	0	1	0
⋮								⋮							
1	0	0	1					1	0	0	"	"	"	"	"

equations for $A_3, A_2, A_1, \& A_0$



don't care from
10, 11, ..., 15

	00	01	11	10
00	D_{00}	1	3	2
01	4	5	7	6
11	X 8	X 9	X 11	X 10
10	12	13	X 15	X 14

	00	01	11	10
00	0	D_1 1	3	2
01	4	5	7	6
11	X 8	X 9	X 11	X 10
10	12	13	X 15	X 14

	00	01	11	10
00	0	1	3	D_2 2
01	4	5	7	6
11	X 8	X 9	X 11	X 10
10	12	13	X 15	X 14

Similarly
all would
be like this
& combining all
in 1 k-map

	00	01	11	10
00	D_{00} 0	D_1 1	D_3 3	D_2 2
01	D_4 4	D_5 5	D_7 7	D_6 6
11	X 8	X 9	X 11	X 10
10	D_8 12	D_9 13	X 15	X 14

On simplifying

$$D_0 = \bar{A}_3 \cdot \bar{A}_2 \cdot \bar{A}_1 \cdot \bar{A}_0$$

$$D_1 = \bar{A}_3 \cdot \bar{A}_2 \cdot \bar{A}_1 \cdot A_0$$

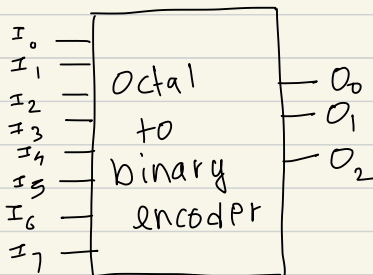
$$D_2 = \bar{A}_2 A_1 \bar{A}_0 \quad (\text{after grouping})$$

⋮

Then you can simplify the circuit above accordingly as per these expressions.

(D) octal to binary encoder.

(8 input \rightarrow 3 output lines)



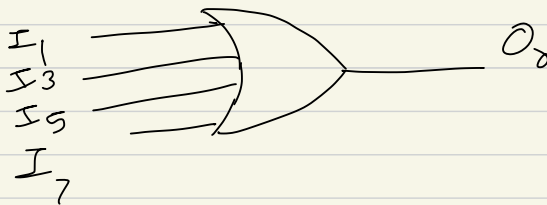
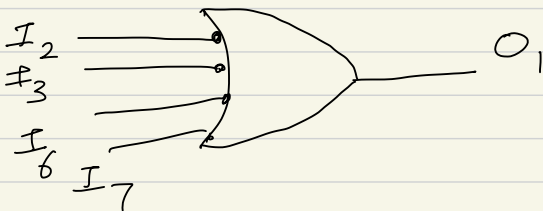
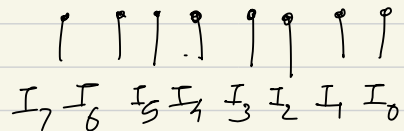
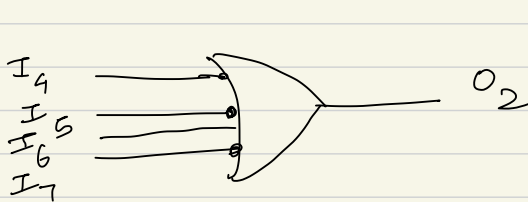
	O_2	O_1	O_0
I_0	0	0	0
I_1	0	0	1
I_2	0	1	0
I_3	0	1	1
I_4	1	0	0
I_5	1	0	1
I_6	1	1	0
I_7	1	1	1

On making the eq^{ns} & then the CKT

$$O_2 = I_4 + I_5 + I_7$$

$$O_1 = I_2 + I_3 + I_6 + I_7$$

$$O_0 = I_1 + I_3 + I_5 + I_6 + I_7$$

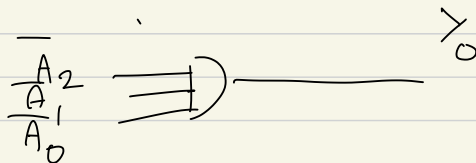
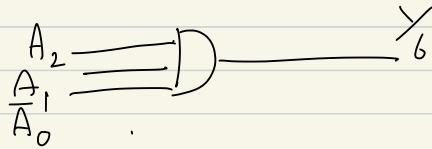
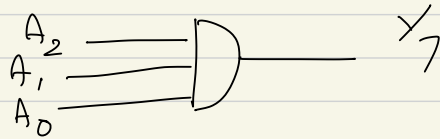


(C) 3 to 8 decoder :

decodes n inputs to 2^n outputs.

A_2	A_1	A_0								
I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7			
0	0	0	1	0	0	0	0			
0	0	1	0	1	0	0	0			
0	1	0	0	0	1	0	0			
0	1	1	0	0	0	1	0			
1	0	0	0	0	0	0	1			
.			
1	1	1	0	0	1	1	1			

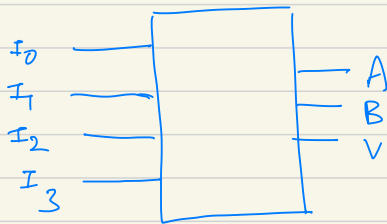
∴ The ckt is as follows.



(d) 4:2 Priority encoder

Limitation of binary encoder is that it can only have 1 high input at a time otherwise it will result in error. The other drawback is that for D_0 (0000) & D_0 input as high gives the same o/p (2 diff input conditions we get same o/p)

To remove this limitation a valid bit is placed at the output which checks if all inputs are 0 or any one of them is 1.



$I_3 > I_2 > I_1 > I_0$ (priority order)

I_0	I_1	I_2	I_3	A	B	V
0	0	0	0	X	X	0
1	0	0	0	0	0	1
X	1	0	0	0	1	1
X	X	1	0	1	0	1
X	X	X	1	1	1	1

as we can see for the first case
if all inputs are zero so it
does not matter & $V=0$ proceeds
A & B.

$$A = I_2 \cdot \overline{I_3} + I_3$$

$$B = I_3 + \overline{I_2} \cdot \overline{I_3} \cdot I_1$$

$$V = I_0 + I_1 + I_2 + I_3$$

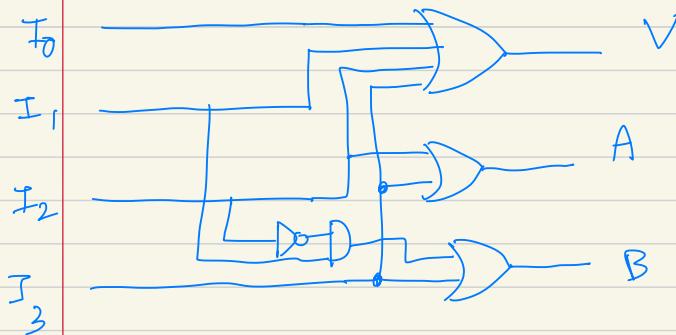
on simplifying using $X + \overline{X}Y = X + Y$

$$\Rightarrow A = I_3 + I_2$$

$$B = I_3 + \overline{I_3} (\overline{I_2} \cdot I_1)$$

$$= I_3 + \overline{I_2} \cdot I_1$$

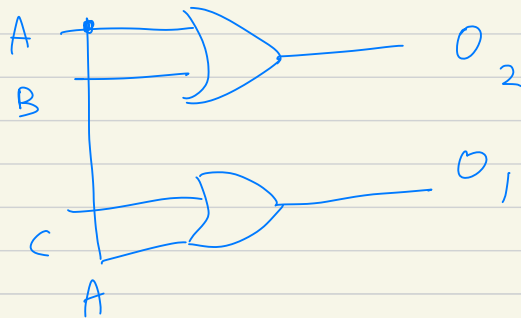
$$V = I_0 + I_1 + I_2 + I_3$$



2) (a) Encoder encodes 2^N input bits to N output bits.
 Whereas, decoder decodes N input bits to 2^N output bits.
 example ckt for :

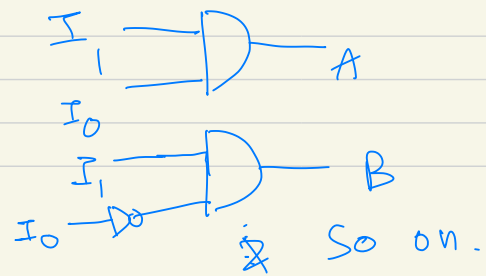
① 4 to 2 encoder

A	B	C	D	O_2	O_1
0	0	0	0	x	x
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
1	0	0	0	1	1



② 2 to 4 decoder

I_1	I_0	A	B	C	D
x	x	0	0	0	0
0	0	0	0	0	1
0	1	0	0	1	0
1	0	0	1	0	0
1	1	1	0	0	0



b) Encoder & priority encoder differ in the no. of b/p's; In case of priority encoder it has a valid bit that checks if any i/p is 1; if not then $v=0$. & also in case of encoder at a time only 1 bit could be high & others have to be low but this drawback is removed in case of P.E.

3)

(a) Appⁿ of priority encoder.

- ① keyboard encoder
- ② Data Compression
- ③ Handling interrupt request (based on the priority).
- ④ Digital Circuits & Control System
(in deciding between multiple control S/N)
- ⑤ In prioritizing Network routing.

(b) priority decoder :

- (1) Decoding of address in memory system.
- (2) Traffic light control ckt.

Not clear on what
Priority decoder means.

A) (a) Digital Encoder : or Binary encoder

The basic functions of the encoder include encoding : we can use less bits & efficiently use the resources.

- Simplification of ckt.
- Reduction of i/p lines.

(b) Digital decoder :

- Converts binary to one-hot conversion.
- Address decoding.