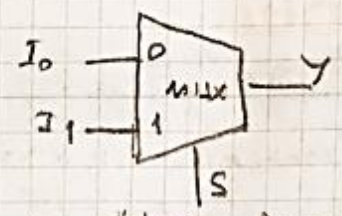
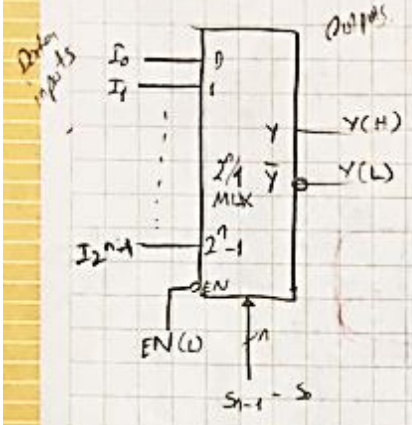
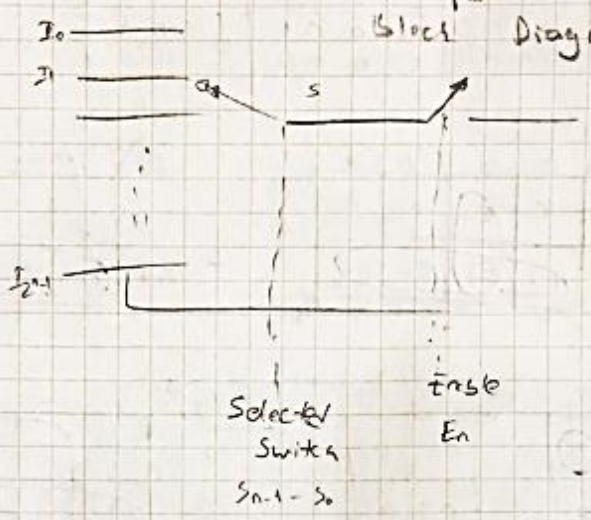
OSOW

MULTIPLEXER (MUX)



Block Diagram





Multiplexer Design

$$Y_{SOP} = \sum_{k=0}^{2^n-1} m_k I_k$$

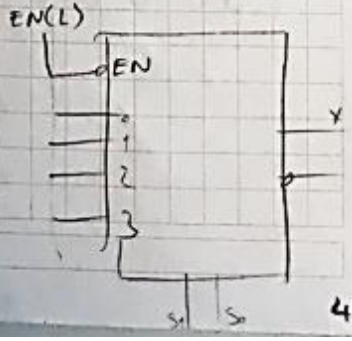
$$Y_{SOP} = (\bar{S}_{n-1} \cdots \bar{S}_1 \bar{S}_0) I_0 + (\bar{S}_{n-1} \cdots \bar{S}_1 S_0) I_1 + \cdots + (S_{n-1} \cdots S_1 S_0) I_{2^n-1}$$

EN	S_{n-1} ···· S_0	Y
0	x x	0
1	0 0 ··· 0	I_0
1	0 0 ··· 1	I_1
	⋮	
1	1 1 ··· 1	I_{2^n-1}

4/1 MUX

$\overline{EN}$	S_1	S_0	Y
0	X	X	0
1	0	0	I_0
1	0	1	I_1
1	1	0	I_2
1	1	1	I_3

S_1 \ S_0	0	1
0	$I_0 EN$	$I_1 EN$
1	$I_2 EN$	$I_3 EN$



$Y_{SOP} = m_0 I_0 EN + m_1 I_1 EN + m_2 I_2 EN + m_3 I_3 EN$

$= \bar{S_1}\bar{S_0} I_0 EN + \bar{S_1} S_0 I_1 EN + S_1 \bar{S_0} I_2 EN + S_1 S_0 I_3 EN$

$Y_{SOP} = \overline{\overline{Y_{SOP}}} = \overline{\overline{m_0 I_0 EN} \cdot \overline{m_1 I_1 EN} \cdot \overline{m_2 I_2 EN} \cdot \overline{m_3 I_3 EN}}$ } NAND

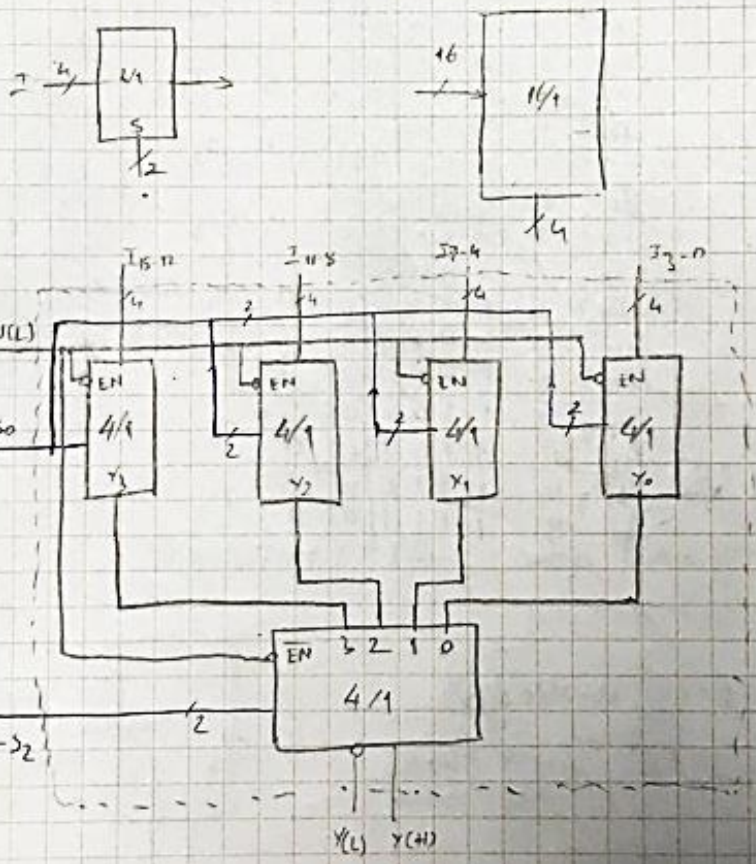
The Expansion Format for MUX

Given

Single

4 → 1 MUX Solution

Needed → 16 - 1 MUX



Logic Design by using MUX

MUX	Logic Func
S	n
	N (variables)

a) $n = N$

b) $n < N$

Örn: $F = \sum m(0,1,3,5,8,13,14)$ bu fonksiyonu

a) 16/1 MUX kullanarak

b) 8/1 MUX "

c) 4/1 MUX kullanarak

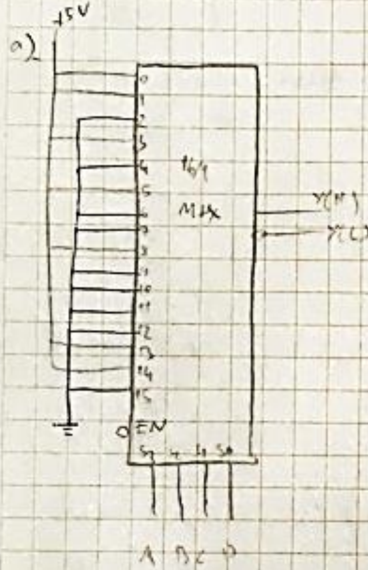
gerçekleştiriniz

a) $n=4$ dir $N=4 \rightarrow n=N$

b) $n=3$ dir $N=4$ } $n<N$

c) $n=2$ $N=4$

a)

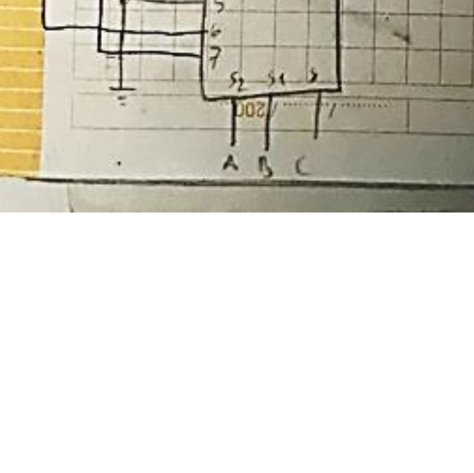


		Dec	A (S_3)	B (S_2)	C (S_1)	D (S_0)	F		
I_0	0	0	0	0	0	0	1	1	I_0
I_1		1	0	0	0	1	1		
I_2	1	2	0	0	1	0	0	D	I_1
I_3		3	0	0	1	1	1		
I_4	2	4	0	1	0	0	0	D	I_2
I_5		5	0	1	0	1	1		
I_6	3	6	0	1	1	0	0	0	I_3
I_7		7	0	1	1	1	0		
I_8	4	8	0	0	0	0	1	$\bar{D}$	I_4
I_9		9	1	0	0	1	0		
I_{10}	5	10	1	0	1	0	0	0	I_5
I_{11}		11	1	0	1	1	0		
I_{12}	6	12	1	1	0	0	0	D	I_6
I_{13}		13	1	1	0	1	1		
I_{14}	7	14	1	1	1	0	1	$\bar{D}$	I_7
I_{15}		15	1	1	1	1	0		

b) $n=3$, $N=4$

$N-n = 4-3 = 1 \rightarrow$ (free variable: D)

(tablo'da yapıldı tablo)



c) $n=2, N=4$

S_1 S_0 ABCD

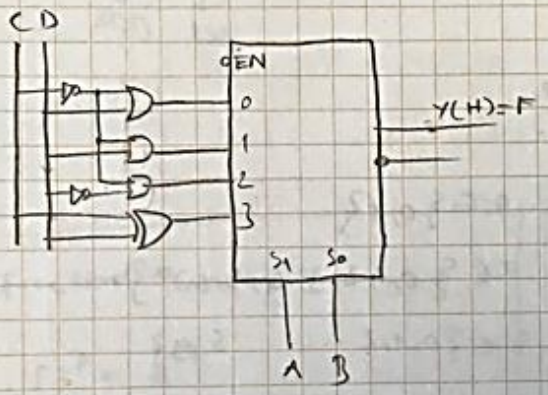
$N-n-4-2=2$

$2^2=4$

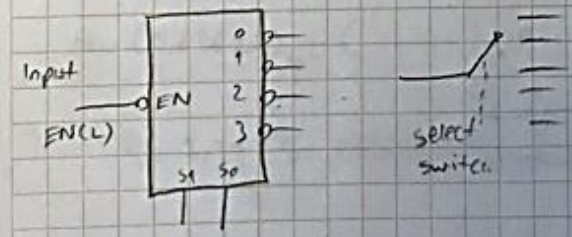
ABCD free variable

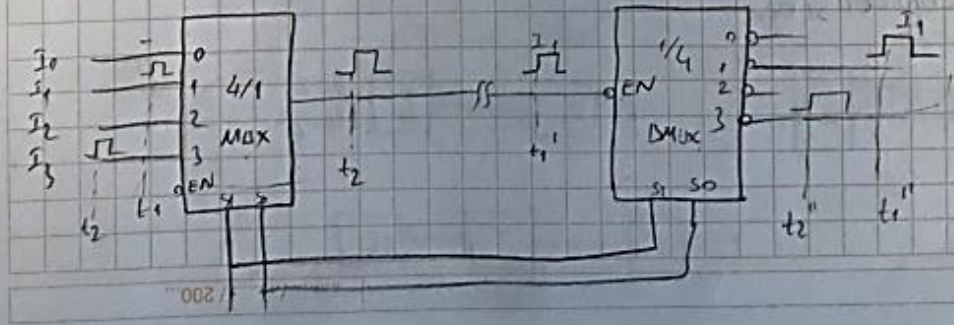
S_1 S_0 C,D

	dec	A	B	C	D	F	
0	0	0	0	0	0	1	
	1	0	0	0	1	1	$\bar{C}+D$ I_0
	2	0	0	1	0	0	
	3	0	0	1	1	1	
1	4	0	1	0	0	0	
	5	0	1	0	1	1	$\bar{C}\cdot D$ I_1
	6	0	1	1	0	0	
	7	0	1	1	1	0	
2	8	1	0	0	0	1	
	9	1	0	0	1	0	$C\cdot\bar{D}$ I_2
	10	1	0	1	0	0	
	11	1	0	1	1	0	
3	12	1	1	0	0	0	
	13	1	1	0	1	1	$C\oplus D$ I_3
	14	1	1	1	0	1	
	15	1	1	1	1	0	

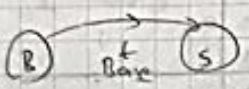


DEMULTIPLEXER





NUMBERS SYSTEMS



Element set: $b \in B$ — symbol set: $a_i \in S$, $a_i \in \{0, 1, 2, \ldots t-1\}$

* Fixed point Number system

floating " " "

1) $b = s\,(a_n t^n + \cdots a_1 t + a_0 + a_{-1} t^{-1} + \cdots a_{-l} t^{-l})$

2) $b = s \sum_{i=-l}^{n} a_i t^i$

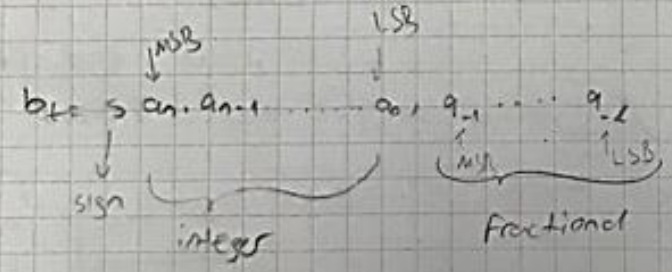
3) $b = s\, a_n a_{n-1} \cdots a_1 a_0, a_{-1} \cdots a_{-l}$

$t = 2$ Binary Number System $a_i \in \{0, 1\}$

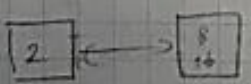
$t = 8$ Octal " " $a_i \in \{0, 1, 2, 3, 4, 5, 6, 7\}$

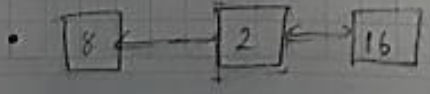
$t = 10$ Decimal $a_i \in \{0, 1, 2 \ldots 8, 9\}$

$t = 16$ Hexade $a_i \in \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F\}$



BASE CONVERSION





t → 10

b = (11010, 10110)$_2$ →

$1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^1 + 1 \cdot 2^{-1} + 1 \cdot 2^{-3} + 1 \cdot 2^{-4}$

b = $(26,6875)_{10}$

10 → t (2,8,16)

örn: $(353)_{10} = (\ldots)_2$

b = N , M

LSB MSB

MSB LSB

+ 2	353	q:	
	176	1	a_0 LSB
	88	0	
	44	0	
	22	0	
	11	0	
	5	1	
	2	1	
	1	0	
	0	1	a_8 MSB

$(353)_{10} = (101100001)_2$

A | 1 / Q | B

A = B + Q

Fractional Conversion

$r^{-p} = t^{-q}$

$q = p \cdot \frac{\ln r}{\ln t} \Rightarrow q = p \frac{\ln 10}{\ln 2} \cong 3,32p$

$M = (0,65625)_{10} = (\ldots)_2$

$q = 3,32 \cdot 5 = 16,6 \cong 17$

17 kez gidiş

	a_{-i}	F	+
MSB	–	,65625	2
	1	0,31250	
	0	0,6250	
	1	0,250	
	0	0,50	
LSB	1	0,0000	

$(0,10101)_2$

OSOW

- 2 ⟷ 8 / 16 $\quad 2^3=8$, $2^4=16$

$(100111010)_2 = (472)_8$

4 3 2

$(\quad)_{16}$

$(100111010)_2 = (13A)_{16}$

1 3 A

Ex.

$(BA92)_{16} = (1011\ 1010\ 1001\ 0010)_2$

B A 9 2