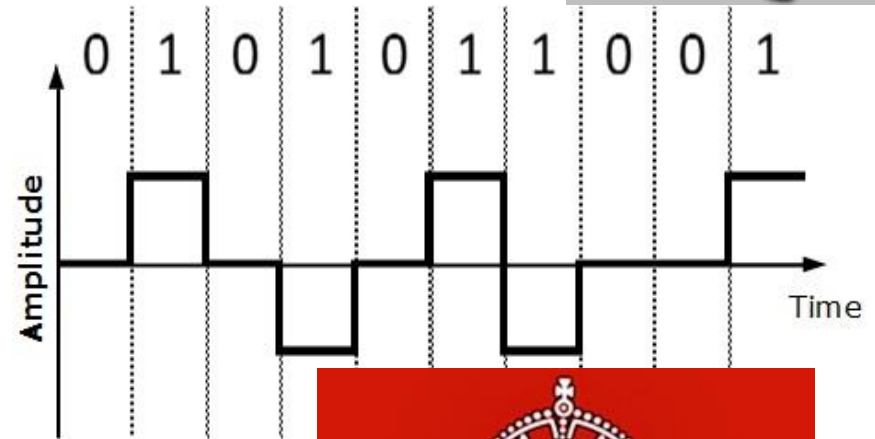
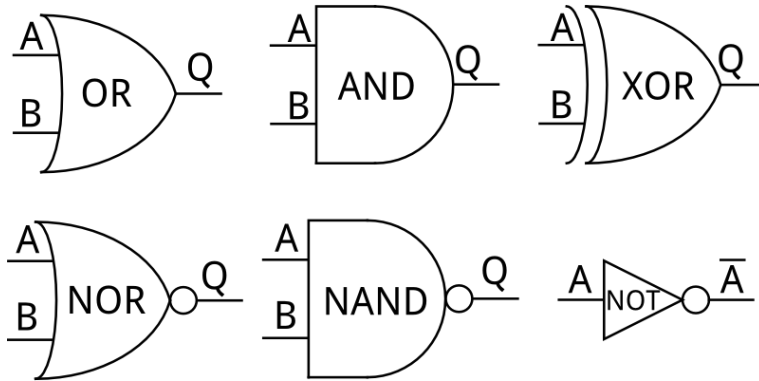


Proiectare Logica

Digital Logic Design

Curs 05



Problema logica

In a suburban home live Abner, his wife Beryl and their three children, Cleo, Dale and Ellsworth. The time is 8 P.M. on a winter evening.

1. If Abner is watching television, so is his wife.
2. Either Dale or Ellsworth, or both of them, are watching television.
3. Either Beryl or Cleo, but not both, is watching television.
4. Dale and Cleo are either both watching or both not watching television.
5. If Ellsworth is watching television, then Abner and Dale are also watching.

Who is watching television and who is not?

Problema logica R1

In a suburban home live Abner, his wife Beryl and their three children, Cleo, Dale and Ellsworth. The time is 8 P.M. on a winter evening.

1. If Abner is watching television, so is his wife. ($\neg A + B == A \rightarrow B$)
2. Either Dale or Ellsworth, or both of them, are watching television.
3. Either Beryl or Cleo, but not both, is watching television.
4. Dale and Cleo are either both watching or both not watching television.
5. If Ellsworth is watching television, then Abner and Dale are also watching.

Who is watching television and who is not?

Problema logica R2

In a suburban home live Abner, his wife Beryl and their three children, Cleo, Dale and Ellsworth. The time is 8 P.M. on a winter evening.

1. If Abner is watching television, so is his wife. ($\neg A + B == A \rightarrow B$)
 2. Either Dale or Ellsworth, or both of them, are watching television. ($D + E$)
 3. Either Beryl or Cleo, but not both, is watching television.
 4. Dale and Cleo are either both watching or both not watching television.
 5. If Ellsworth is watching television, then Abner and Dale are also watching.
- Who is watching television and who is not?

Problema logica R3

In a suburban home live Abner, his wife Beryl and their three children, Cleo, Dale and Ellsworth. The time is 8 P.M. on a winter evening.

1. If Abner is watching television, so is his wife. **$(!A+B == A \rightarrow B)$**
 2. Either Dale or Ellsworth, or both of them, are watching television. **$(D+E)$**
 3. Either Beryl or Cleo, but not both, is watching television.
 $(B.!C+!B.C) == B \text{ XOR } C$
 4. Dale and Cleo are either both watching or both not watching television.
 5. If Ellsworth is watching television, then Abner and Dale are also watching.
- Who is watching television and who is not?

Problema logica R4

In a suburban home live Abner, his wife Beryl and their three children, Cleo, Dale and Ellsworth. The time is 8 P.M. on a winter evening.

1. If **A**bner is watching television, so is his wife. $(!A+B == A \rightarrow B)$
 2. Either **D**ale or **E**llsworth, or both of them, are watching television. $(D+E)$
 3. Either **B**eryl or **C**leo, but not both, is watching television.
 $(B.!C+!B.C) == B \text{ XOR } C$
 4. **D**ale and **C**leo are either both watching or both not watching television. $!(D.!C+!D.C) == D \text{ XNOR } C$
 5. If **E**llsworth is watching television, then **A**bner and **D**ale are also watching.
- Who is watching television and who is not?

Problema logica R5

In a suburban home live **Abner**, his wife **Beryl** and their three children, **Cleo**, **Dale** and **Ellsworth**. The time is 8 P.M. on a winter evening.

1. If **Abner** is watching television, so is his wife. $(\neg A + B == A \rightarrow B)$
 2. Either **Dale** or **Ellsworth**, or both of them, are watching television. $(D + E)$
 3. Either **Beryl** or **Cleo**, but not both, is watching television.
 $(B \cdot \neg C + \neg B \cdot C) == B \text{ XOR } C$
 4. **Dale** and **Cleo** are either both watching or both not watching television. $\neg(D \cdot \neg C + \neg D \cdot C) == D \text{ XNOR } C$
 5. If **Ellsworth** is watching television, then **Abner** and **Dale** are also watching. $(\neg E + A \cdot D)$
- Who is watching television and who is not?

Problema logica R6

In a suburban home live **Abner**, his wife **Beryl** and their three children, **Cleo**, **Dale** and **Ellsworth**. The time is 8 P.M. on a winter evening.

1. If **Abner** is watching television, so is his wife. $(\neg A + B == A \rightarrow B)$
2. Either **Dale** or **Ellsworth**, or both of them, are watching television. $(D + E)$
3. Either **Beryl** or **Cleo**, but not both, is watching television. $(B \cdot \neg C + \neg B \cdot C) == B \text{ XOR } C$
4. **Dale** and **Cleo** are either both watching or both not watching television. $\neg(D \cdot \neg C + \neg D \cdot C) == D \text{ XNOR } C$
5. If **Ellsworth** is watching television, then **Abner** and **Dale** are also watching. $(\neg E + A \cdot D)$

Who is watching television and who is not?

R. Functia de implementat este

$(\neg A + B) \cdot (D + E) \cdot (B \cdot \neg C + \neg B \cdot C) \cdot \neg(D \cdot \neg C + \neg D \cdot C) \cdot (\neg E + A \cdot D)$ Verifica [aici](#).

de copiat acolo functia:

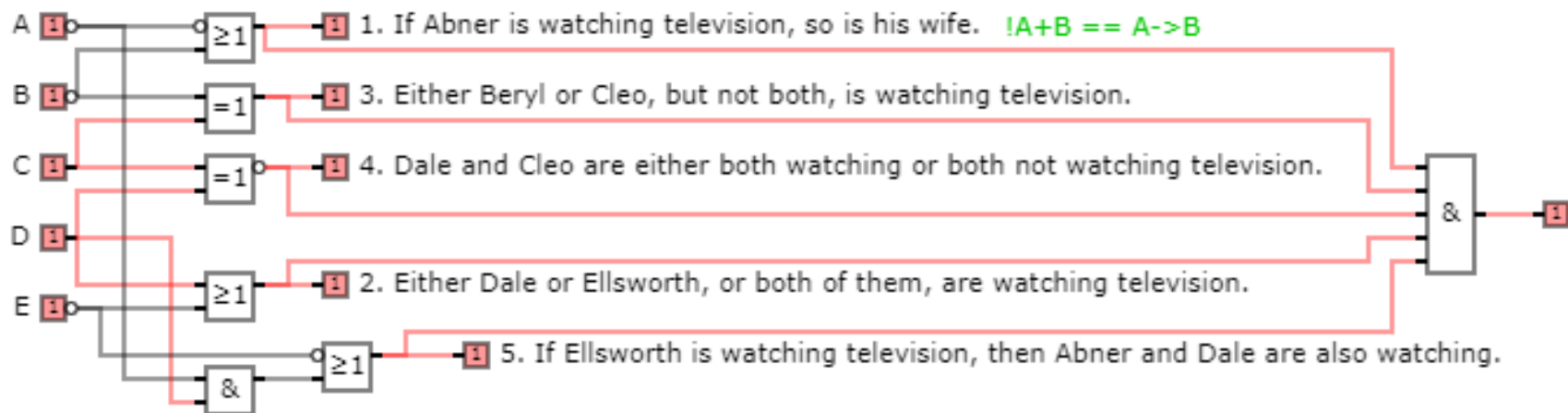
$(\neg A + B) \cdot (B \cdot \neg C + \neg B \cdot C) \cdot (D + E) \cdot \neg(D \cdot \neg C + \neg D \cdot C) \cdot (\neg E + A \cdot D)$

Problema logica R7

$A|B|C|D|E|| (A+B).(B.C+!B.C).(D+E).!(D.C+!D.C).(!E+A.D)$

=====

0|0|0|0|0|| 0
 0|0|0|0|1|| 0
 0|0|0|1|0|| 0
 0|0|0|1|1|| 0
 0|0|1|0|0|| 0
 0|0|1|0|1|| 1
 0|0|1|1|0|| 0
 0|0|1|1|1|| 0
 0|1|0|0|0|| 0
 0|1|0|0|1|| 0
 0|1|0|1|0|| 0
 0|1|0|1|1|| 0
 0|1|1|0|0|| 0
 0|1|1|0|1|| 0
 0|1|1|1|0|| 0
 0|1|1|1|1|| 0
 1|0|0|0|0|| 0
 1|0|0|0|1|| 0
 1|0|0|1|0|| 0
 1|0|0|1|1|| 0
 1|0|1|0|0|| 0
 1|0|1|0|1|| 0
 1|0|1|1|0|| 0
 1|0|1|1|1|| 0
 1|1|0|0|0|| 0
 1|1|0|0|1|| 1
 1|1|0|1|0|| 0
 1|1|0|1|1|| 0
 1|1|1|0|0|| 0
 1|1|1|0|1|| 0
 1|1|1|1|0|| 0
 1|1|1|1|1|| 0



Problema logica R7

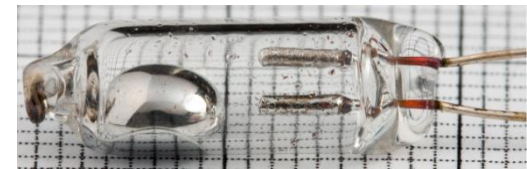
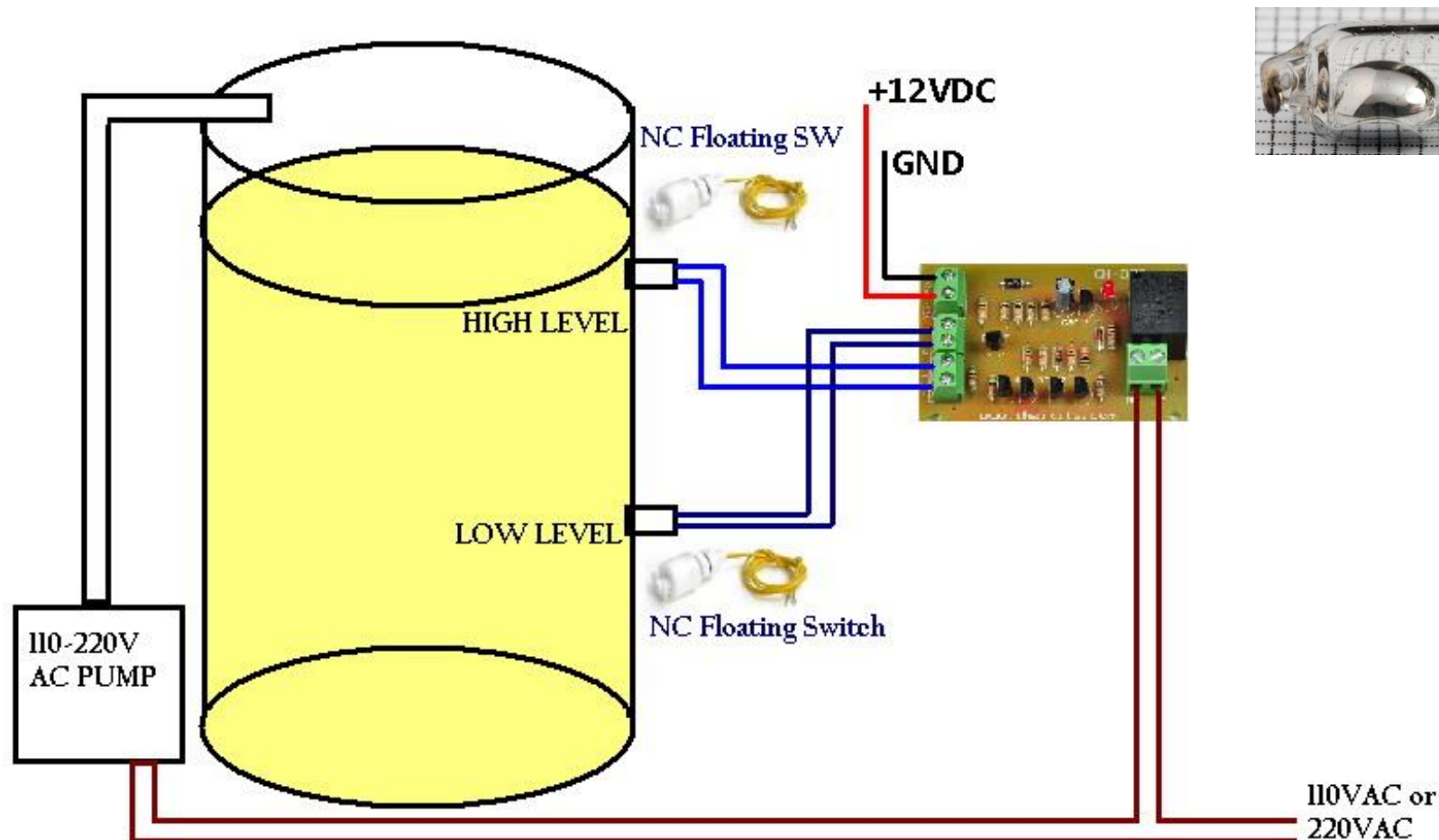
Martin Gardner (1914 – 2010), scriitor american în domeniul matematicii și științei, specializat în *matematică recreativă*, dar interesat și de magie, literatură (în special operele lui Lewis Carroll), filosofie, scepticism științific și religie. A publicat seria de articole Mathematical Games în Scientific American între 1956 și 1981, și a scris peste 70 de cărți.



[Martin Gardner, New Mathematical Diversions](#), p 20

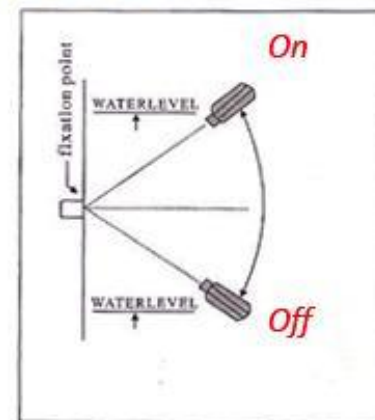
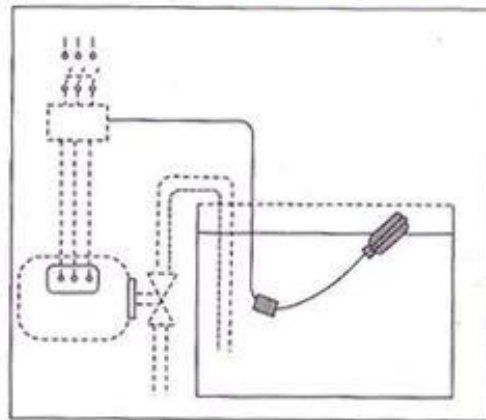
Controlul nivelului apei intr-un rezervor

- Avem nevoie de senzori (intrerupatoare) de nivel



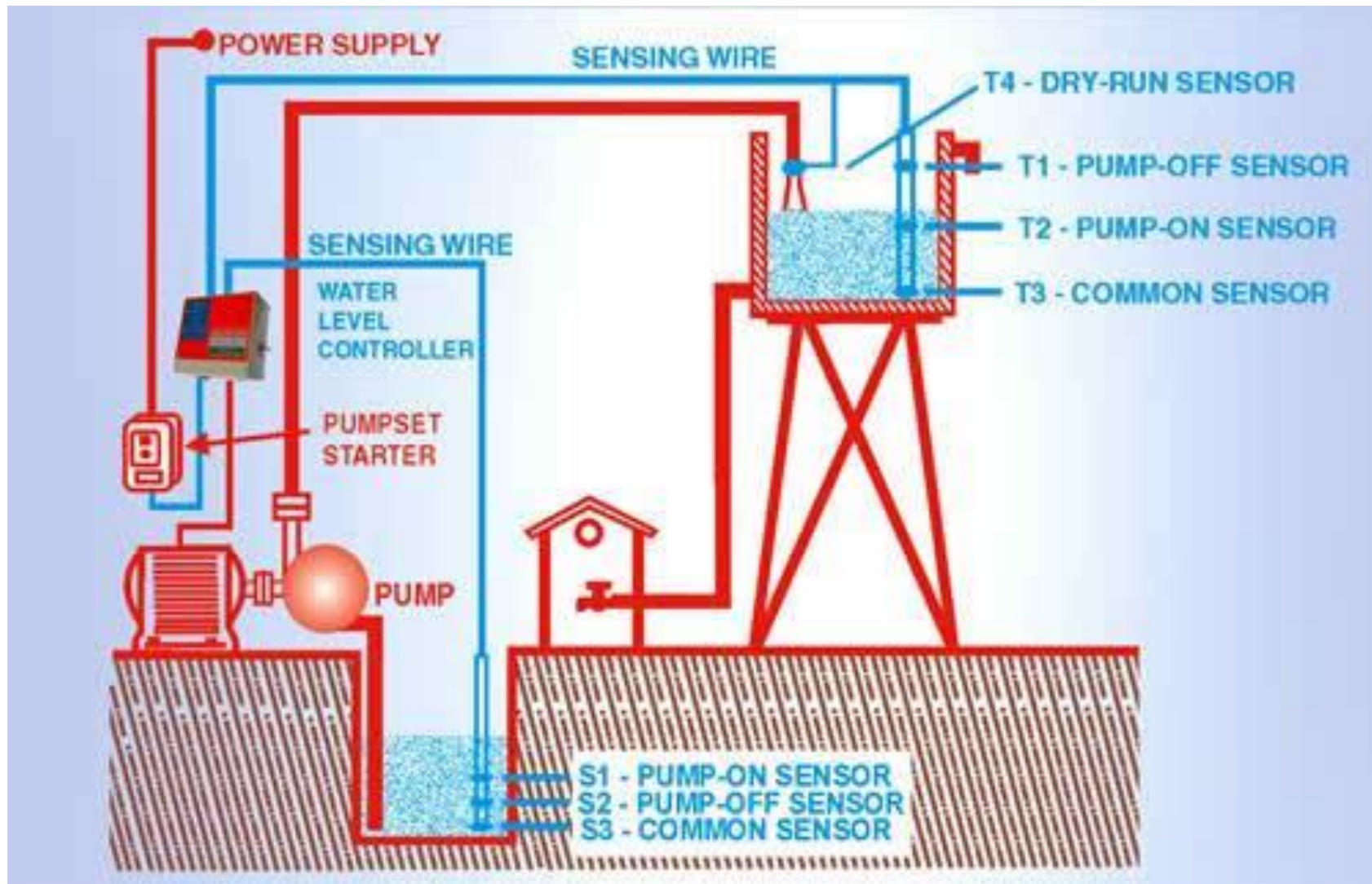
tilt switches

- Intrerupatoarele de nivel sunt de regula folosite ca senzori care detecteaza inclinarea



Alt Sistem de control al nivelului

Aici apa se extrage dintr-un put

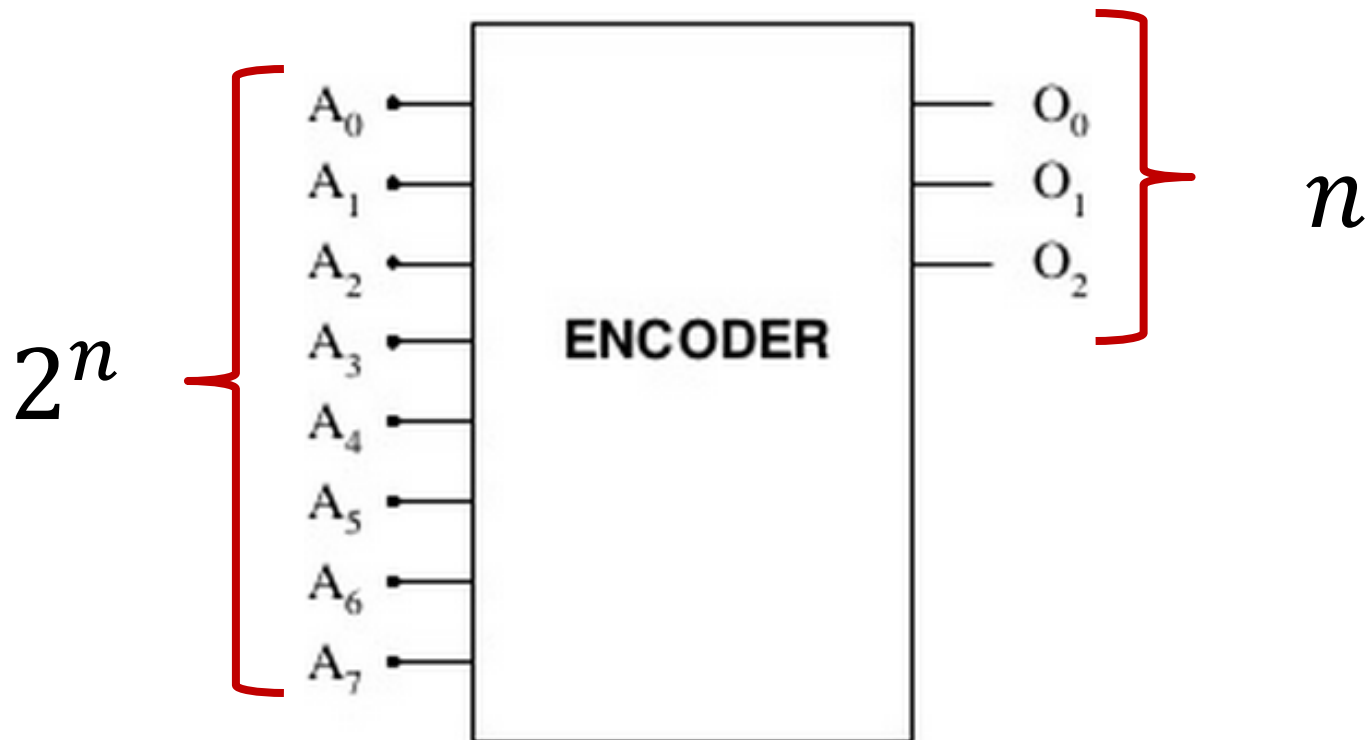


Codificatorul

- Numai o singura intrare este activa (HIGH/LOW)

Output = adresa intrarii active

- Activeaza la iesire codului numeric al intrarii active.
Exemplu: Intrarea 2 este activa -> iesirea in starea 010_2 (2_{10}).



Codificator: exemplu

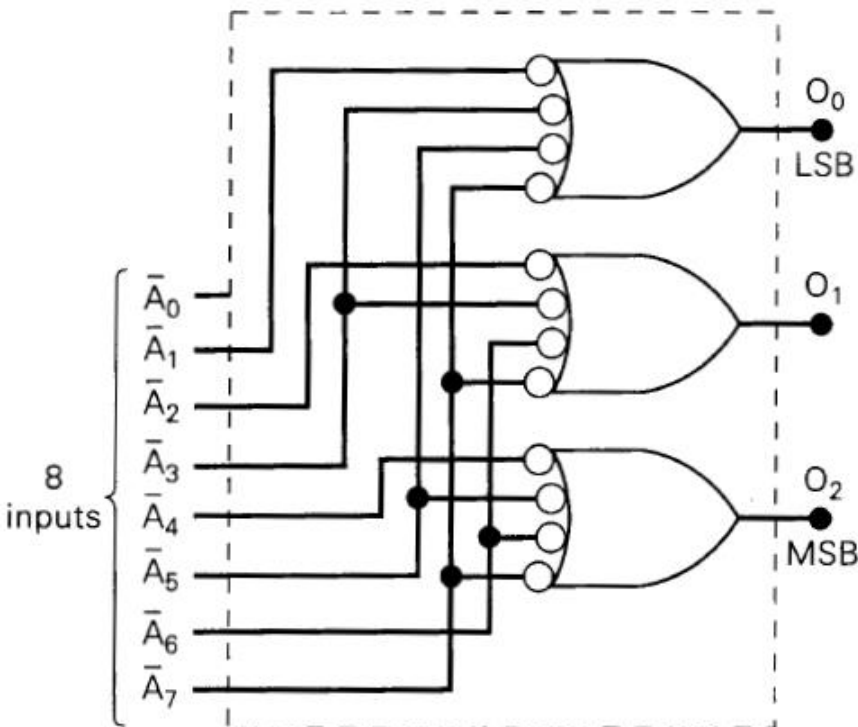
- Codificatorul 8-3. **Numai o intrare este in starea LOW.** Exemplu

Cand este 1 O_0 ?

Cand A_1 (sau A_3 , sau A_5 , sau A_7) este 0!

Cand este 1 O_1 ?

Cand este 1 O_2 ?



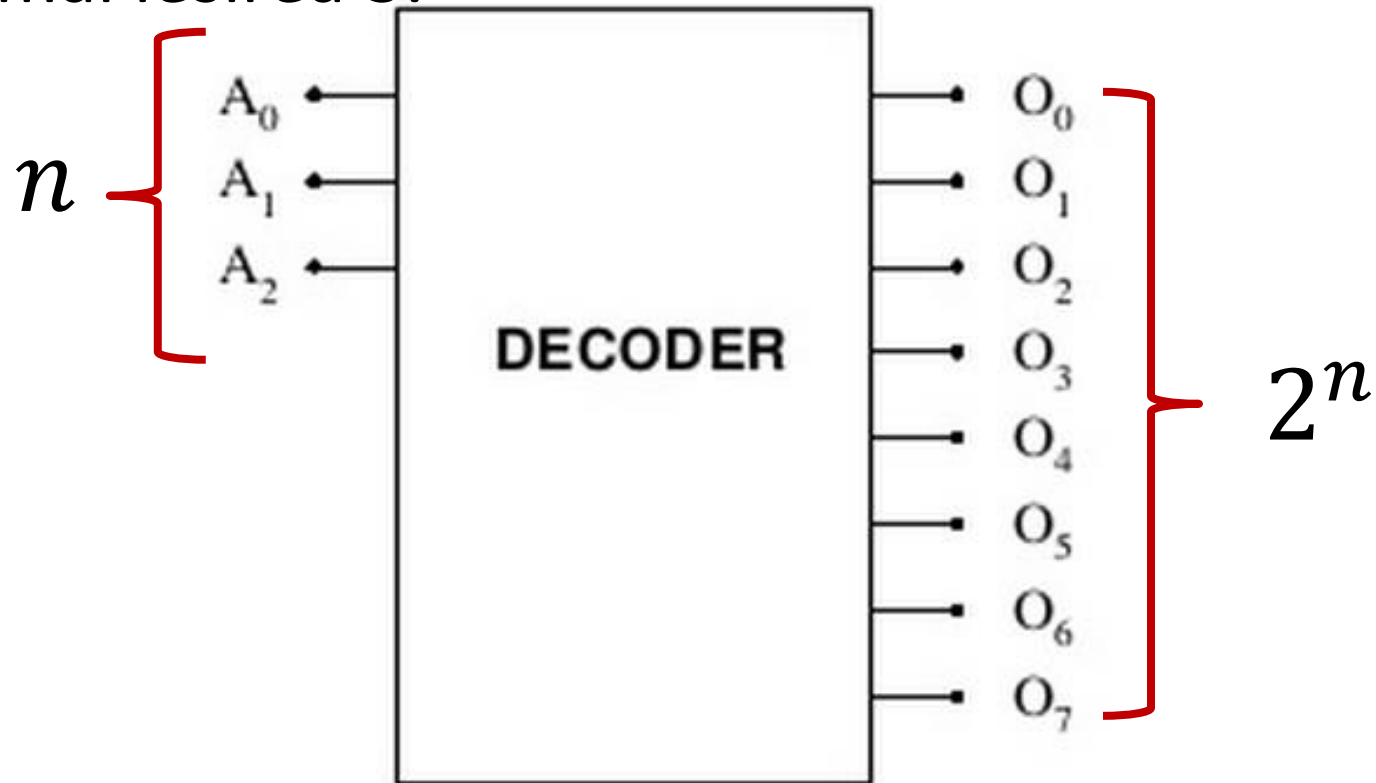
Inputs								Outputs		
$\bar{A}_0$	$\bar{A}_1$	$\bar{A}_2$	$\bar{A}_3$	$\bar{A}_4$	$\bar{A}_5$	$\bar{A}_6$	$\bar{A}_7$	O_2	O_1	O_0
X	1	1	1	1	1	1	1	0	0	0
X	0	1	1	1	1	1	1	0	0	1
X	1	0	1	1	1	1	1	0	1	0
X	1	1	0	1	1	1	1	0	1	1
X	1	1	1	0	1	1	1	1	0	0
X	1	1	1	1	0	1	1	1	0	1
X	1	1	1	1	1	0	1	1	1	0
X	1	1	1	1	1	1	0	1	1	1

Decodificatorul

Activeaza doar acea iesire care corespunde codului numeric de intrare.

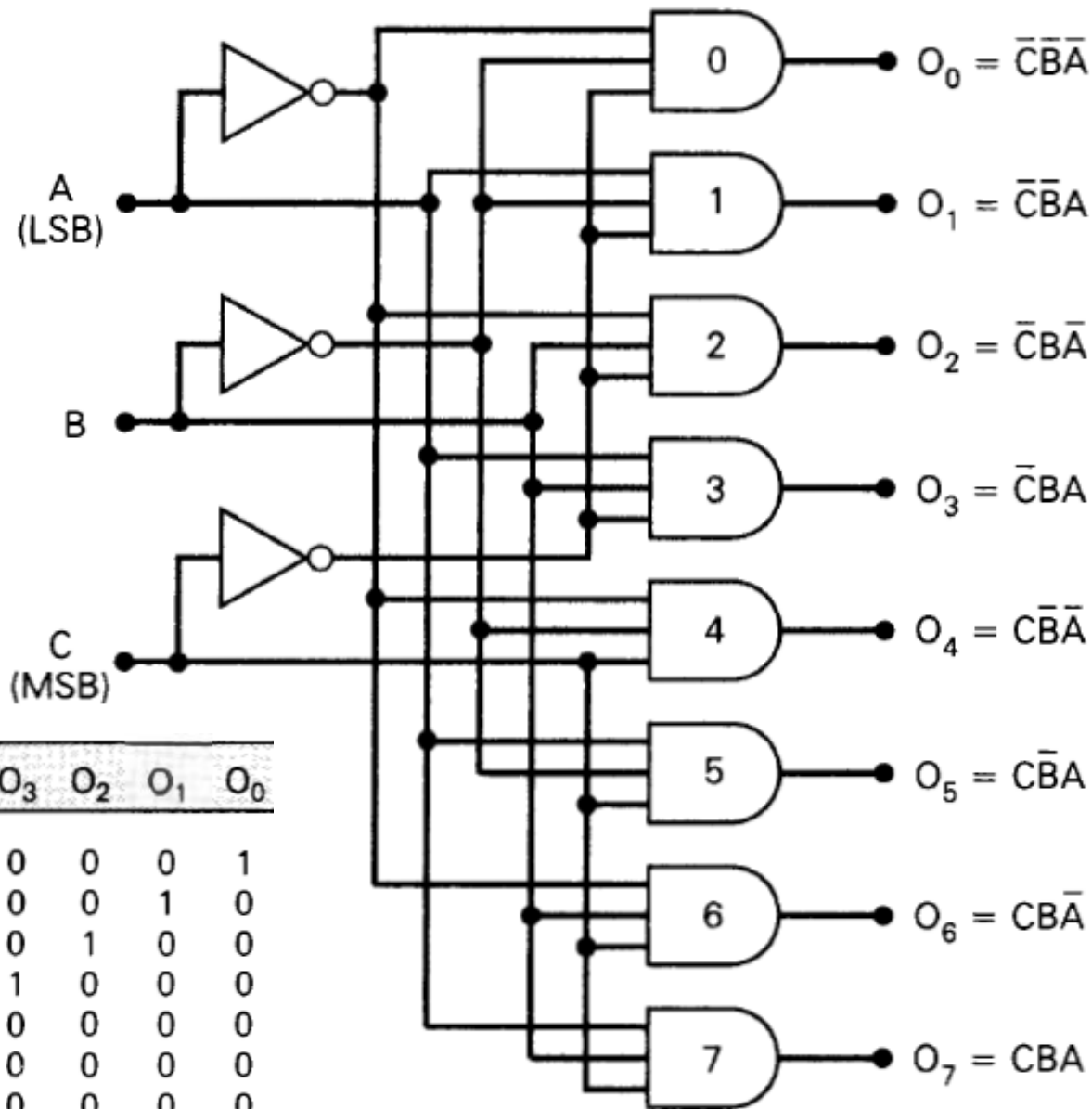
Input = Adresa iesirii selectate

Exemplu: Intrarea = 011_2 (3_{10}) activeaza (aduce in starea HIGH) numai iesirea 3.



Decodificatorul 3-8

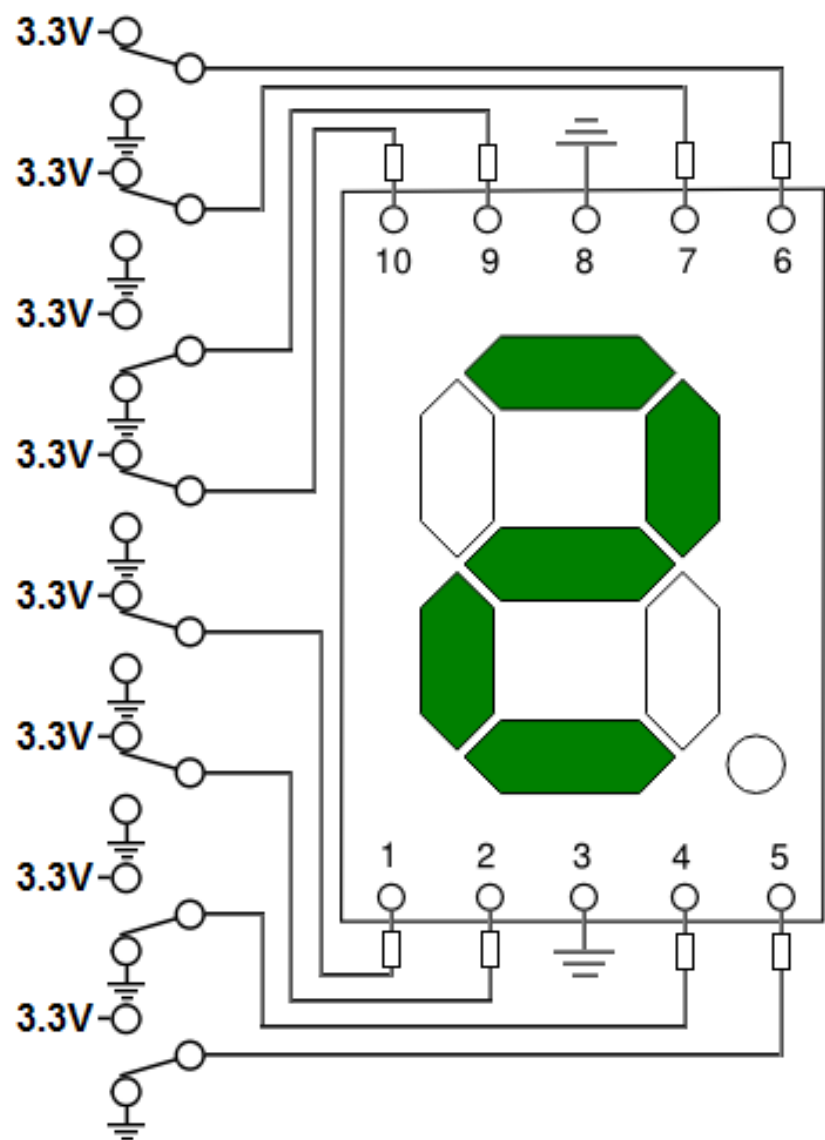
Are **3** intrari si
 $2^3=$ **8** iesiri.



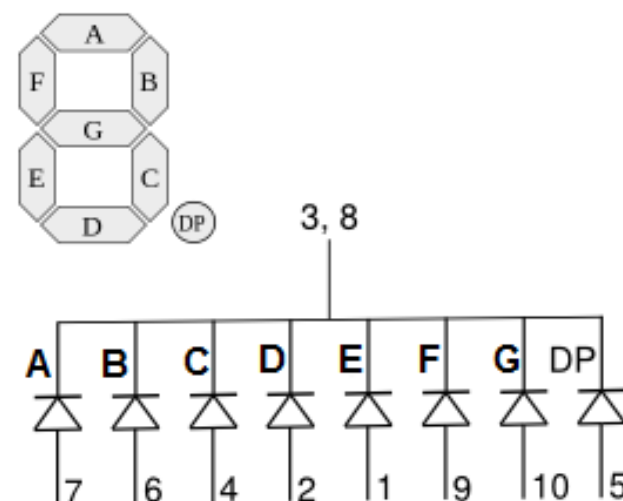
C	B	A	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	0	1	0	0	0
1	0	0	0	0	0	1	0	0	0	0
1	0	1	0	0	1	0	0	0	0	0
1	1	0	0	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

Afisorul cu 7 segmente

Pagina de antrenament [aici](#).

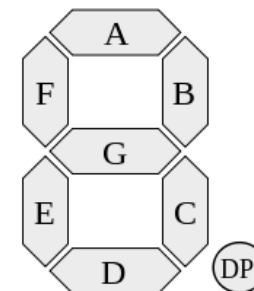


Afisor 7 segmente cu Catodul comun



Afisorul cu 7 segmente

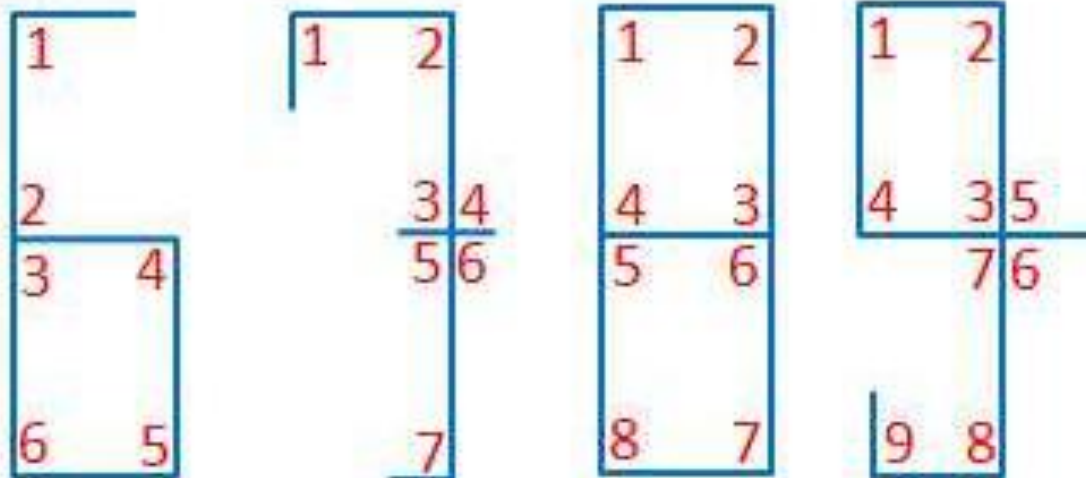
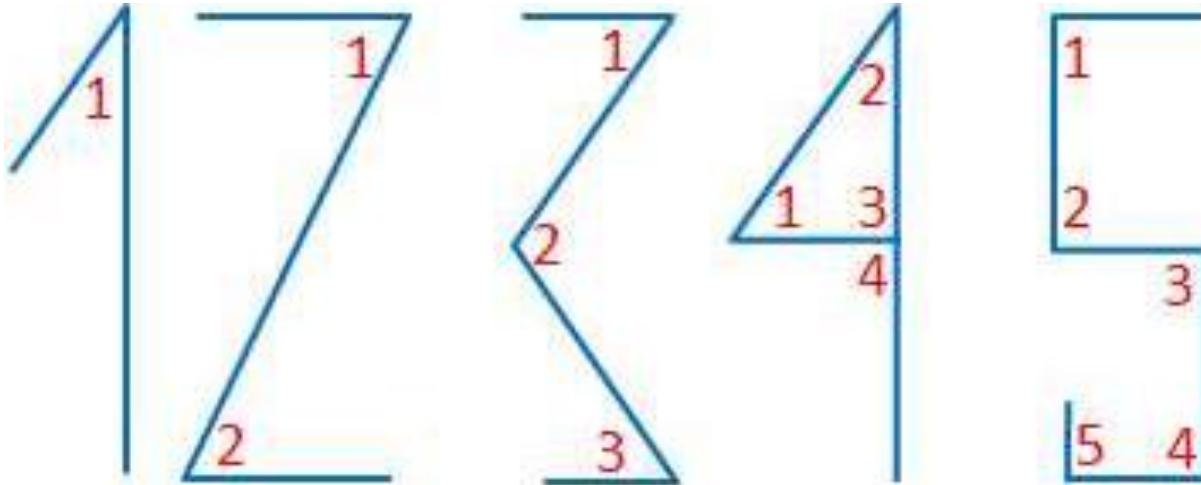
Notarea segmentelor



Segments (✓ = ON)							Display	Segments (✓ = ON)							Display
a	b	c	d	e	f	g		a	b	c	d	e	f	g	
✓	✓	✓	✓	✓	✓		0	✓	✓	✓	✓	✓	✓	✓	8
	✓	✓					1	✓	✓	✓			✓	✓	9
✓	✓		✓	✓		✓	2	✓	✓	✓		✓	✓	✓	A
✓	✓	✓	✓			✓	3			✓	✓	✓	✓	✓	b
	✓	✓			✓	✓	4	✓			✓	✓	✓		c
✓		✓	✓		✓	✓	5		✓	✓	✓	✓		✓	d
✓		✓	✓	✓	✓	✓	6	✓			✓	✓	✓	✓	E
✓	✓	✓					7	✓				✓	✓	✓	F

Hindu-Arabic numerals

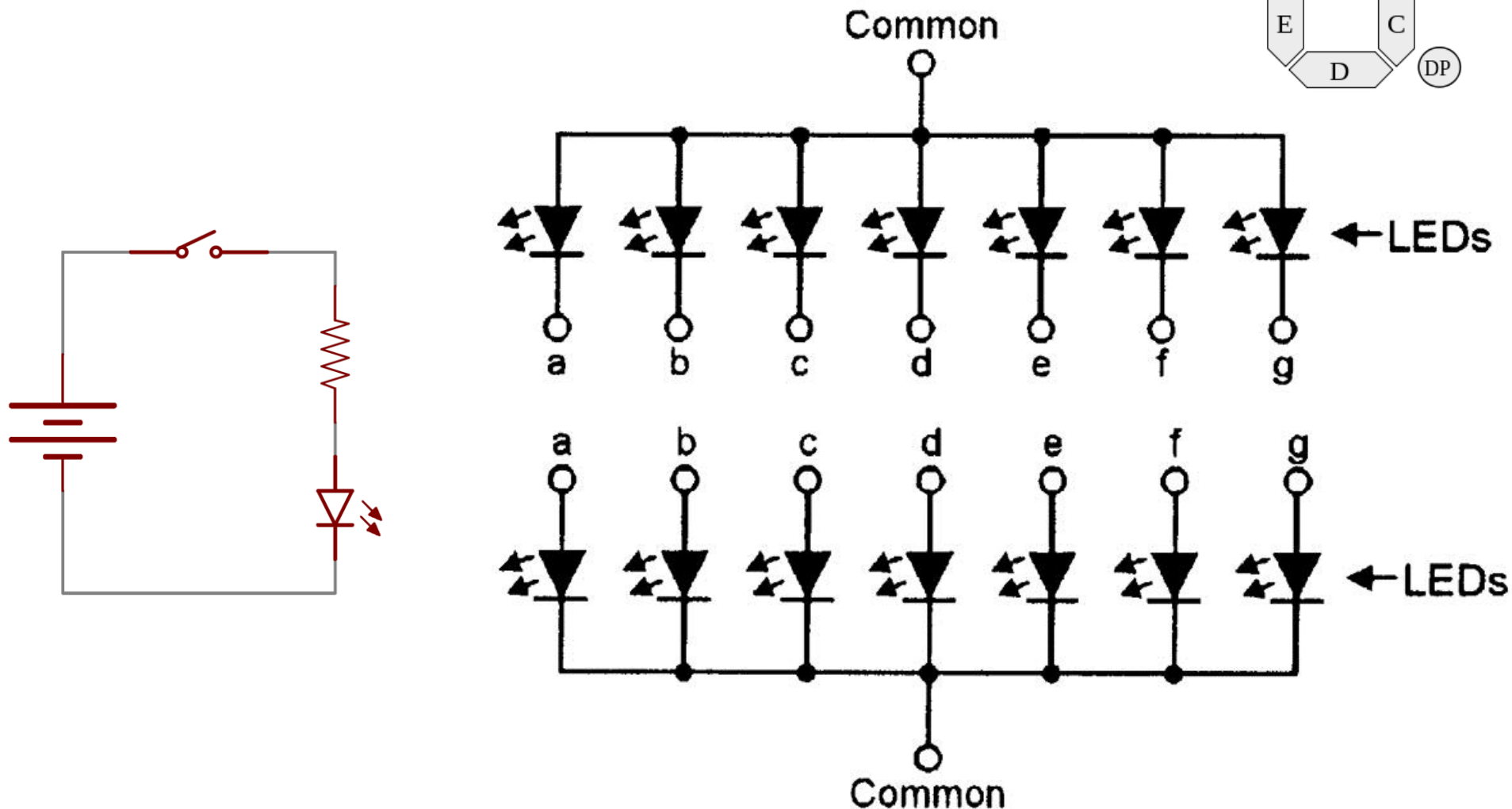
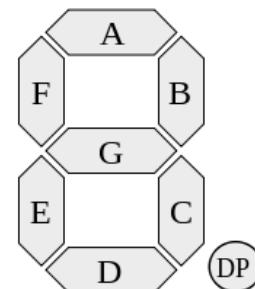
- Unii sustin ca simbolurile numerelor provin de la numarul de unghiuri ale figurilor de mai jos.



Afisorul cu 7 segmente

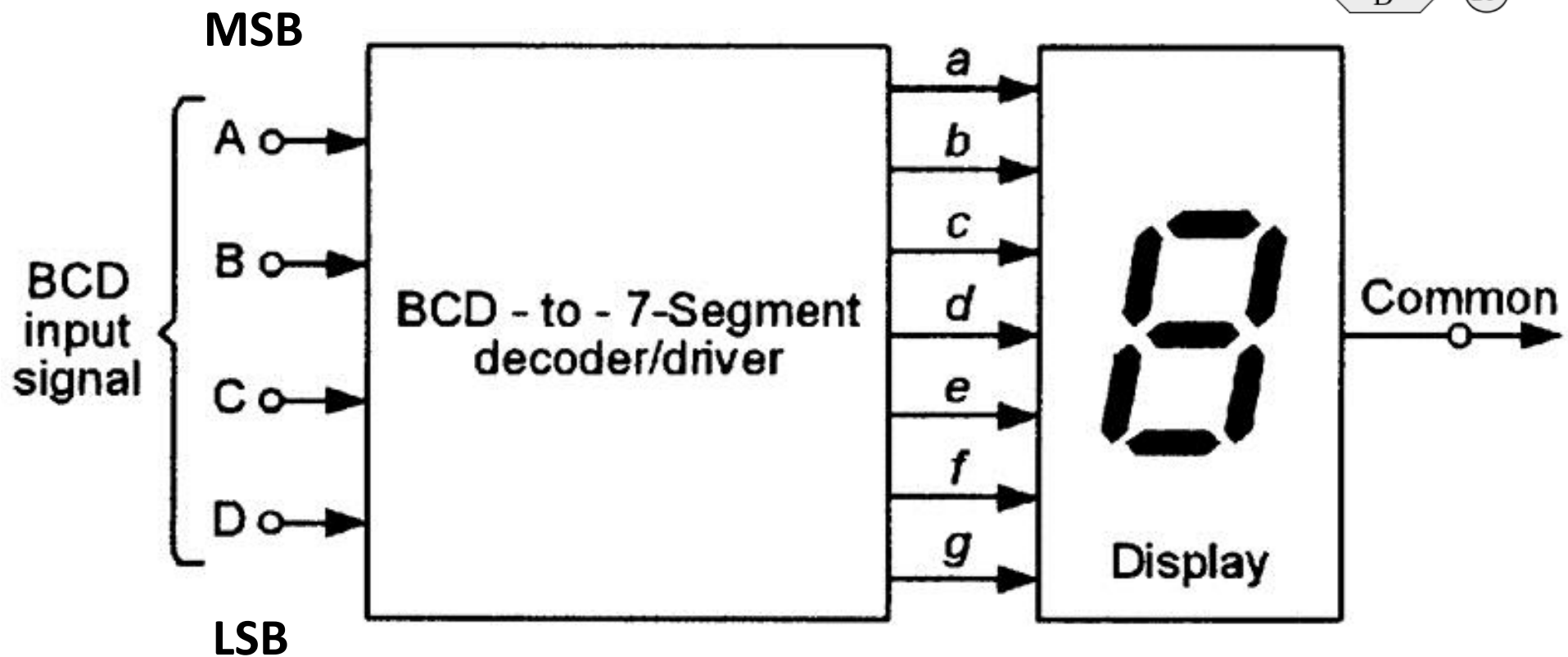
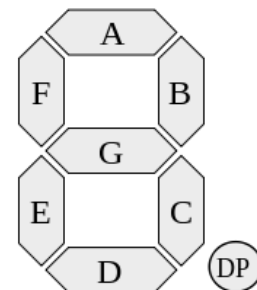
Exista in doua variante:

- cu anod sau cu catod comun



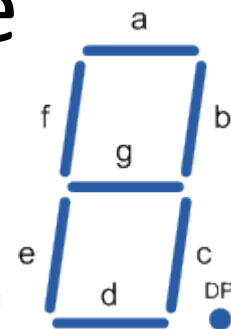
Afisorul cu 7 segmente

Are nevoie de un decodificator special



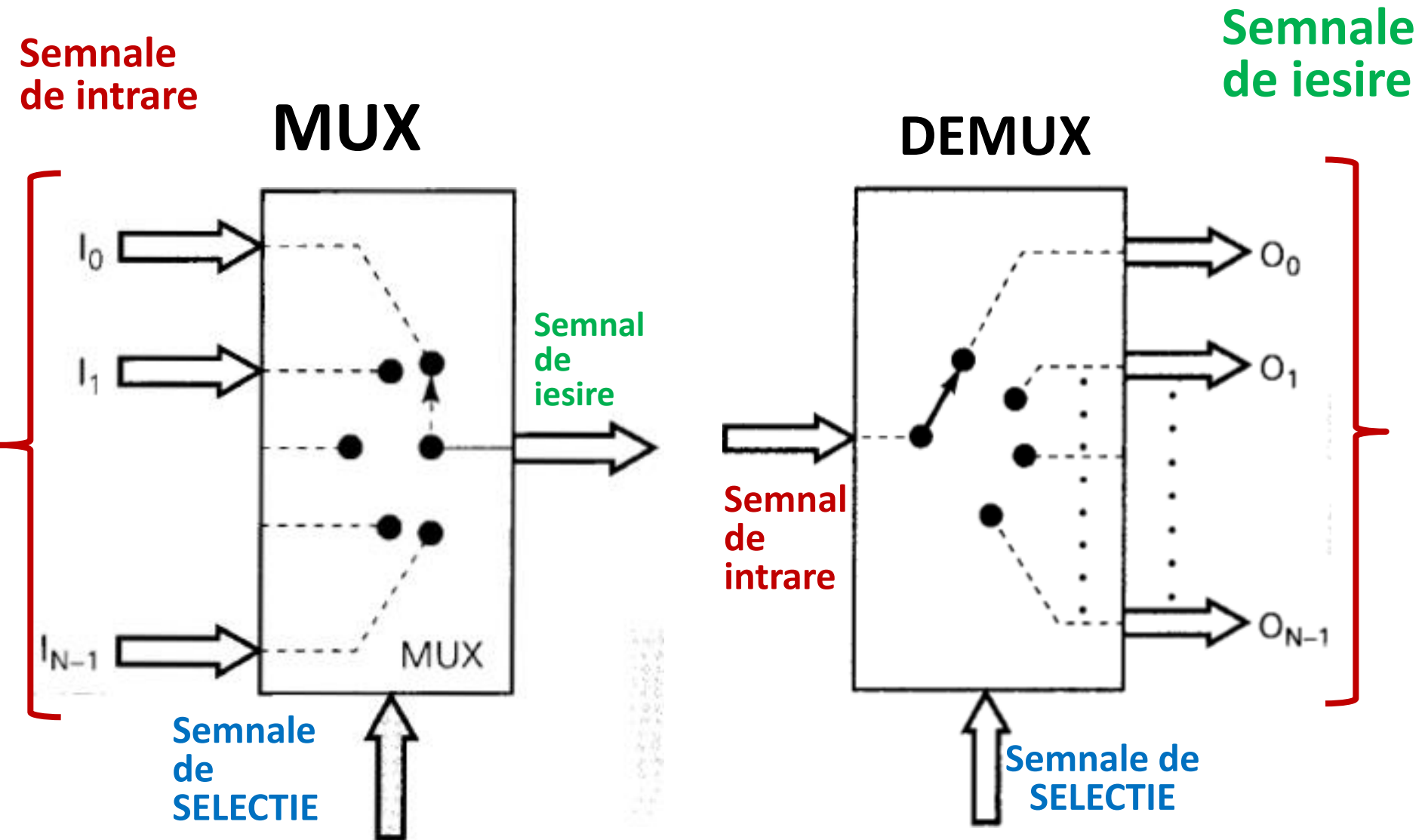
TEMA: Afisorul cu 7 segmente

Minimalizati cele 7 functii si simulati in wronex functionarea acestui decodificator



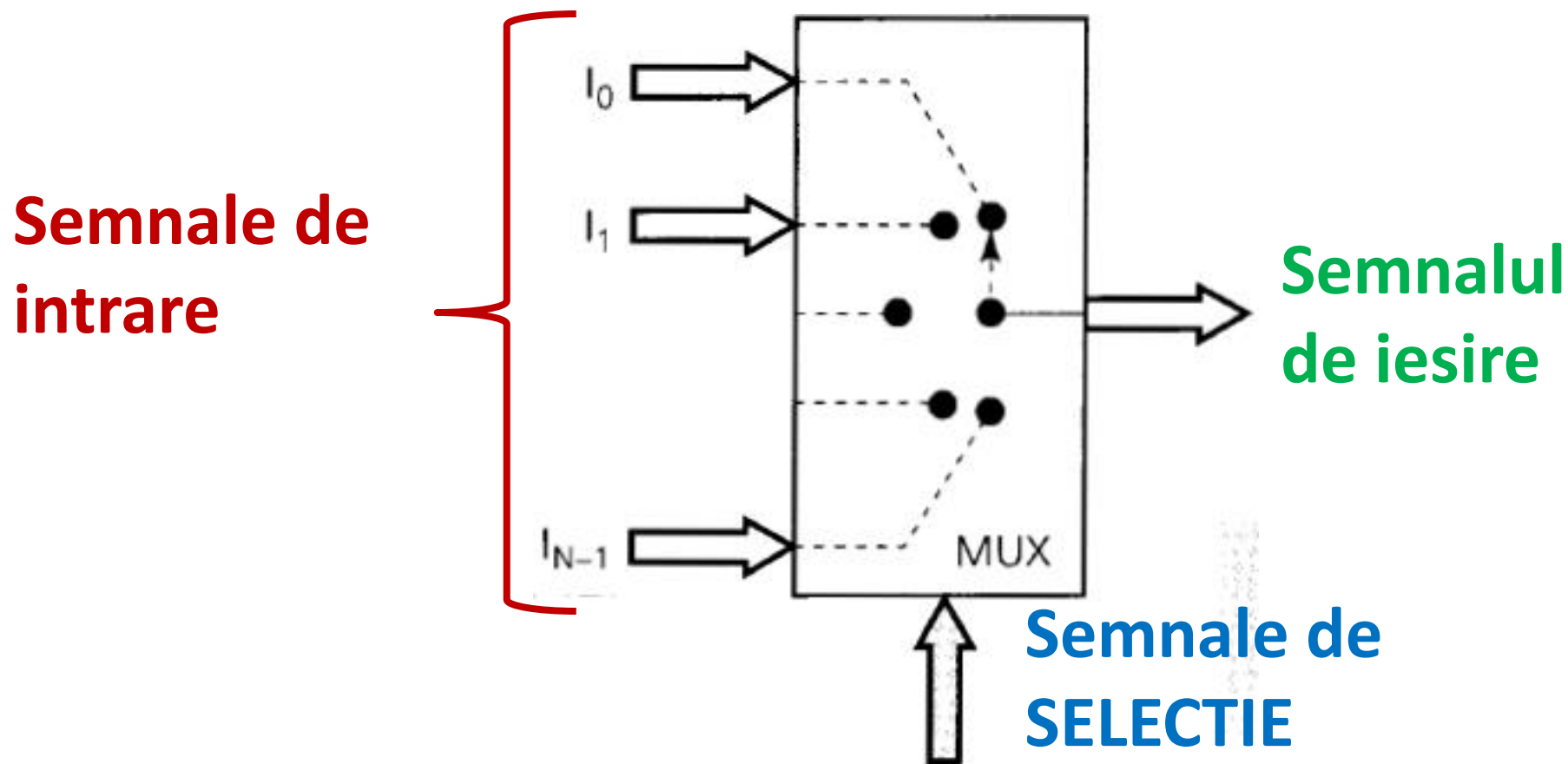
Segments (✓ = ON)							Display	Segments (✓ = ON)							Display
a	b	c	d	e	f	g		a	b	c	d	e	f	g	
✓	✓	✓	✓	✓	✓		0	✓	✓	✓	✓	✓	✓	✓	8
	✓	✓					1	✓	✓	✓			✓	✓	9
✓	✓		✓	✓		✓	2	✓	✓	✓		✓	✓	✓	A
✓	✓	✓	✓			✓	3			✓	✓	✓	✓	✓	b
	✓	✓			✓	✓	4	✓			✓	✓	✓		c
✓		✓	✓		✓	✓	5		✓	✓	✓	✓		✓	d
✓		✓	✓	✓	✓	✓	6	✓			✓	✓	✓	✓	E
✓	✓	✓					7	✓				✓	✓	✓	F

MUX - DEMUX



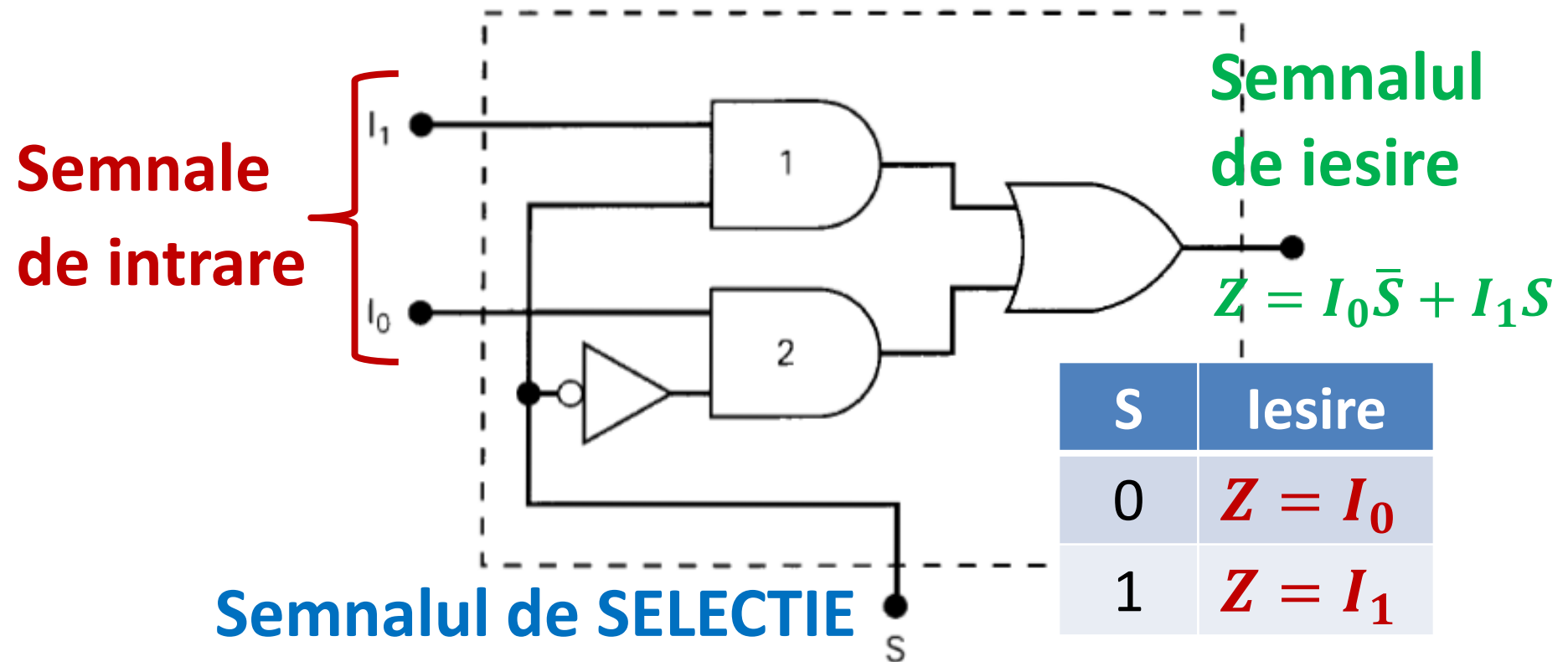
Multiplexers (MUX - *Data Selectors*)

- Circuitul are mai multe intrari digitale.
- Numai una dintre intrari este SELECTATA pentru a fi transmisa la iesire.



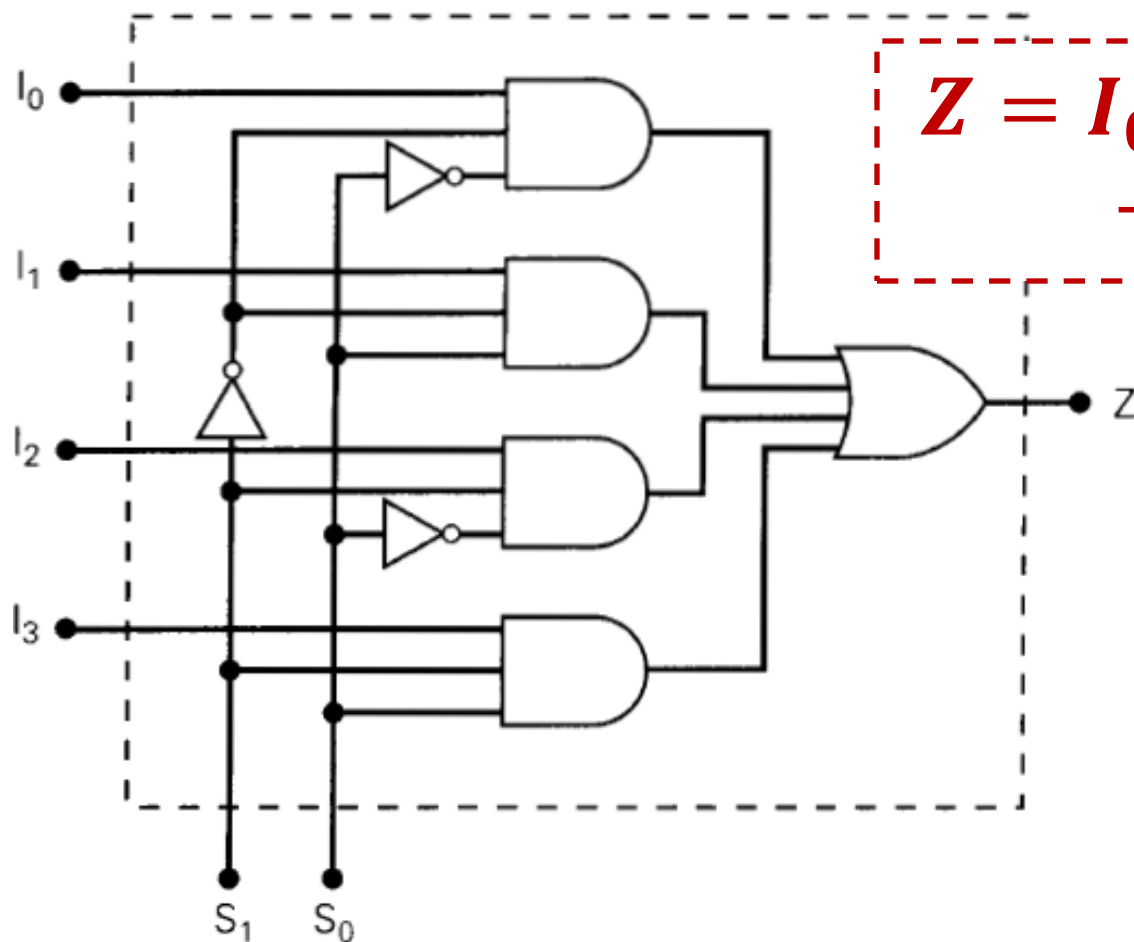
MUX cu doua intrari

- Circuitul are 2 intrari digitale.
- Formula de functionare este: $Z = I_0\bar{S} + I_1S$



MUX cu patru intrari

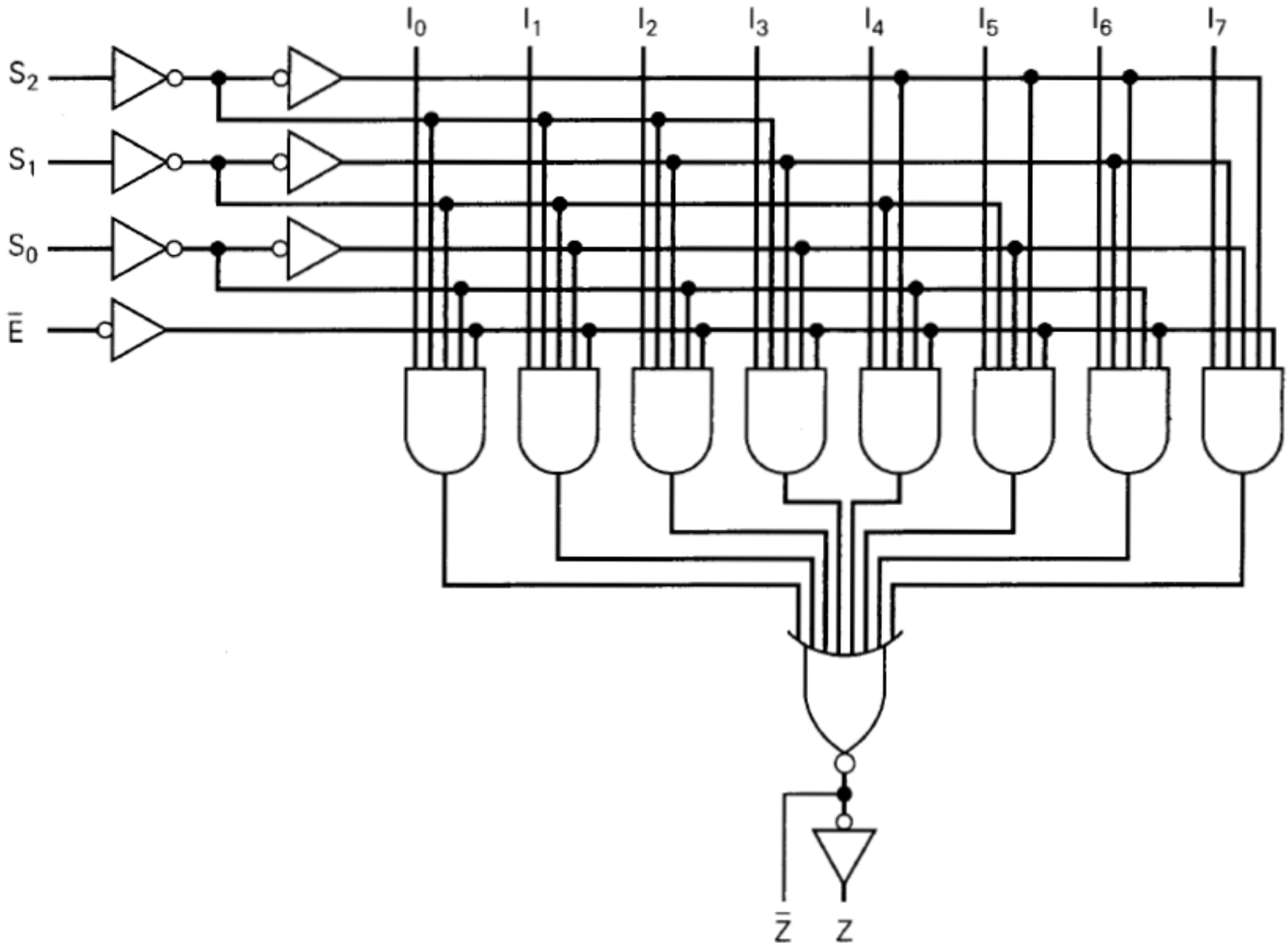
- Circuitul are 4 intrari digitale.
- Formula de functionare este:



$$Z = I_0 \overline{S_0} \overline{S_1} + I_1 \overline{S_0} S_1 + I_2 S_0 \overline{S_1} + I_3 S_0 S_1$$

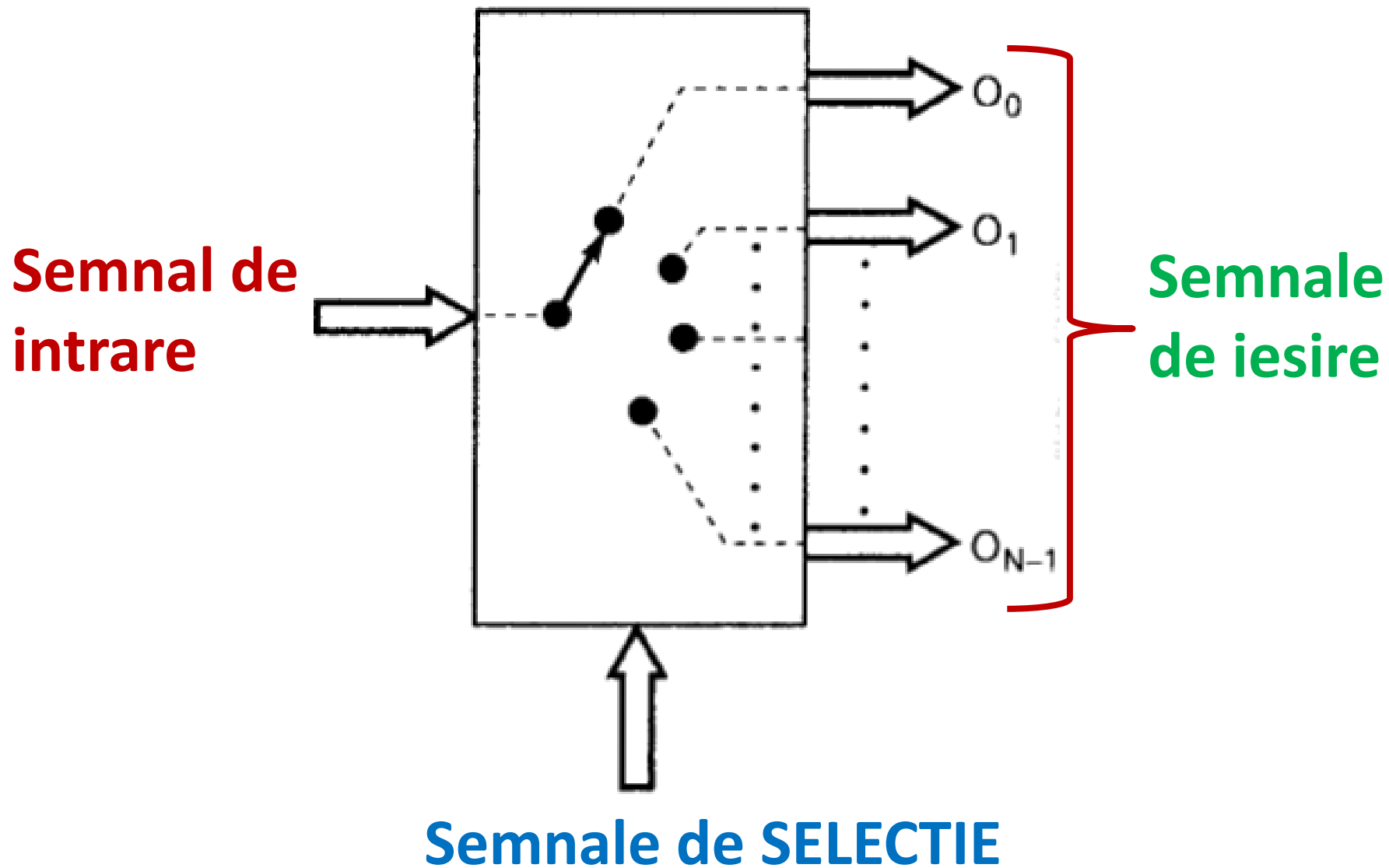
S_0	S_1	iesire
0	0	$Z = I_0$
0	1	$Z = I_1$
1	0	$Z = I_2$
1	1	$Z = I_3$

MUX cu opt intrari – ex teoretic



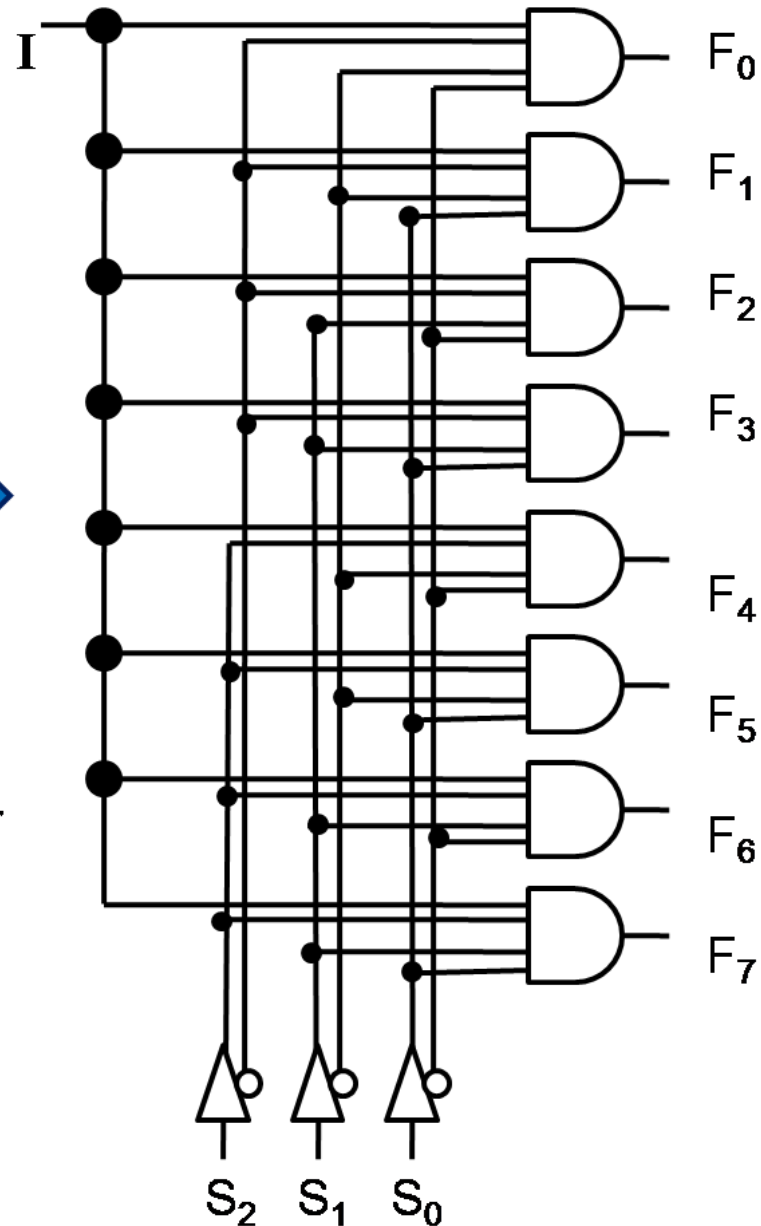
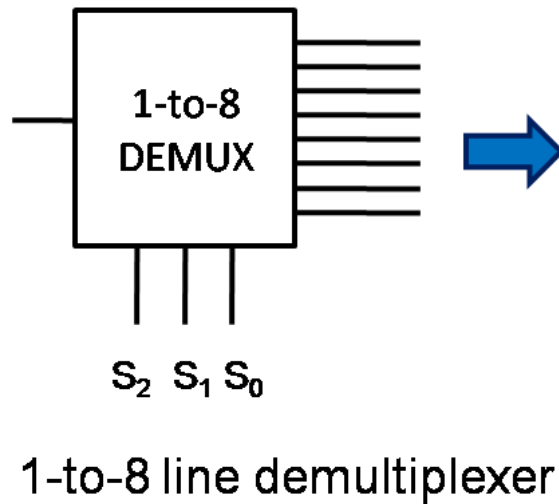
Demultiplexori DEMUX – Data distributors

- Efectueaza operatie inversa MUX



DEMUX: 1 – 8

- lesirea selectata
copiaza intrarea



$$F_5 = I \cdot S_2 \cdot \overline{S_1} \cdot S_0$$

4 to 2 priority encoder

- O secretara deservește 4 directori.
- Ea are in birou o centrala telefonica pe care sunt 4 Becuri, cate unul pentru fiecare director.
- Directorii au ranguri diferite. In ordine descrescatoare a rangurilor ei sunt: D3, D2, D1 si D0.
- Daca 2 (sau mai multi) directori solicita simultan un serviciu de la secretara (fiecare apasand butonul din biroul sau) pe panoul secretarei se va aprinde doar becul directorului cel mai mare in rang dintre solicitatori.

				Codul celui mai mare in rang		Exista solicitare ?
D3	D2	D1	D0	O ₁	O ₀	V
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	X	0	1	1
0	1	X	X	1	0	1
1	X	X	X	1	1	1



Mulumesc pentru atentie