

PROIECTAREA CU MICROPROCESOARE

C3 2022-2023 Sem. 2

Proiect 6 Sapt 6 2 aprilie 2024 14:00-16:00

serban@upit.ro

Regulament disciplina

Nota finala este formata din activitatile:

- Laborator 15%
- Lucrare control 15%
- Prezentare si sustinere proiect 20%
- Examen 50%
- Bonus prezenta – 10%

Conditii pentru promovare:

- Nota de la laborator trebuie sa fie minim 5 (prezenta obligatorie la toate sedintele de laborator);
- Nota proiect minim 5 (conditie obligatorie pentru intrare in examen);
- Nota de la examen trebuie sa fie minim 5;
- Nota de minim 5 la Lucrarea de control.

In cazul reluarii disciplinei intr-un alt an universitar, activitatile nepromovate trebuie parcuse din nou.

Cerinte proiect

1). Realizarea suportului scris (format pdf) care sa contine capitolele:

Proiectarea Hardware si Proiectarea Software

- In cap. Proiectarea Hardware trebuie sa fie inclusa argumentarea pentru logica de conectare a circuitelor de memorie si I/O, respectiv a perifericelor;
- Este **obligatorie** schema de conectare finala a tuturor componentelor (eventual fara circuitele de alimentare) cu precizarea tuturor pinilor circuitelor folosite si a modului de conectare a acestora; va fi prezentat modul de programare a tableei prin folosirea tastelor (manualul de utilizare);
- In cap. Proiectarea Software trebuie sa fie inclusa logica de constructie a programului software cu toate componente sale (prin descrieri explicative si organigrame), respectiv listingul programului;
- Este **obligatorie** lista de variabile folosite sub forma unui tabel de forma:

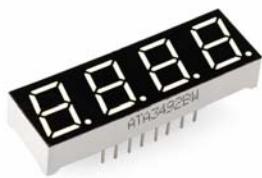
Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM

- Folosirea unui simulator pentru programul (sau portiuni din el) realizat este un bonus.

2). Predarea proiectului se va face pana in ziua de **26 mai 2024 ora 18:00** pe platforma moodle.

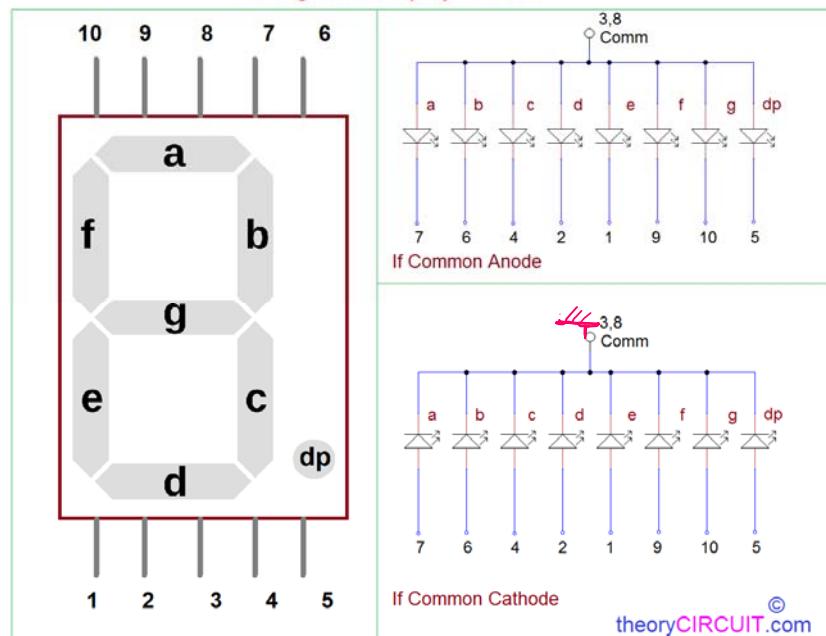
3). Sustinerea proiectului de catre realizator (activitate obligatorie) printr-o sesiune de intrebari legate de solutiile folosite (in ultima saptamana din semestru **27 – 31 mai 2024** la o data stablita de comun accord – marti sau vineri).

Celule de afisaj LED cu 7 segmente



Celule de afisaj LED cu 7 segmente

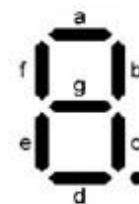
7 Segment Display Pinout



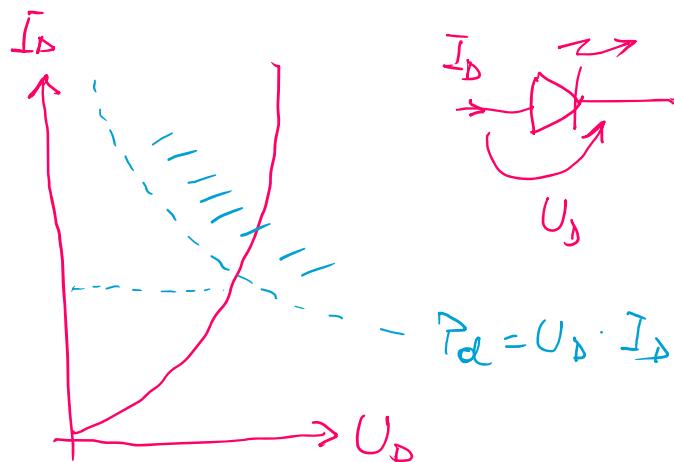
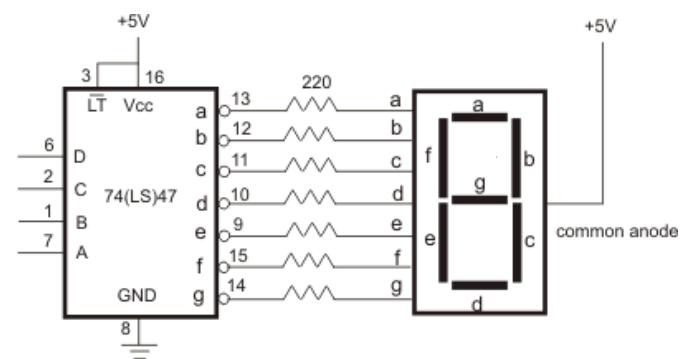
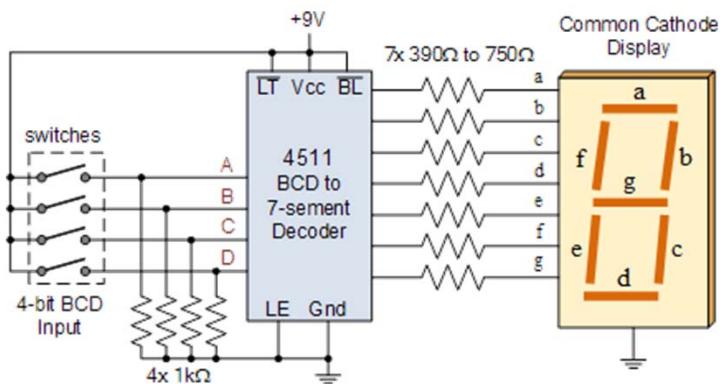
CATHOD COMMON

segment outputs							display
a	b	c	d	e	f	g	
1	1	1	1	1	1	1	0
0	1	1	0	0	0	0	1
1	1	0	1	1	0	1	2
1	1	1	1	0	0	1	3
0	1	1	0	0	1	1	4
1	0	1	1	0	1	1	5
0	0	1	1	1	1	1	6
1	1	1	0	0	0	0	7
1	1	1	1	1	1	1	8
1	1	1	0	0	1	1	9

7-Segment
Display

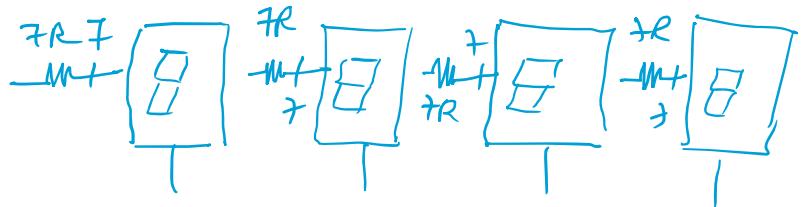
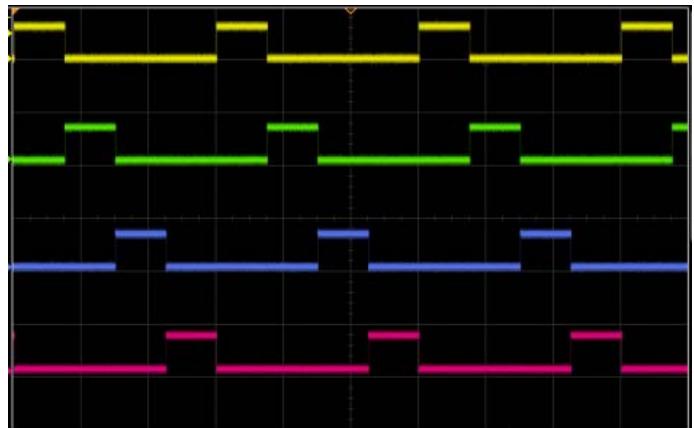
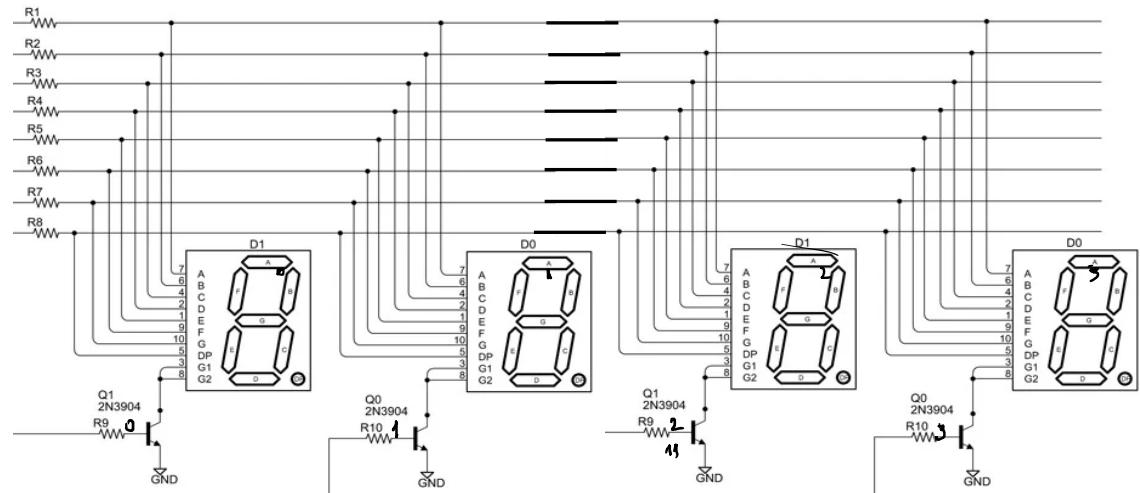


Celule de afisaj LED cu 7 segmente



comanda basică pentru celula LED 7 segmente

Proiectarea afisajului cu celule LED 7 segmente comandat prin multiplexare



$$7R \times 4 = 28R \quad \text{Resistențe}$$

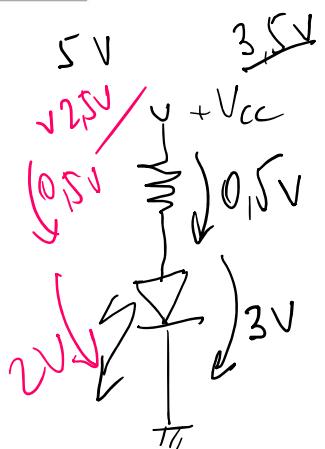
$$7 \times 4 = 28 \quad \text{fire comandă}$$

4 - catorzi -

(comandă clasică)

Comandă prin multiplexare

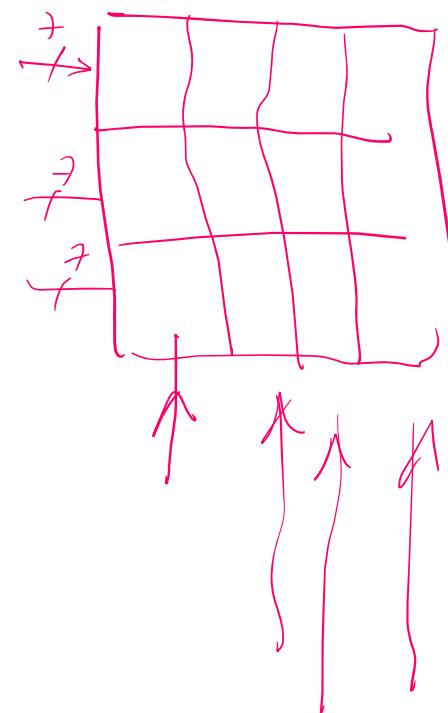
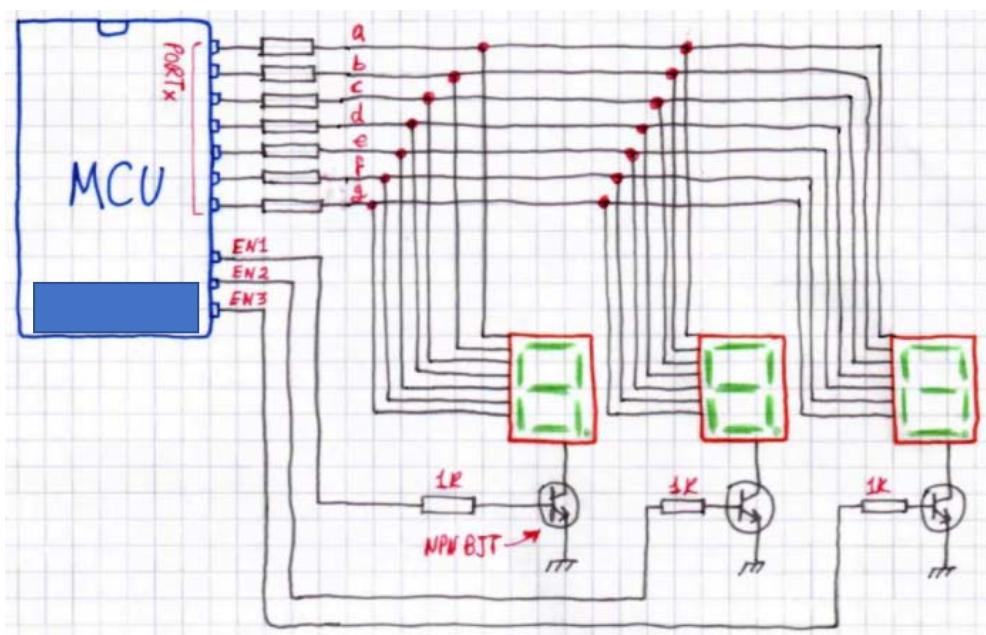
Resurse

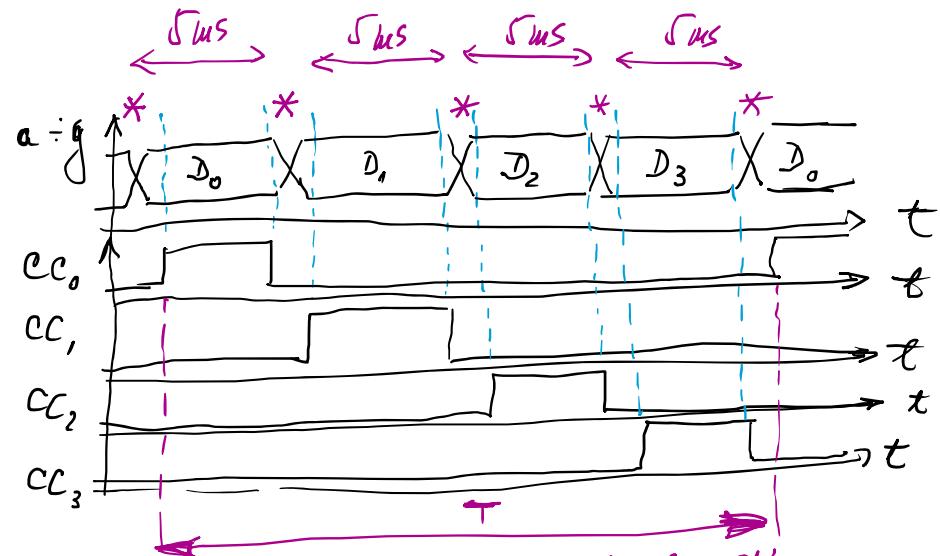


- TR - rezistențe

- $f + 4 = 11$ fire comandă

Proiectarea afisajului cu celule LED 7 segmente comandat prin multiplexare





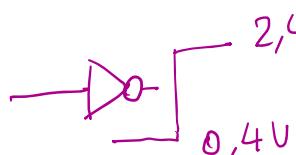
$$T \leq 20 \mu s \quad (f \geq 50 \text{ Hz}) \quad n = 4 \text{ digits}$$

$$\frac{T}{n} = \frac{20 \mu s}{4} = 5 \mu s \Rightarrow \text{necessary timer}$$

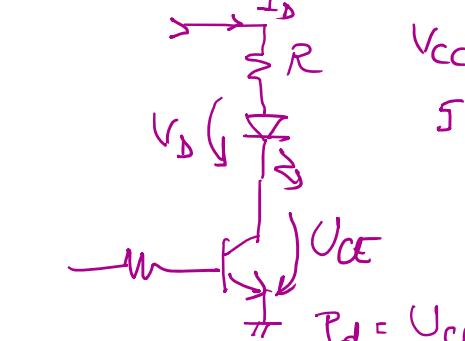
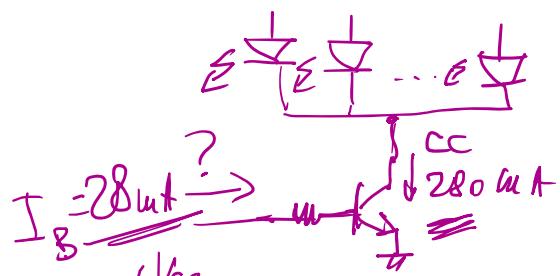
⇒ need to sample
every 5 μs from
the 4 bits
of the counter
and then
integrate current

$$I_{\text{peak}} \geq n \cdot I_D = 4 \cdot 10 \mu A = 40 \mu A$$

⇒ need to
use a
current
amplifier



Circuitul de amplificare în curent I_D
(cotelor colecții) -



$$V_{CC} = I_D \cdot R + U_{CE}$$

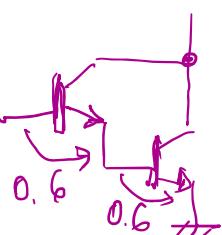
$$5 = 40 \cdot R + 2 + U_{CE(SAT)}$$

$$\frac{1V}{40} (2N2222)$$

$$R = \frac{5 - 2 - 1}{40} = \frac{2}{40} = 0.05 \text{ k}\Omega$$

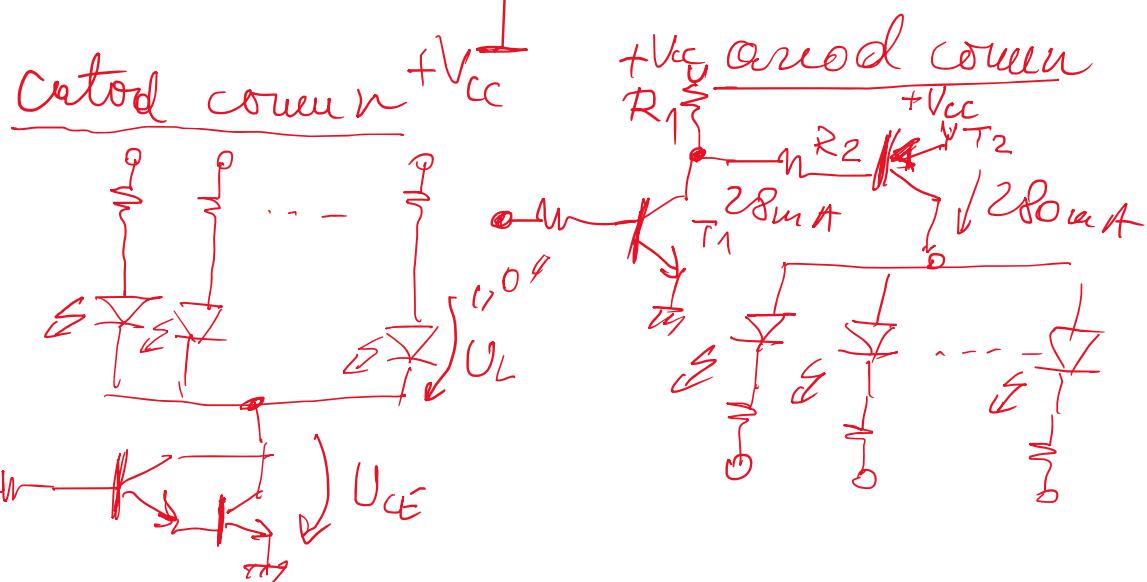
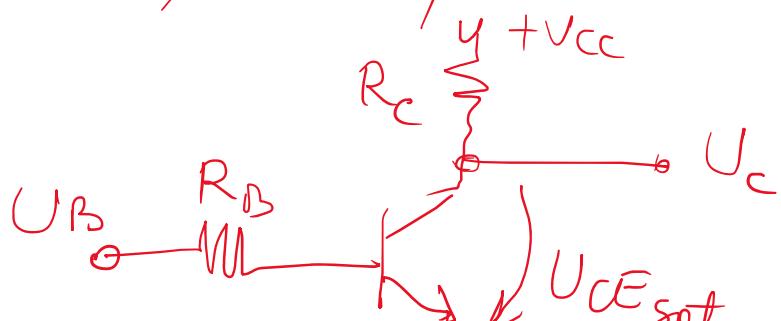
$$\beta_{SAT} = 10 ! \quad = 50 \Omega$$

Regime saturat $U_{CE} \rightarrow 0$
Regime blocat $I_C \rightarrow 0$

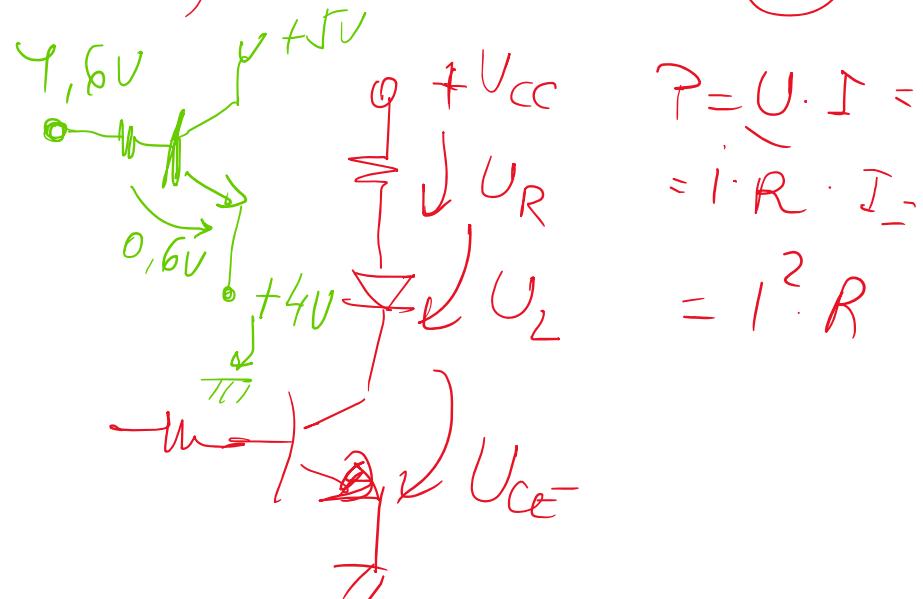
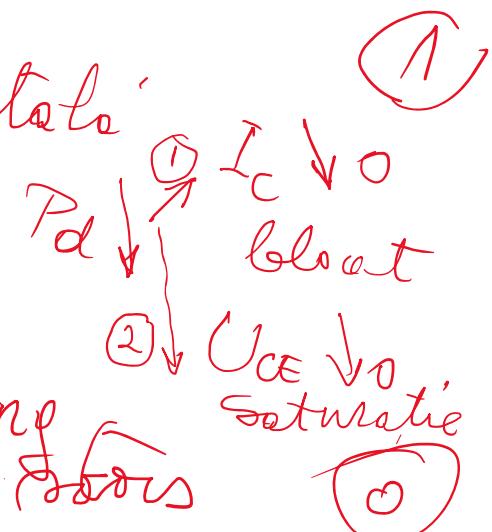


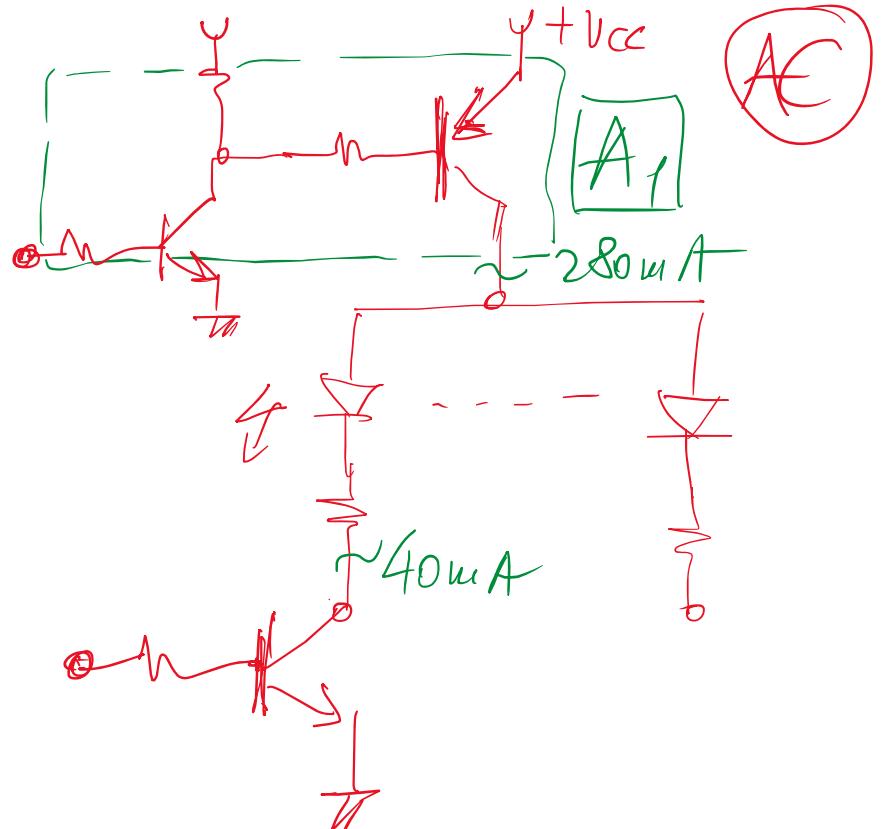
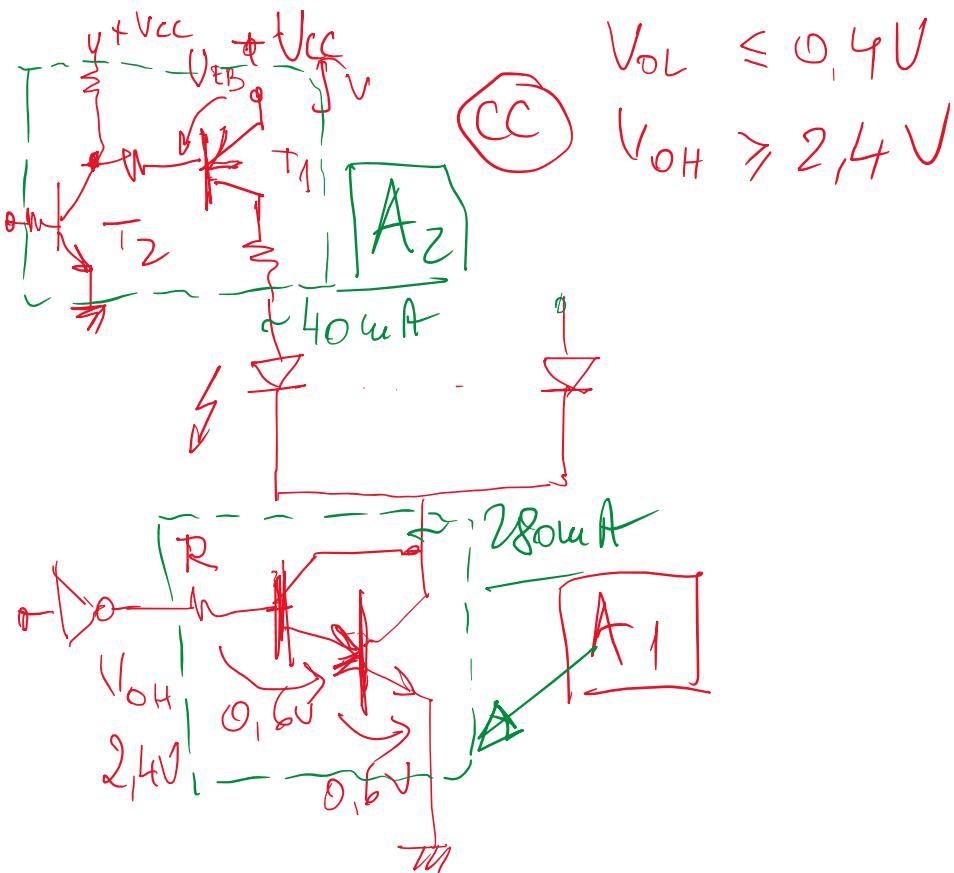
Operare cu tranzistori în logica digitală

II) Putere dissipată

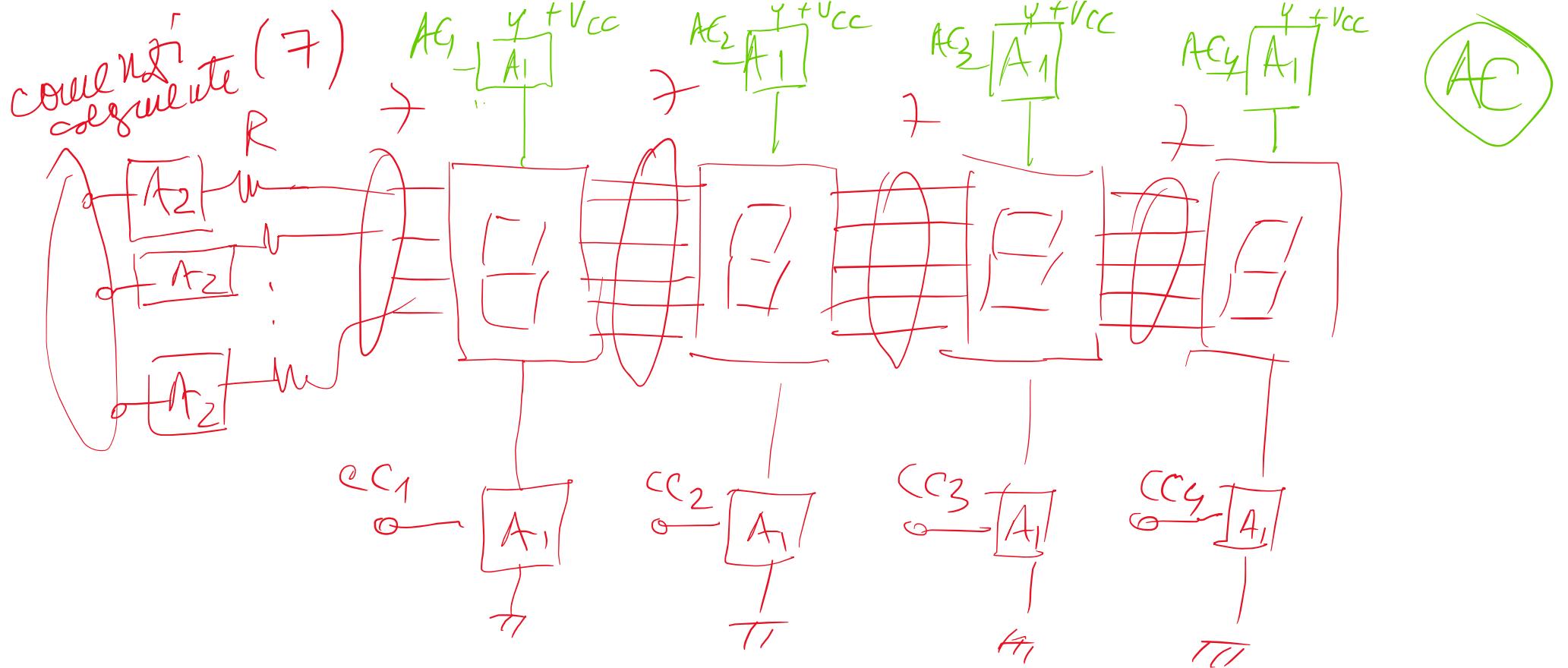


$$P_{d,trans} = U_{CE} \cdot I_C$$

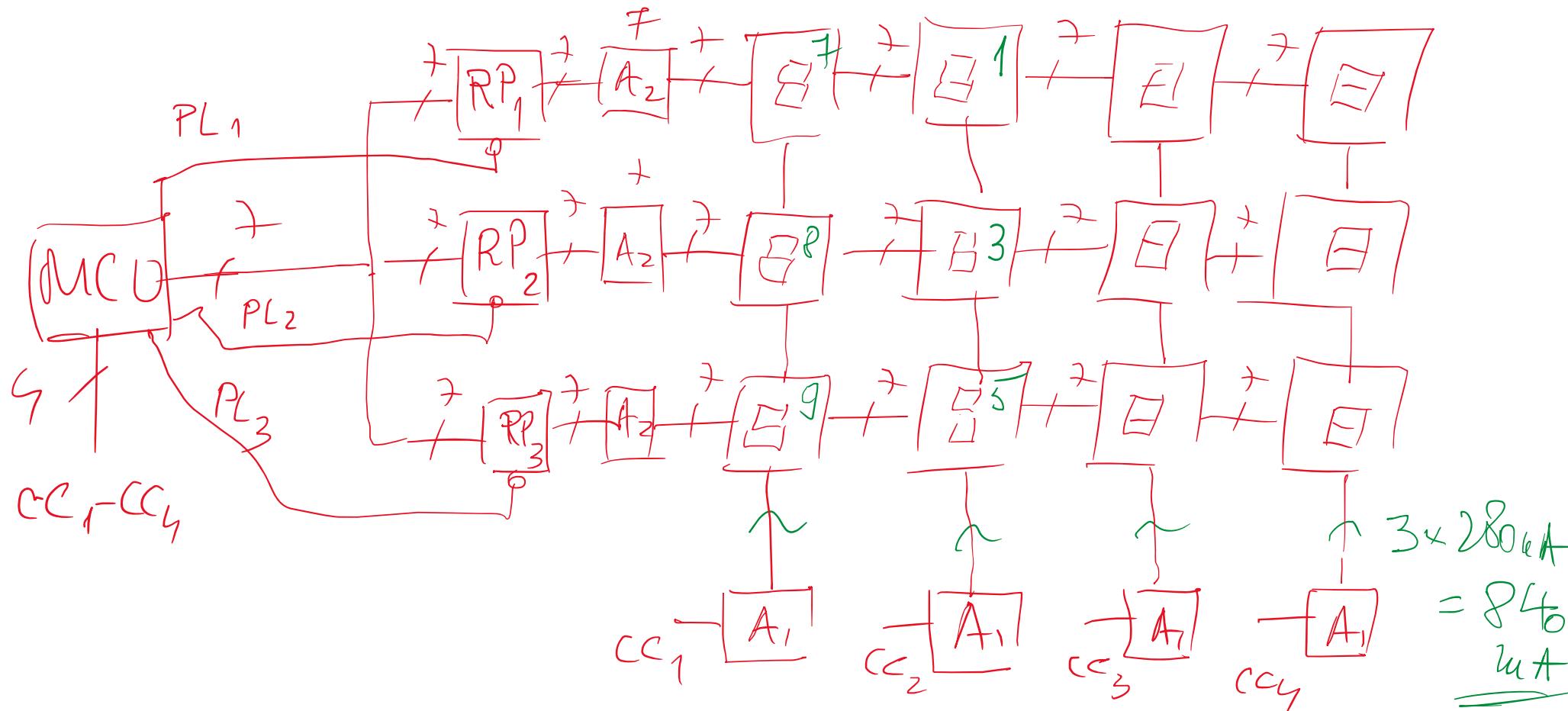




could not
congratulate (7) R

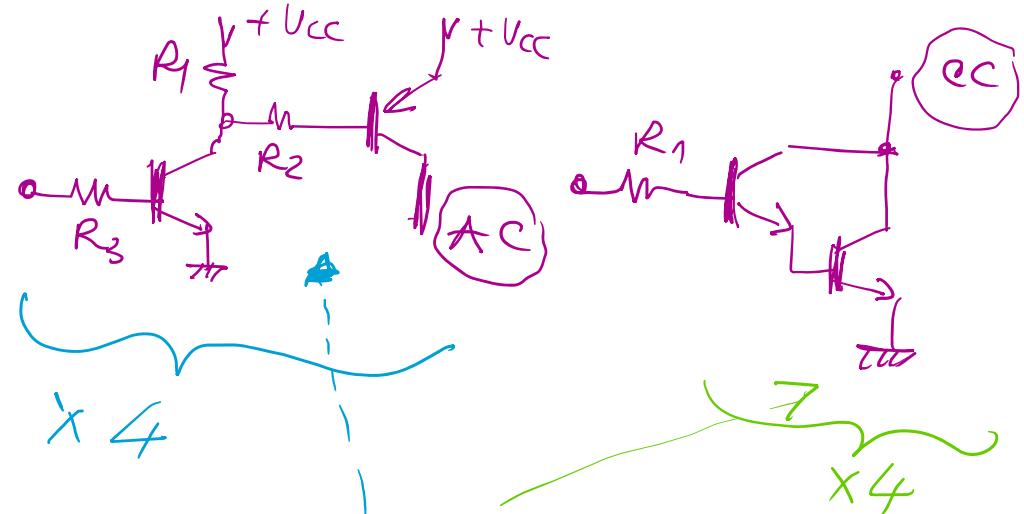
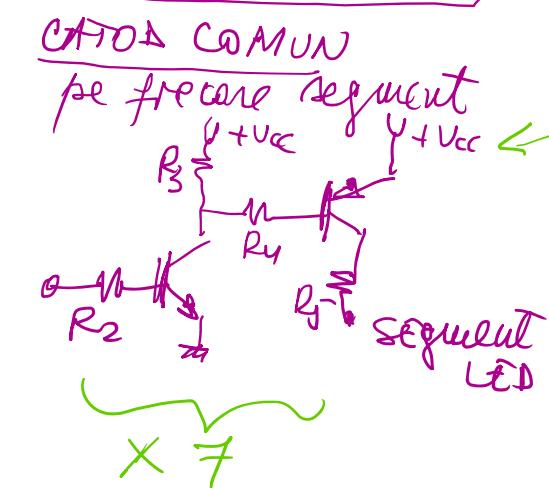
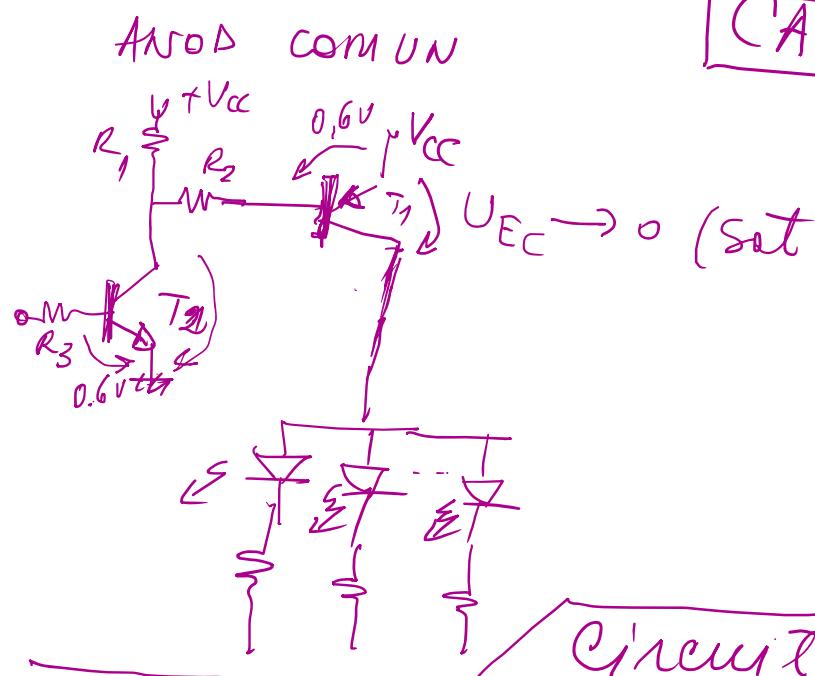


PL - parallel load

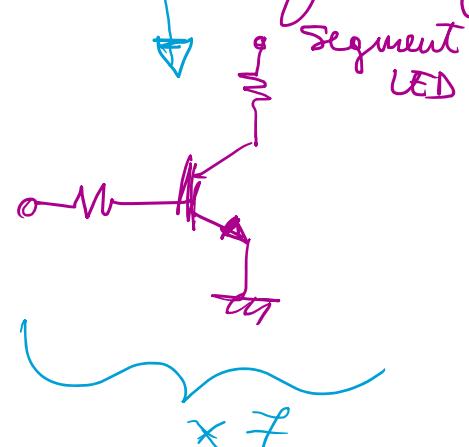


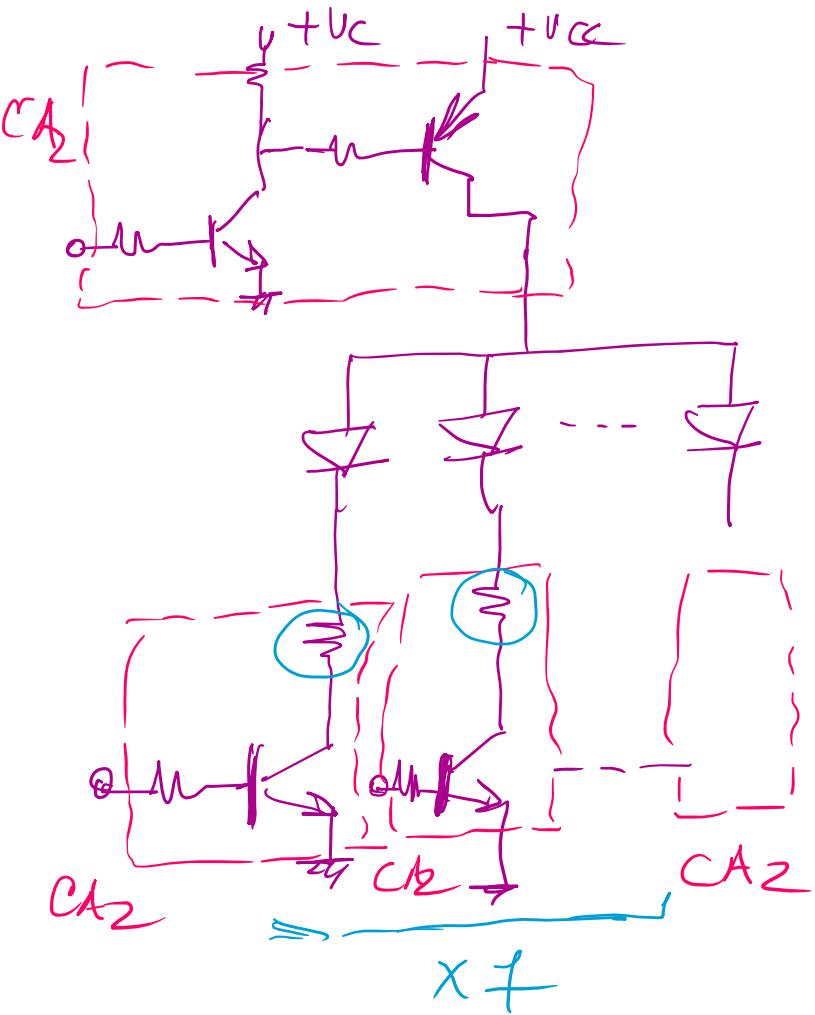
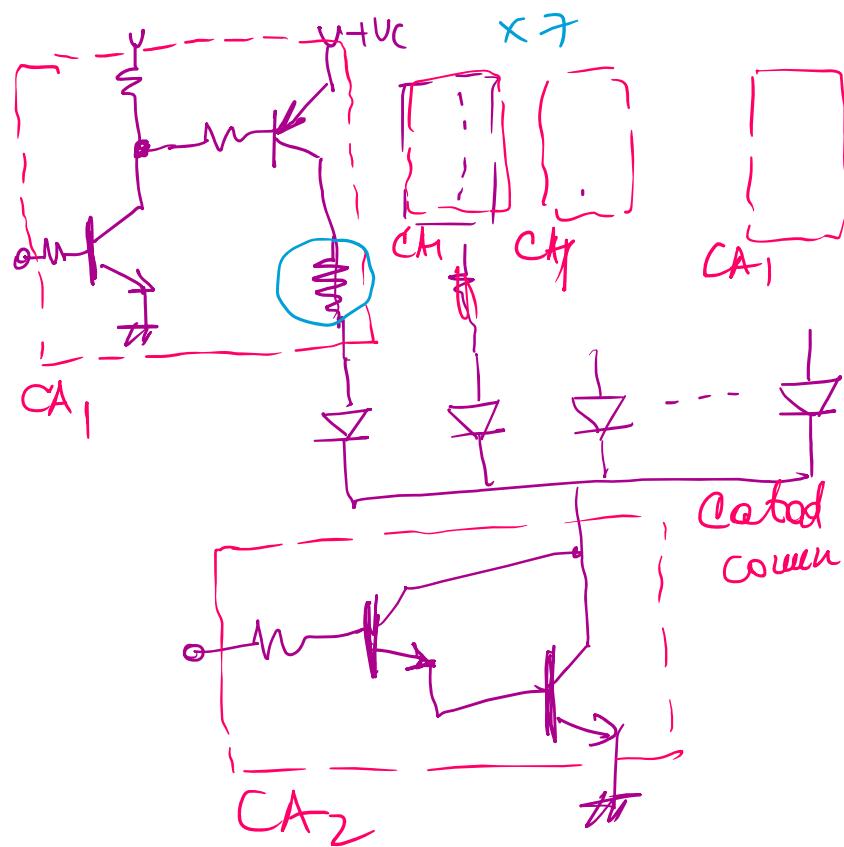
SUBTEM E

- 1) Căutare celule LED FSG (www.farnell.com)
- 3) Căutare tranzistor (-II -) putere A₁, și A₂
- 2) Scheme principale de multiplexare
pentru lemnăticele de celule FSG din tavan
(calcul curent)
- 4) Proiectoare A₁ și A₂ (valori de reflecție +
+ alegeri tranzistor)



Circuit amplificatore current de segmente (CA1)

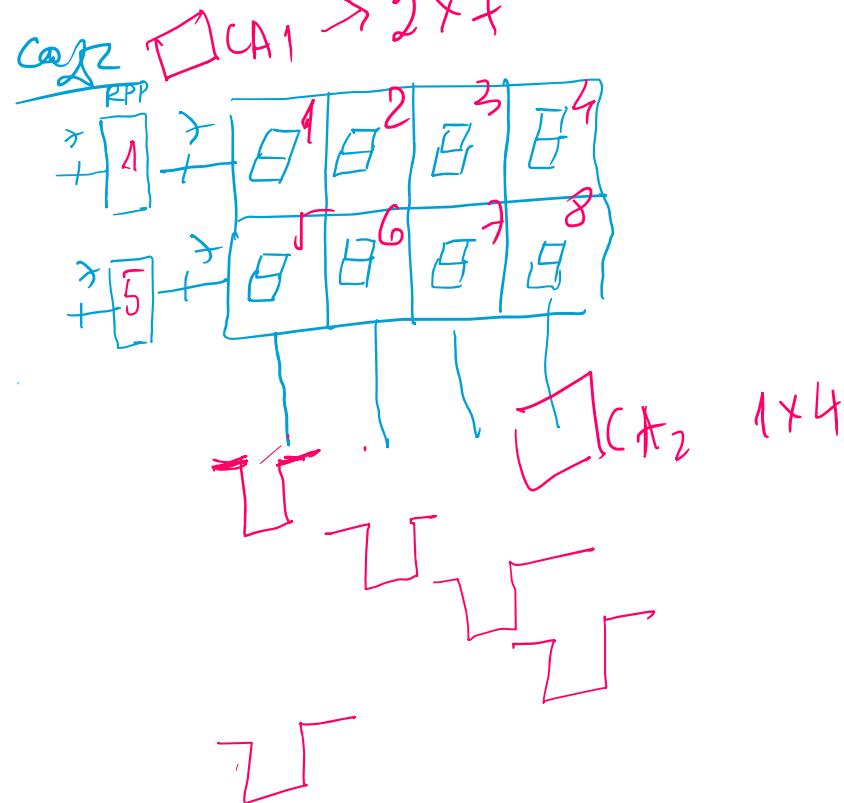


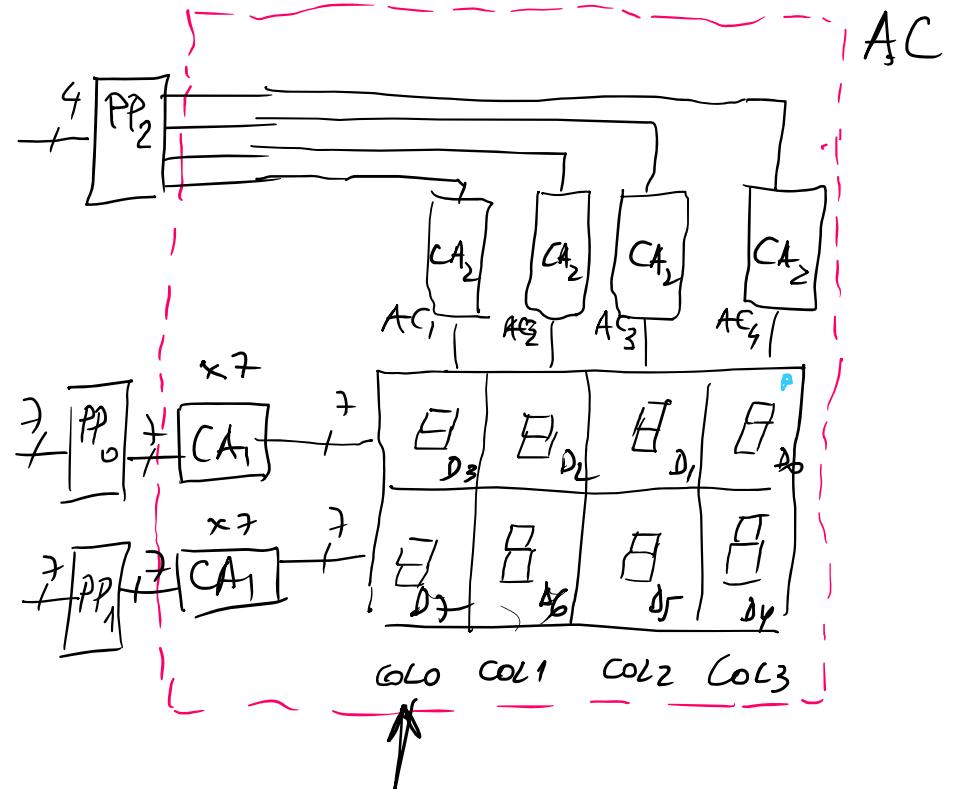
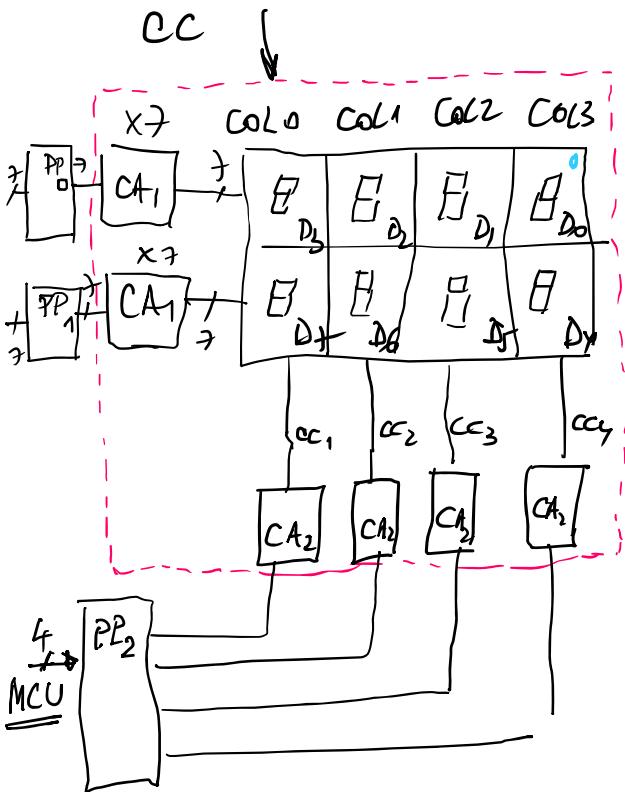


disponere elule afroej

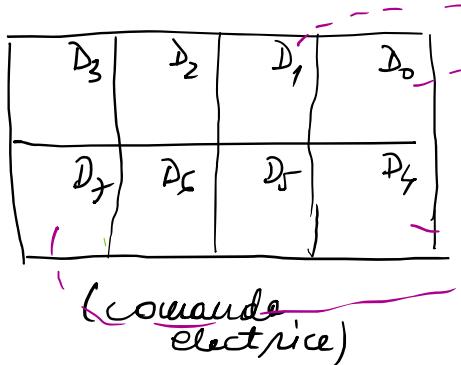
cas 1

□	□	□	□
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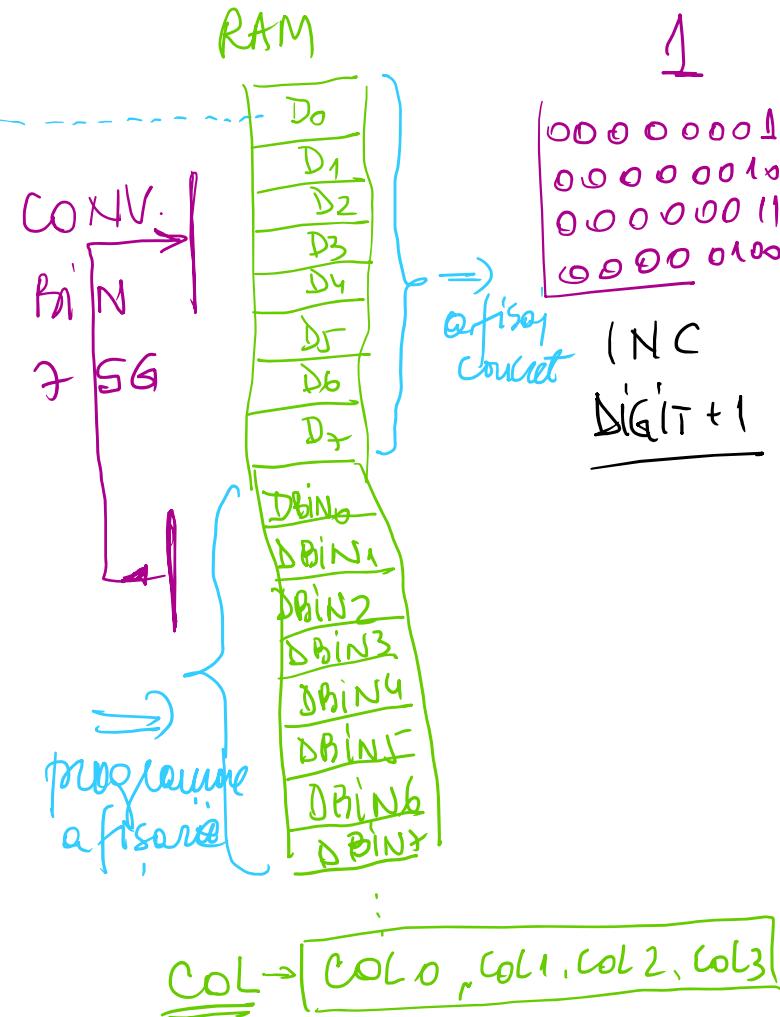




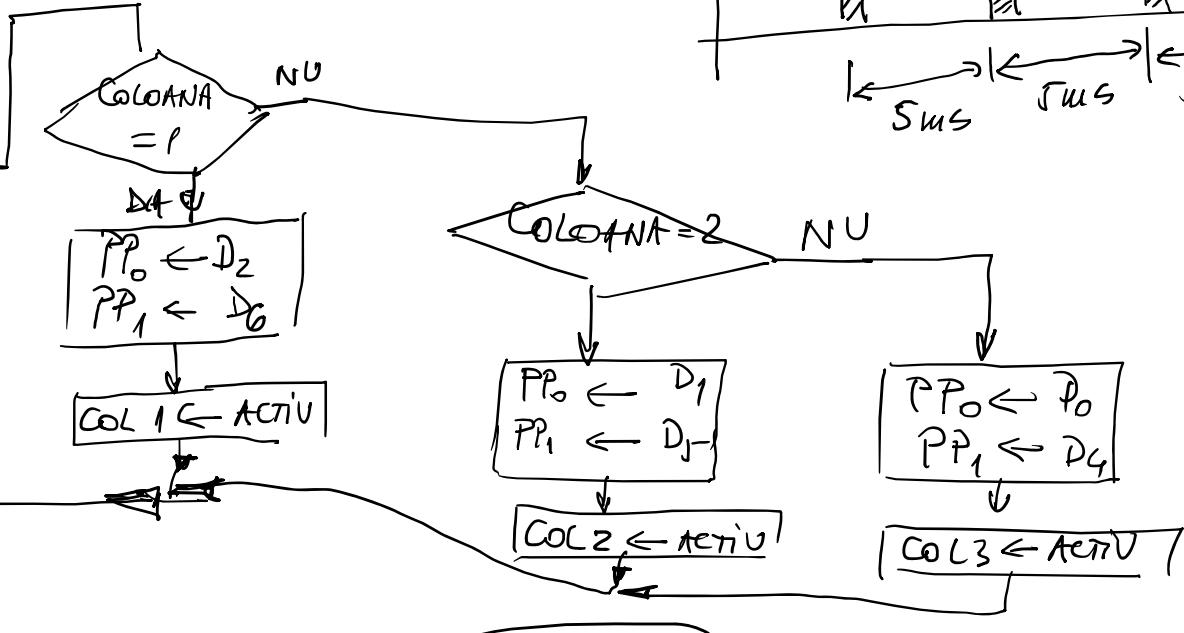
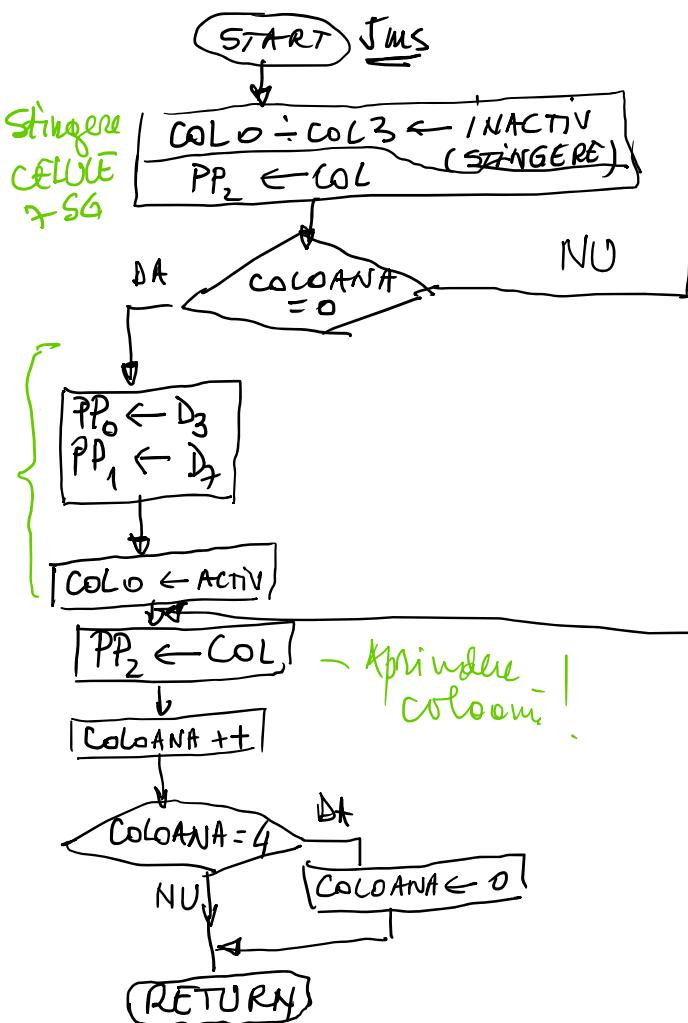
END 5 mar 2024



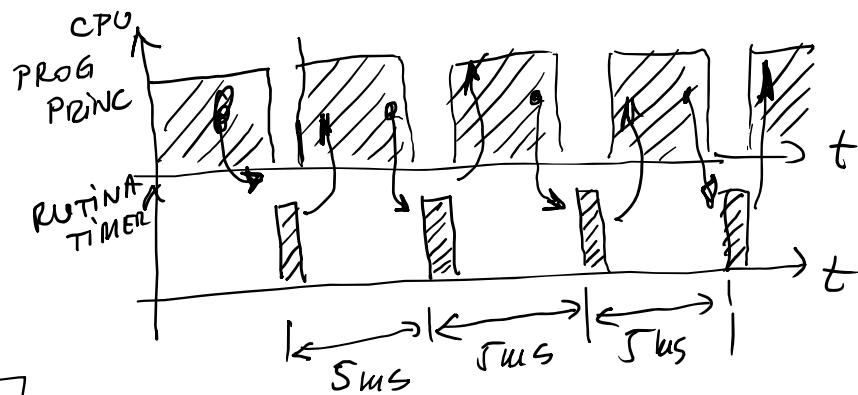
$t_0 \quad 1 \quad 3 \quad 5 \quad 9 \quad 7 \quad 8 \quad 4 \quad 0$
 $t_1 \quad 3 \quad 5 \quad 9 \quad 7 \quad 8 \quad 4 \quad 0 \quad 1$
 $t_2 \quad 5 \quad 9 \quad 7 \quad 8 \quad 4 \quad 0 \quad 1 \quad 3$



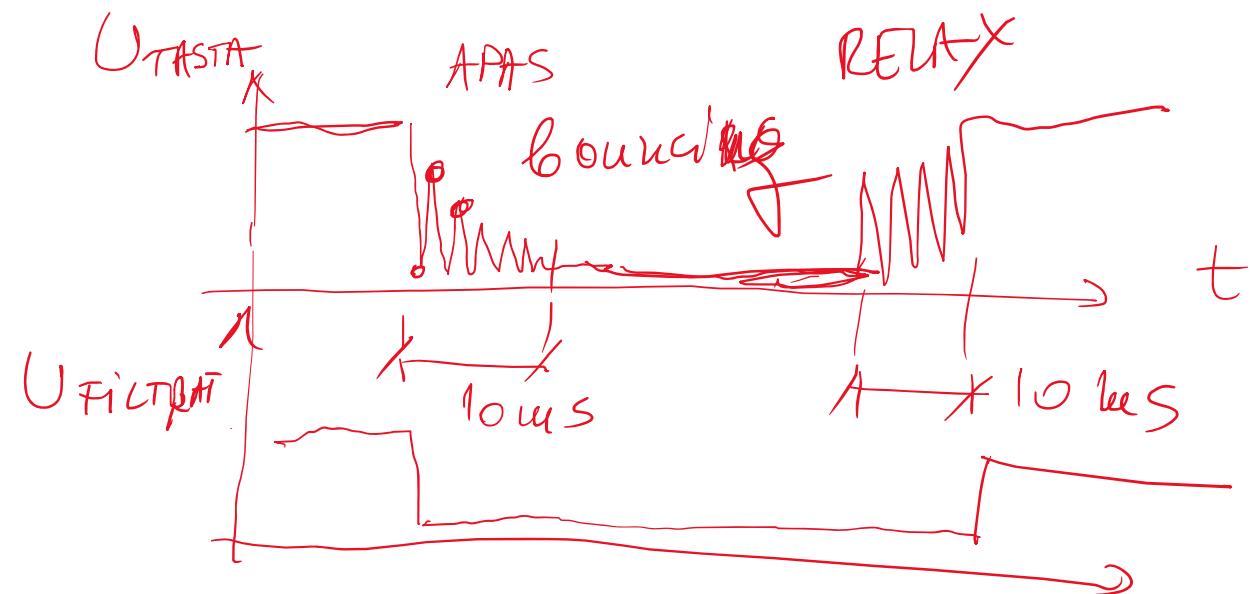
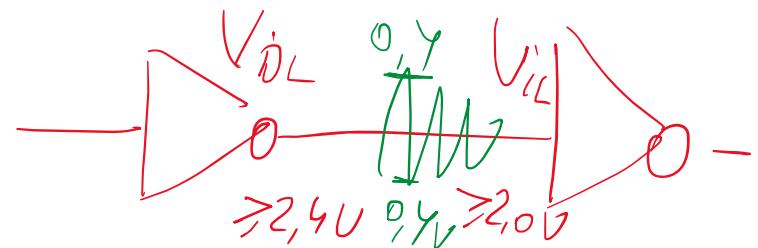
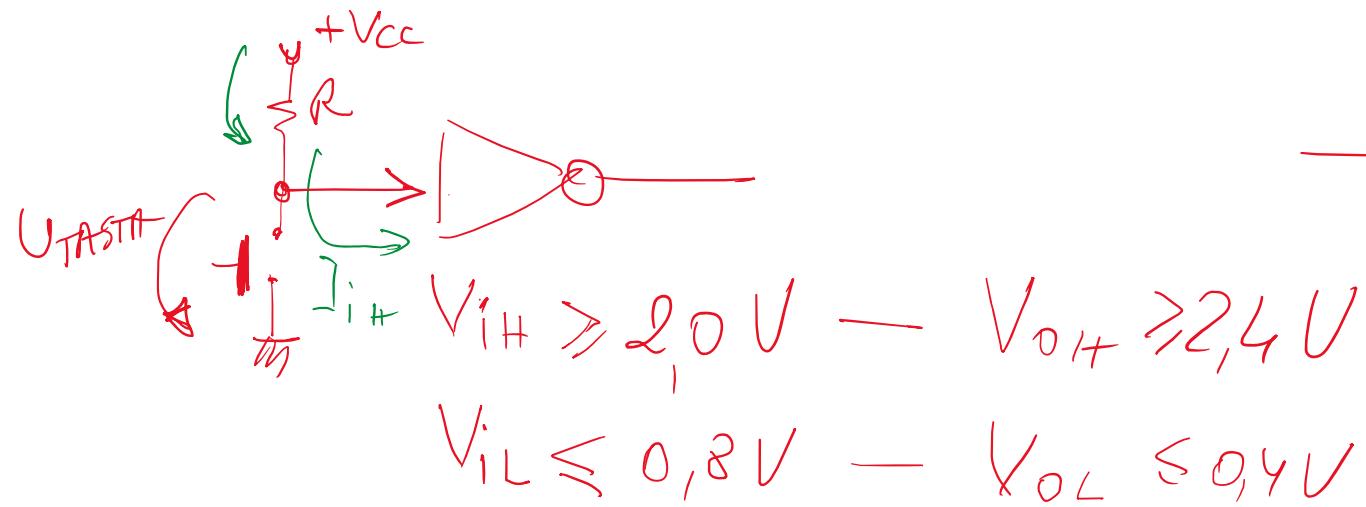
RUTINA TRATARE
INTERUPERE TIMER
(SEMNAZIARE TRECERE 5MS)



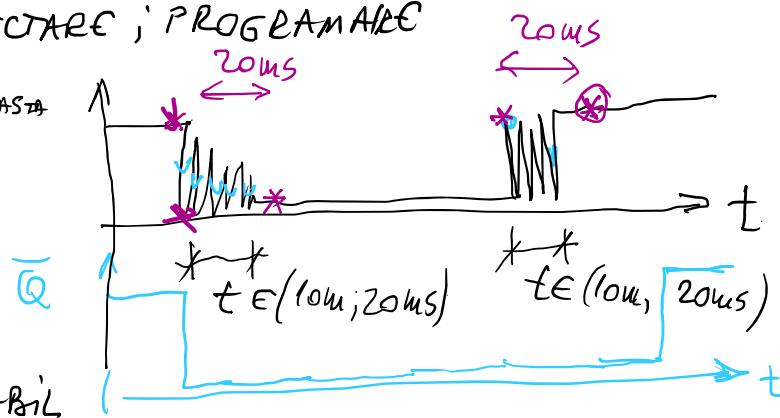
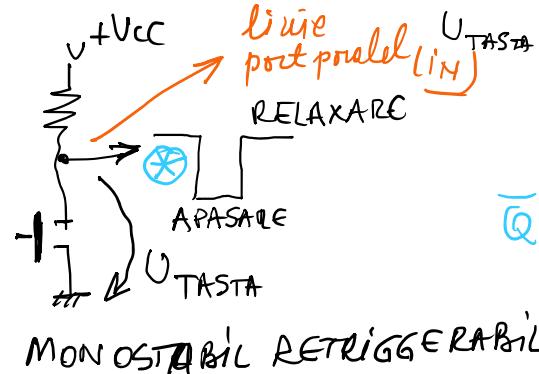
Sublema 1



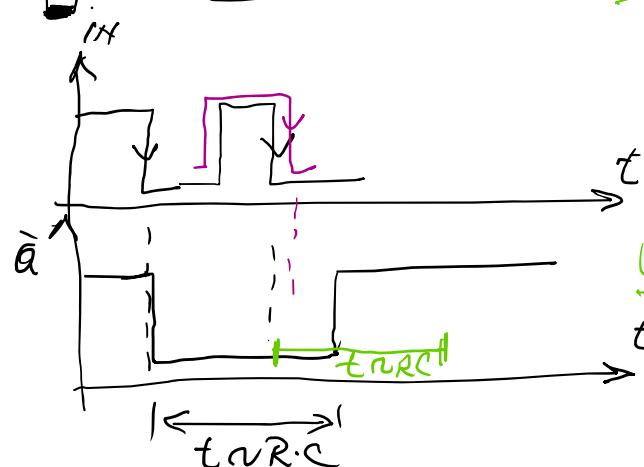
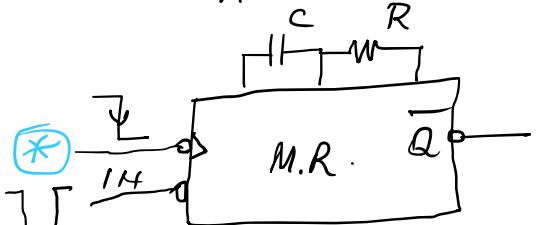
Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
D0-D7	Imagini SW format 7 sg pentru celulele LED	7f(h) – CC; 00(h) – AC (segmente aprinse)	octet (8) – 7 biti utili / octet	30(h) – 37(h)
DBINO-DBIN7	Imagini SW format binar (BCD) pentru celulele LED	08(h)	octet (8) – 4 biti utili / octet	38(h) – 3f(h)
COLO-COL3 (COL)	Imagini SW pentru comenzi pe coloanele comune	01(h) – AC; 0e(h) - CC	4 biti – accesibili individual	20(h) – zona adresabila pe Bit (00h, 01h, 02, 03h)
COLOANA	Indica ce coloana se actioneaza	03 – 00 (4 valori)	Octet	40(h)



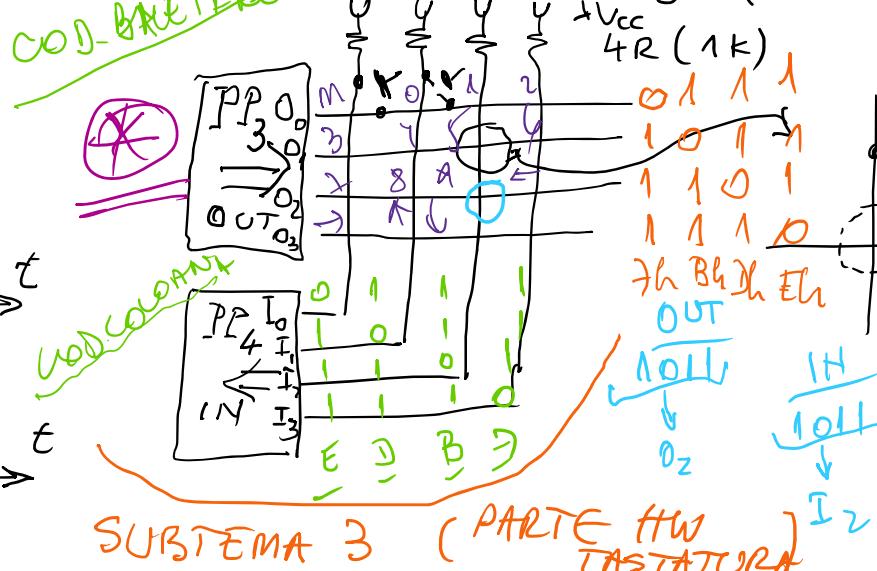
TASTATURA ; CONECTARE ; PROGRAMARE



MONOSTABIL RETRIGGERABIL



COMANDA MULTIPLEXATA
TASTATURA



bounce
debouncing

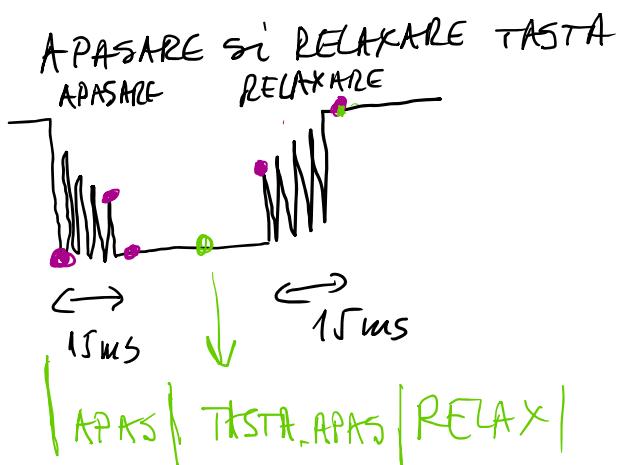
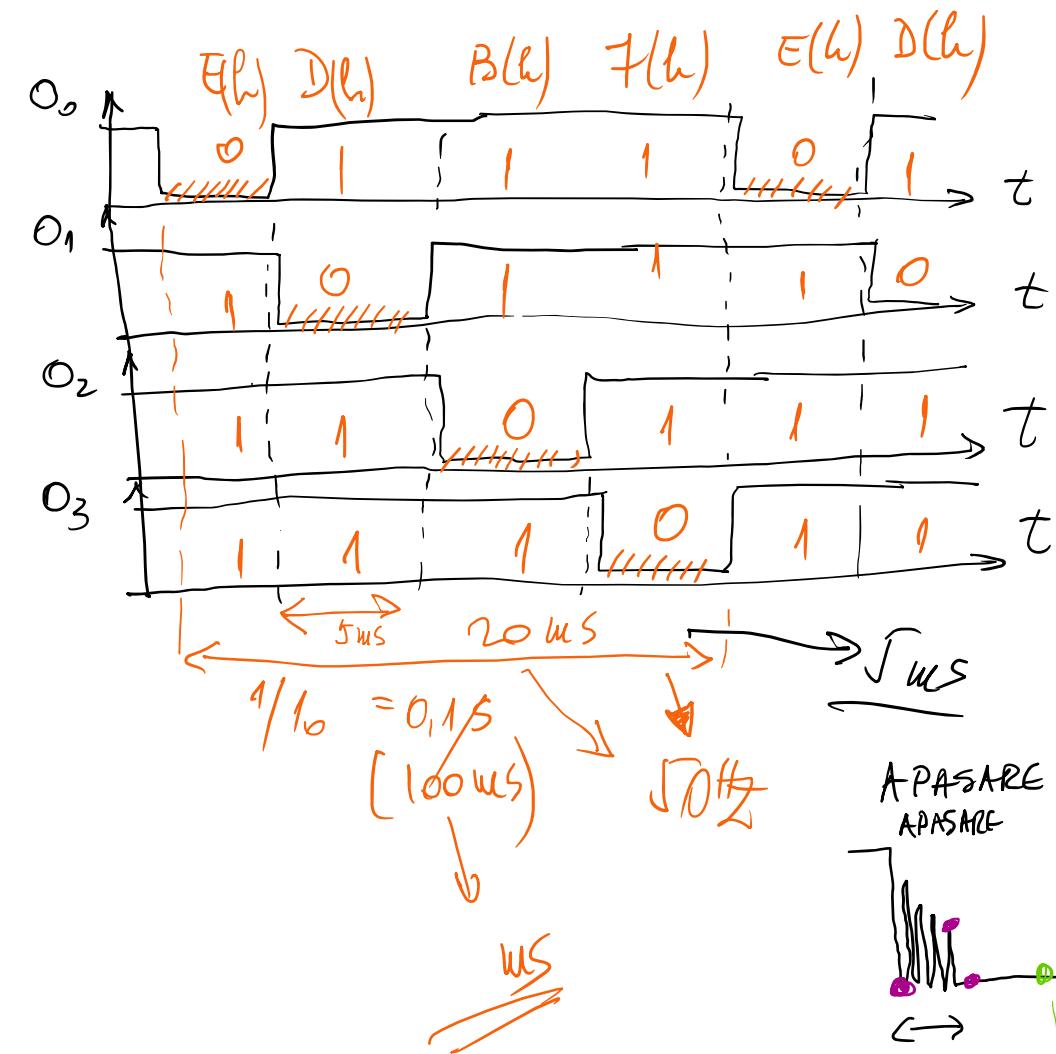


END 12 mar 2024

2OKW - 1 m

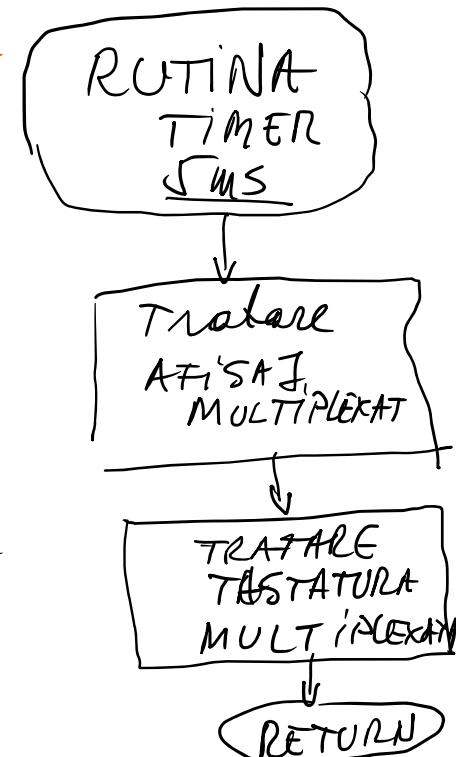
folosire
optimală
linii PP

14 TASTE



Proces de baleiere a tastaturii -

$E \rightarrow D \rightarrow B \rightarrow F \rightarrow E \rightarrow D$



Manual de utilizare al tabelor

Sistemul

- Tabelor are 2 moduri de functionare
 - 1) mod 0 - operare normală
 - 2) mod 1 - programare

Modul se schimbă prin apăsarea tastei M

M modul operare

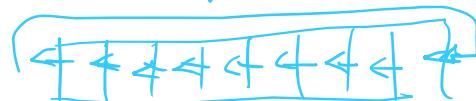
normală

- textul afisat se deplasează către stânga cee urmă de deplasare indicată în fereastra
- supraveghere tastelor M și creșterea mod - nici o altă tastă nu acționează în modul 0 !

Modul programare

- = textul afisat rămâne fix
- = primul digit (deasupra) va clăsi cu timpul indicat în fereastra
- = supraveghere tastele aproapele 0, ..., 9, , ← ↑ → , M ↓
- La tastele 0 ÷ 9 → te programare digitală cu valoarea

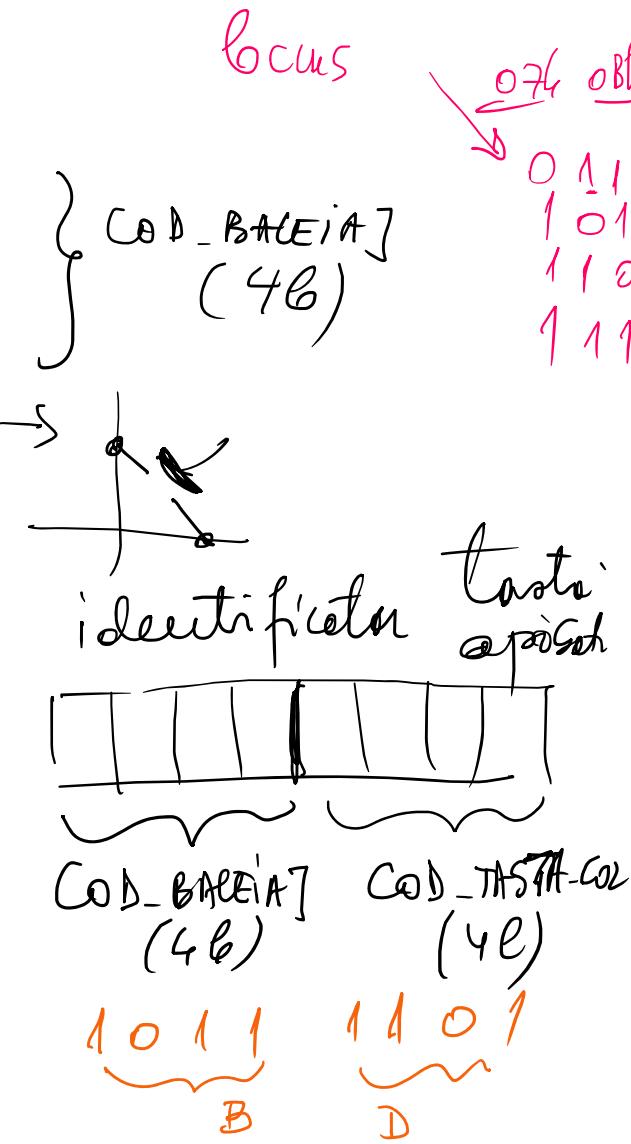
- cu tastele ↑ - incrementare
- ↓ - decrementare
- cu tastele < ⇒ alegera următoarelor digituri care se programă





SEMAPOR-TASTA - indică
textul apăsatoarei crește
Cod-BALEIAJ } tastă
Cod-TASTA-COL } apăsată

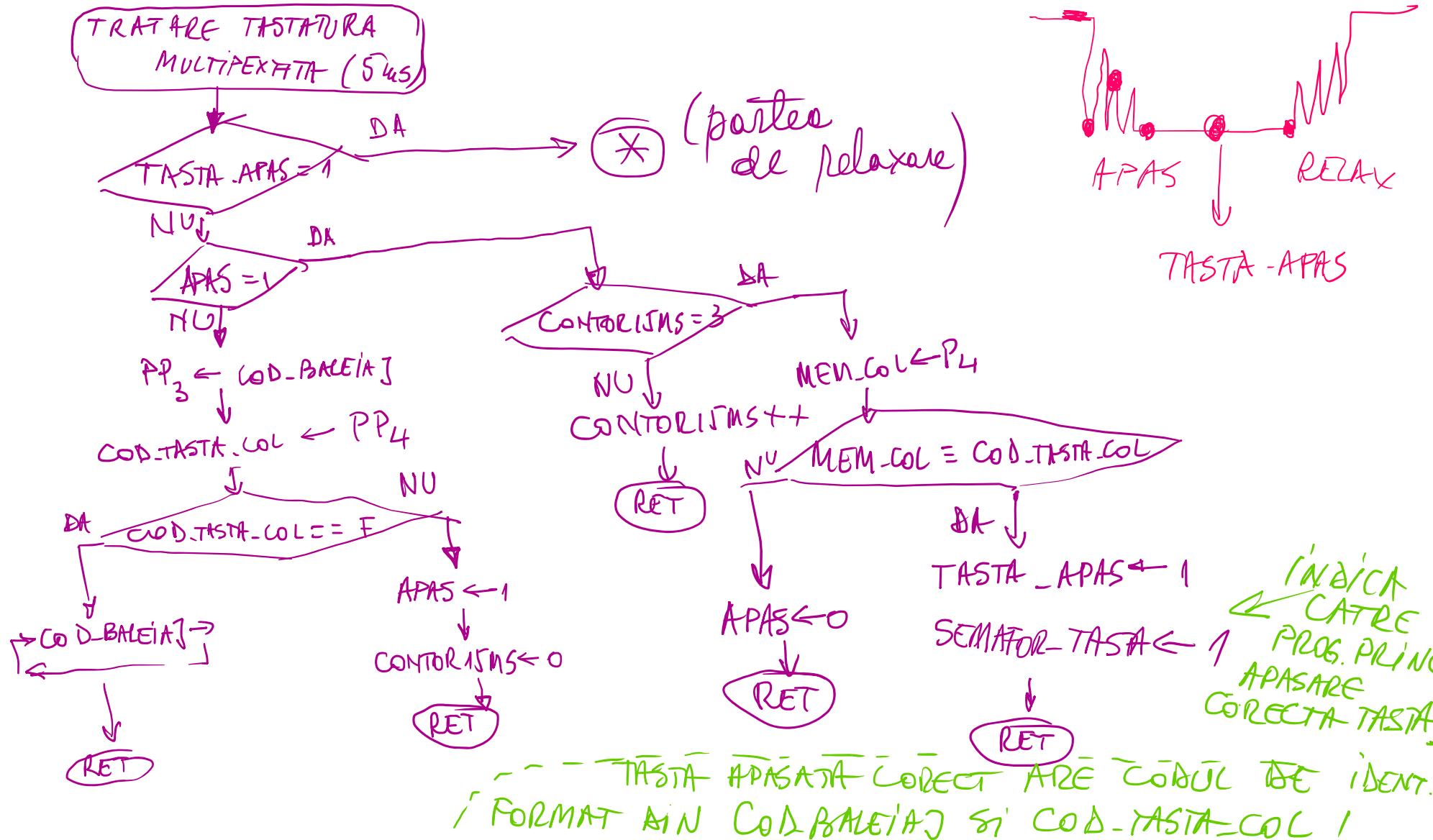
Cod baleiaj \rightarrow
 $\{$ **O7h, OB4h, ODh**
OBh $\}$



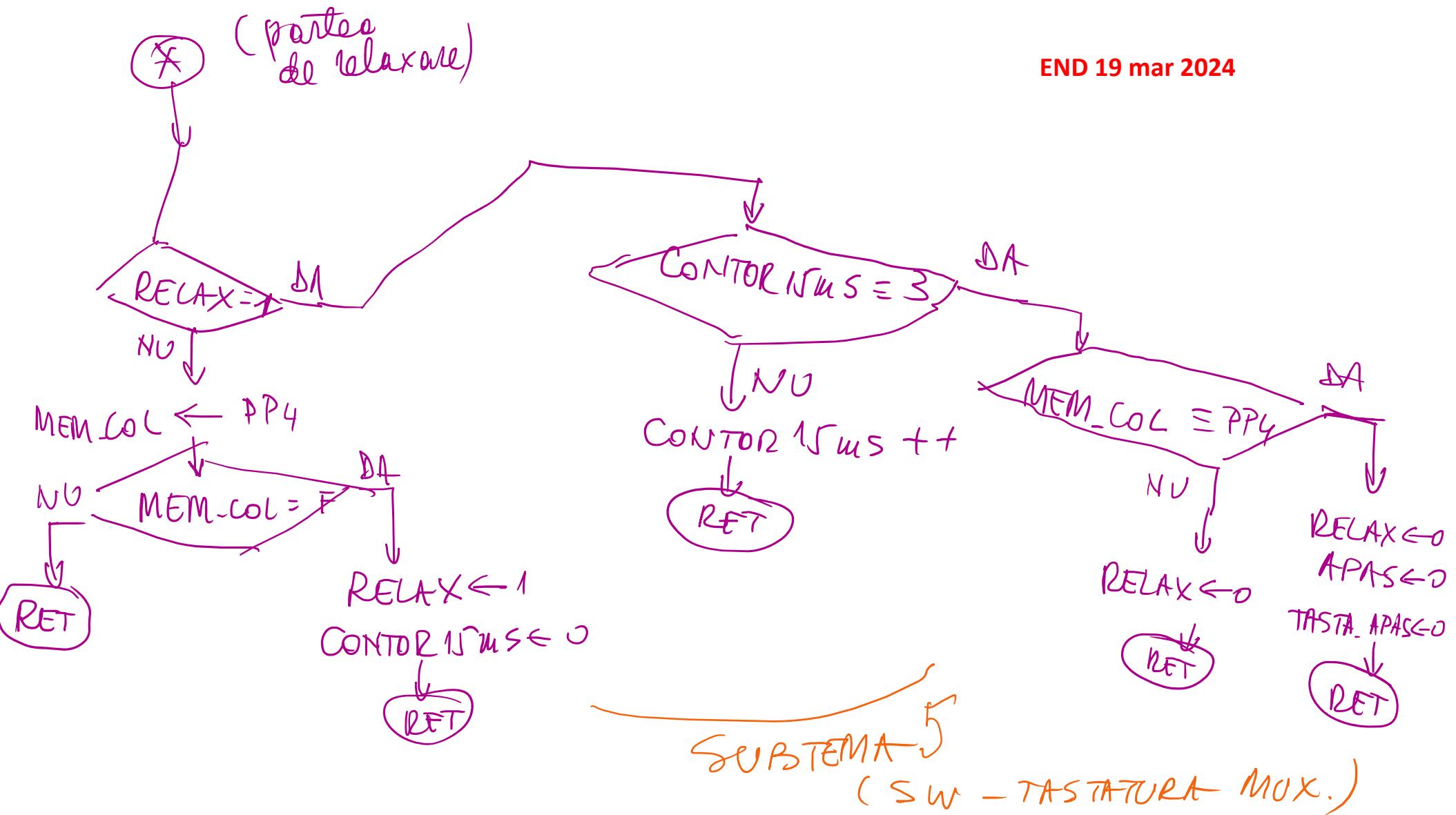
⊗ Sa lucru cu o tastatură este necesar;

- A - identificarea momentului opoziției unei teste
 - B - realizarea unei temperozuri (15 ms) pentru exitatea bouncing-ului
 - C - reverificarea stării de opoziție a testei respective (0)
 - identificarea momentului relaxării unei teste
 - realizarea unei temperozuri (15 ms) pentru exitatea bouncing-ului
 - reverificarea stării de relaxare a testei (1)

④ Prelucrarea unei taste operate de către o altă componentă logică necesită:



END 19 mar 2024



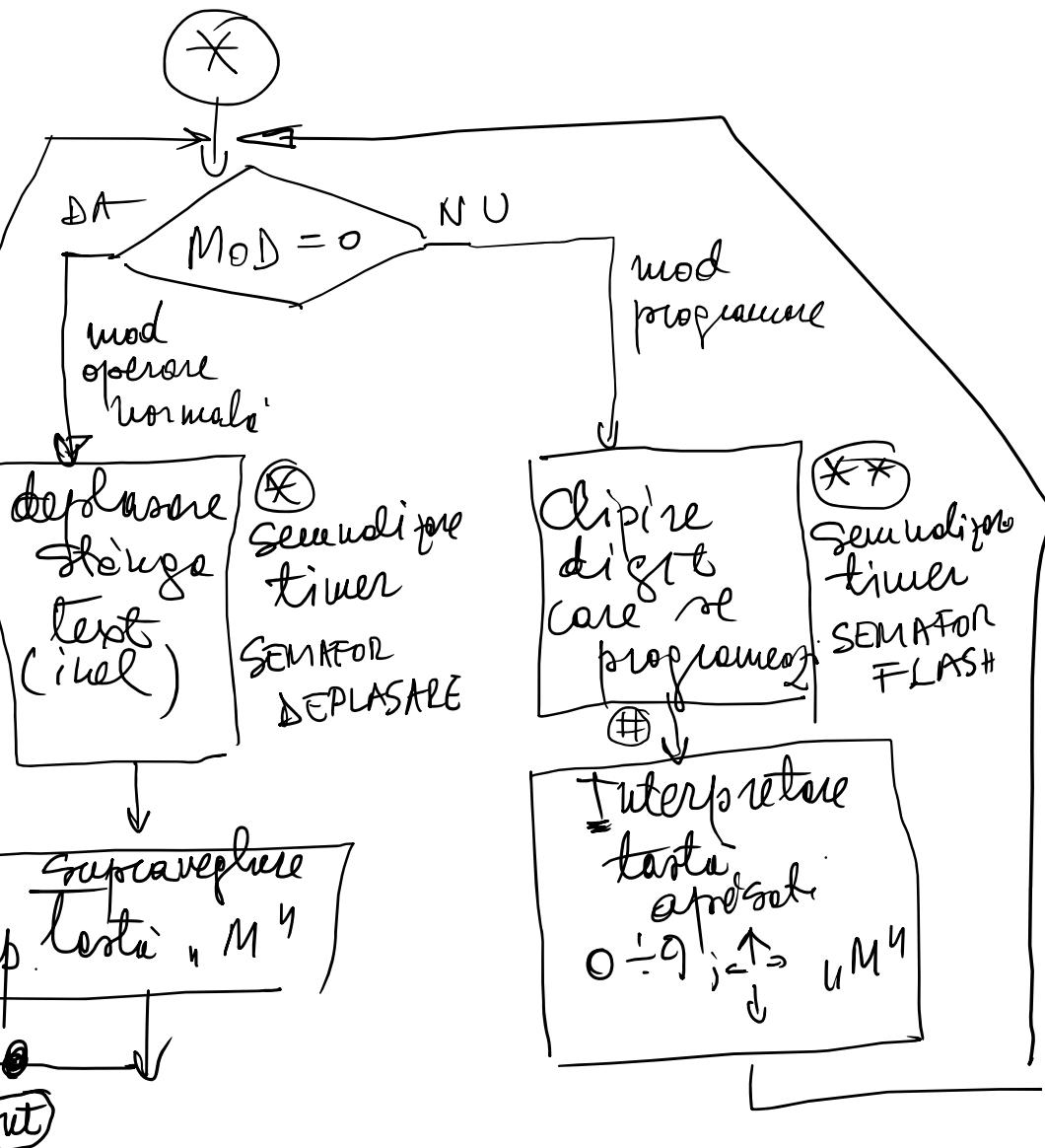
Programul principal

PP
—

initializare
circuite I/O

initializare
lucrare cu
putere

initializare
variabile



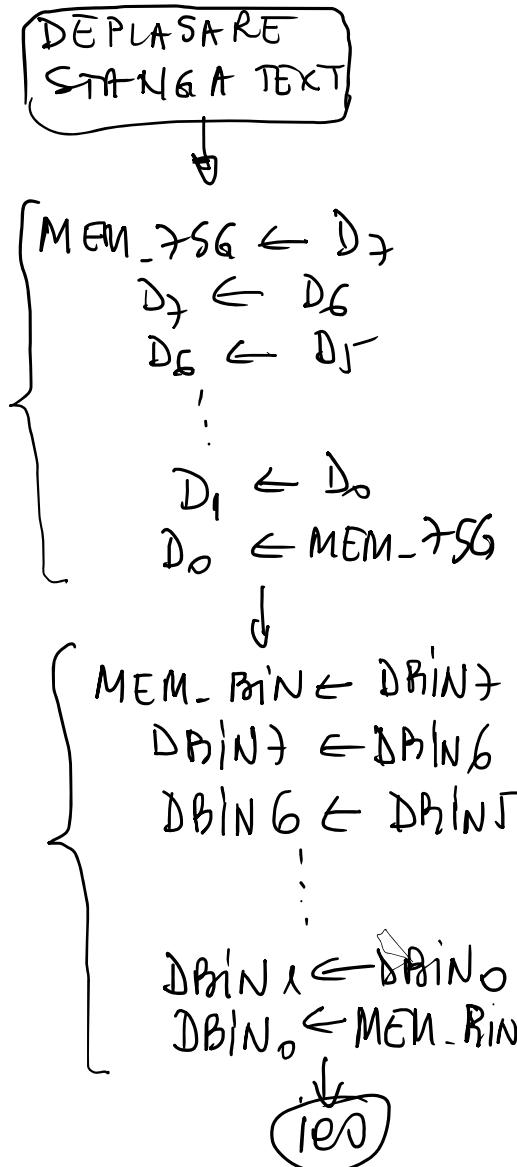
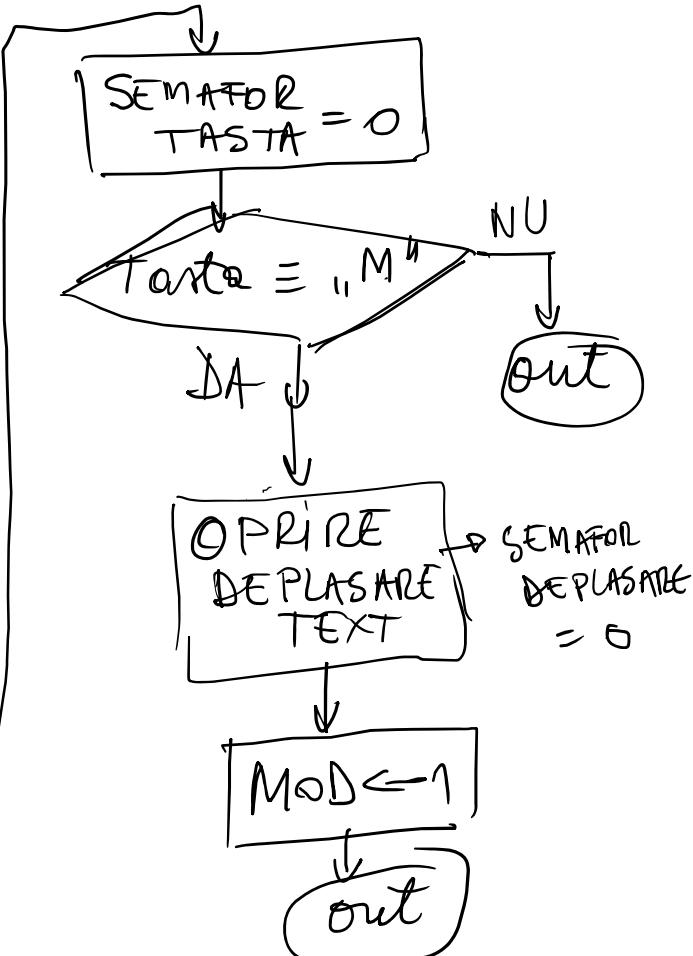
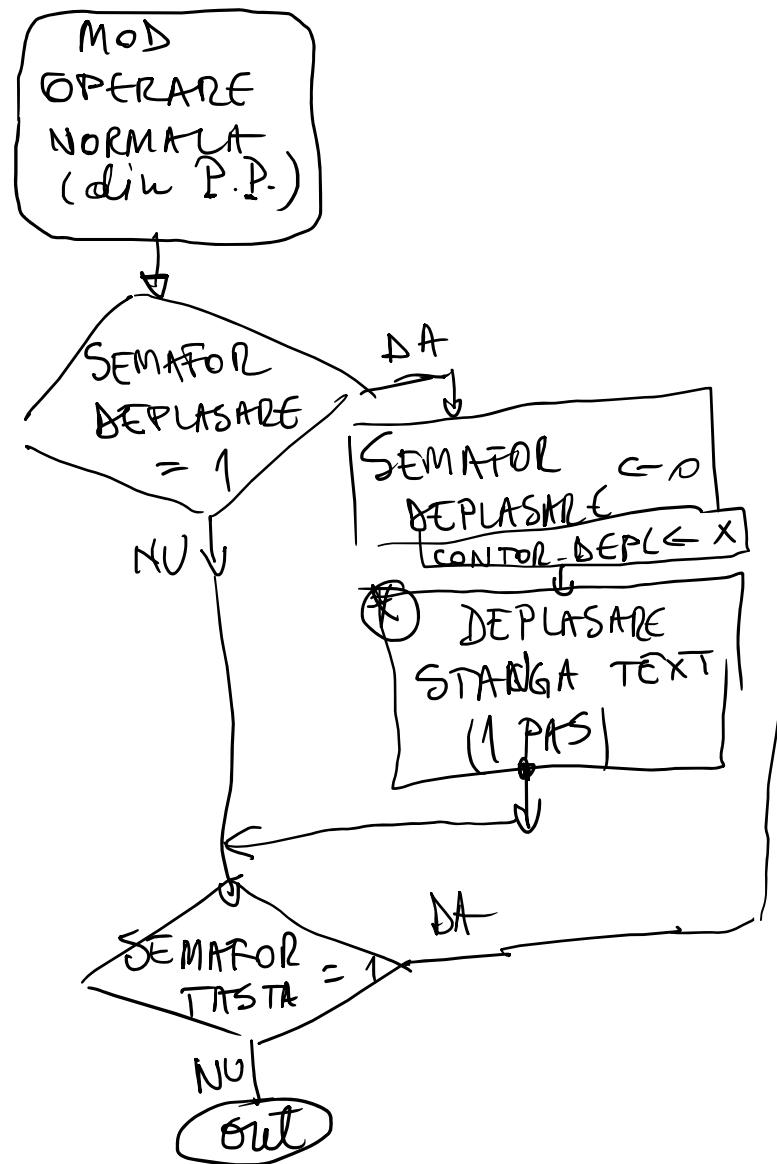
TIMER $\xrightarrow{\text{Sms}}$

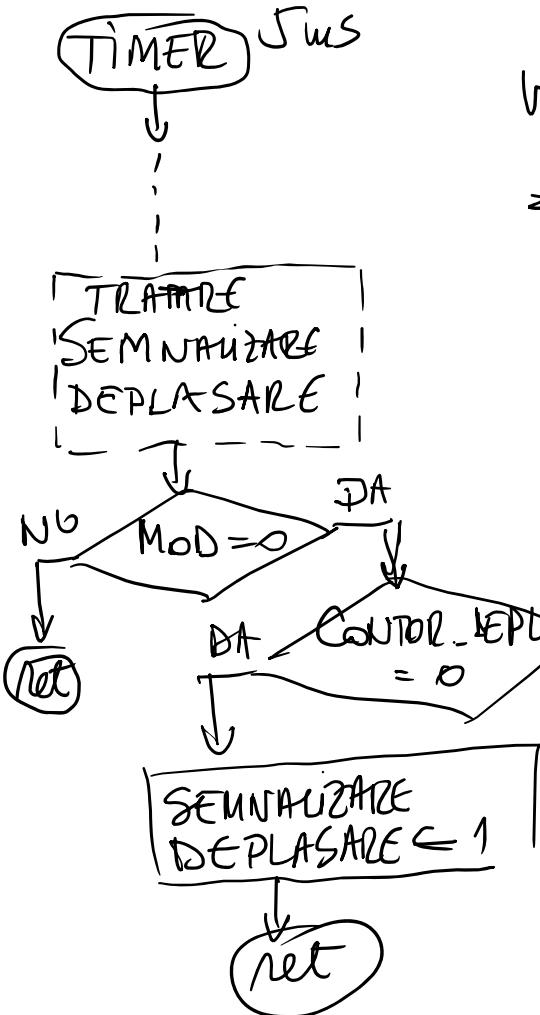
TRATARE
AFISAJ
MULTIPLEXAT

TRATARE
TASTATURA
MULTIPLEXATA

TRATARE
SEMNALIZARE
DEPLASARE
(MOD NORMAL)

TRATARE
SEMNALIZARE
FLASH
MOD PROGRAMARE
RETURNA





Calcul pentru
valoare CONTOR - DEPL

- = seiese de la
viteza de depl
 $v = \frac{nr. corect}{s}$

- = se deduce timpul
de schimbare (deplasare)

$$t = \frac{1}{f}$$

- = valoarea
CONTOR - DEPL

$$= \frac{1/f}{Sum}$$

etalonul
cu care măsur
timpul

$$\begin{aligned} &\text{ex } 4 \text{ corect/s} \\ &v = 4 \text{ /s} \\ &t = \frac{1}{4} \\ &\text{CONTOR} = \frac{1000}{4 \cdot 5} = \\ &= 50 \text{ } \textcircled{v} \end{aligned}$$

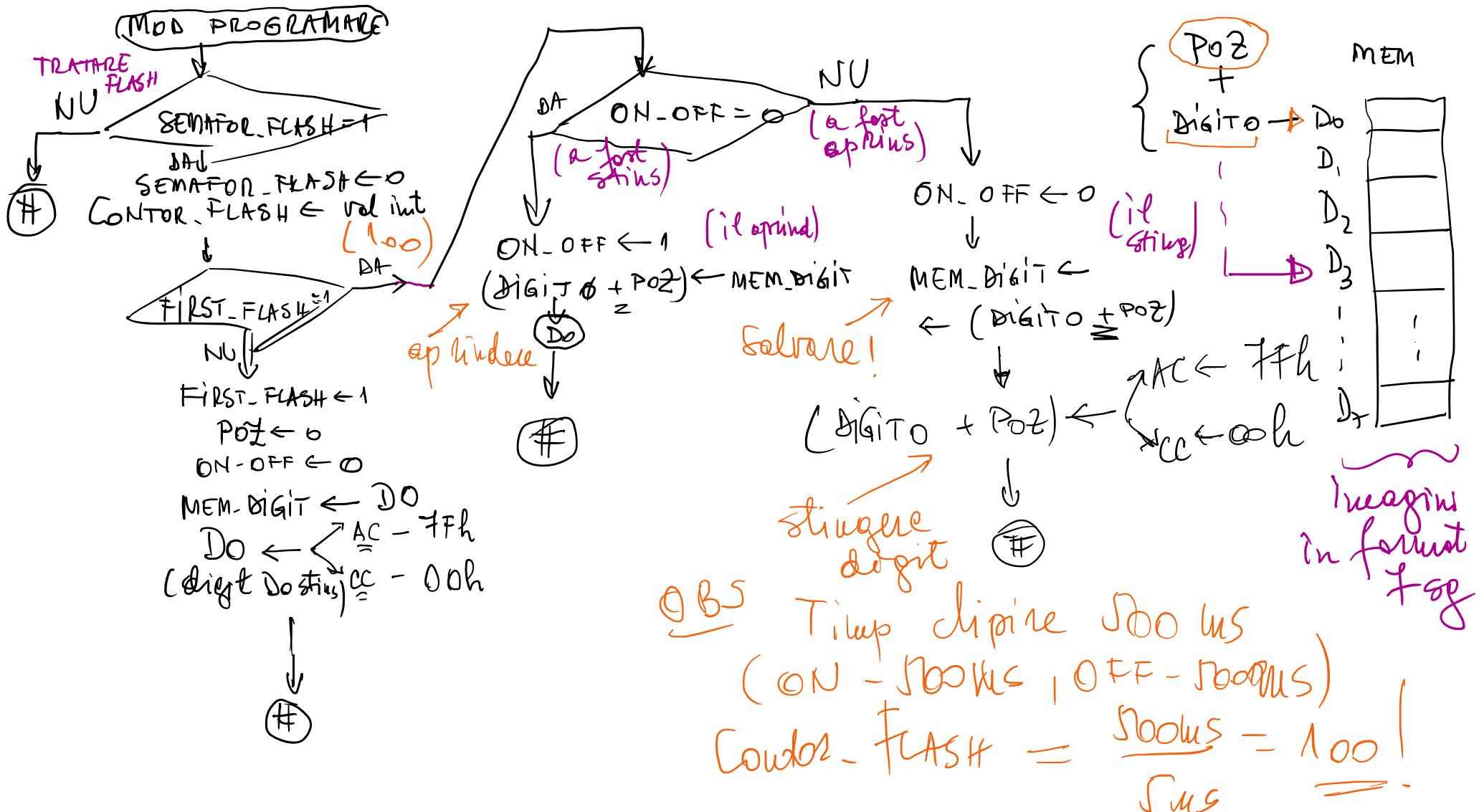
PROBLEMA

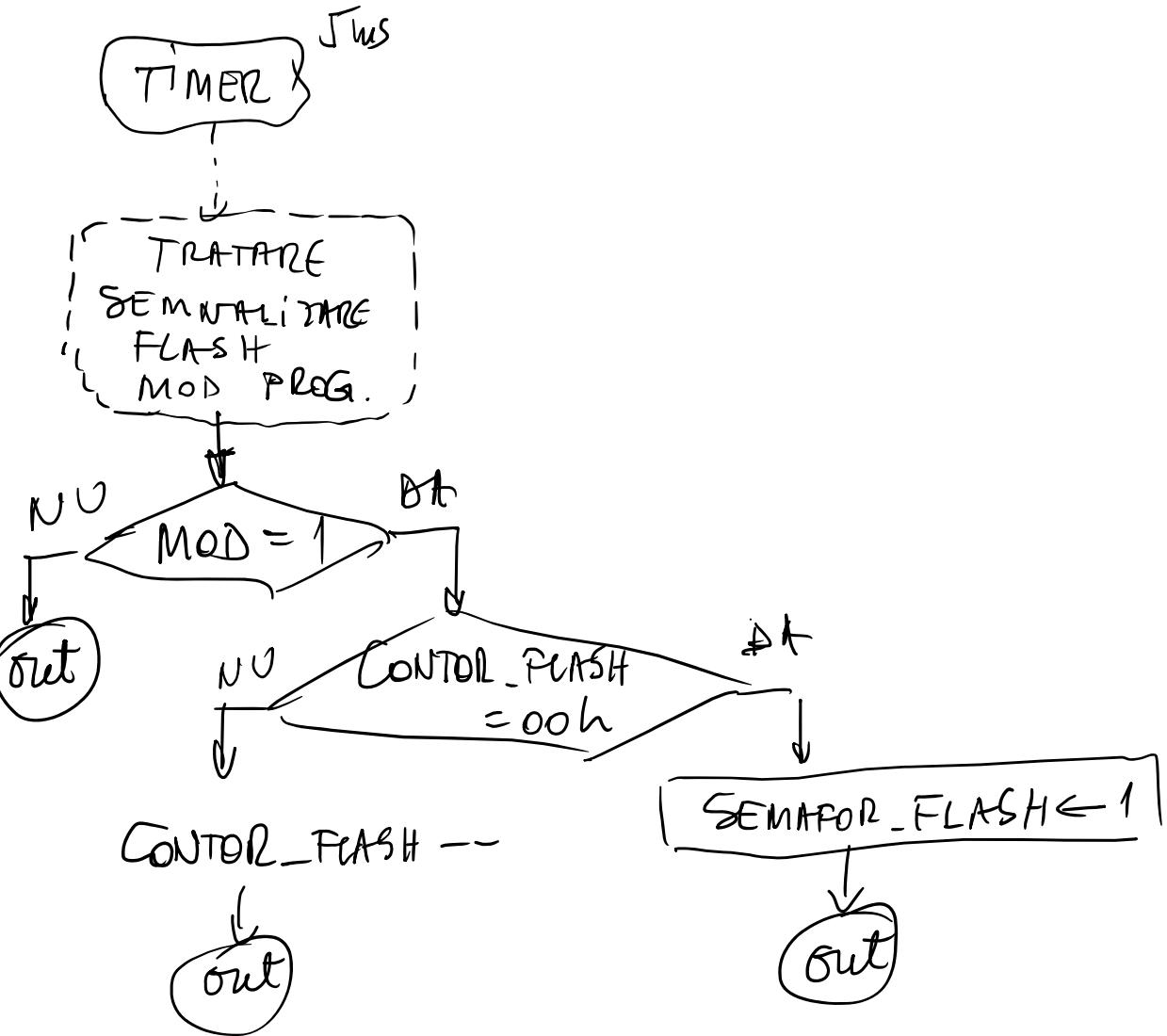
- verificarea operației
cu variabila CONTOR - DEPL

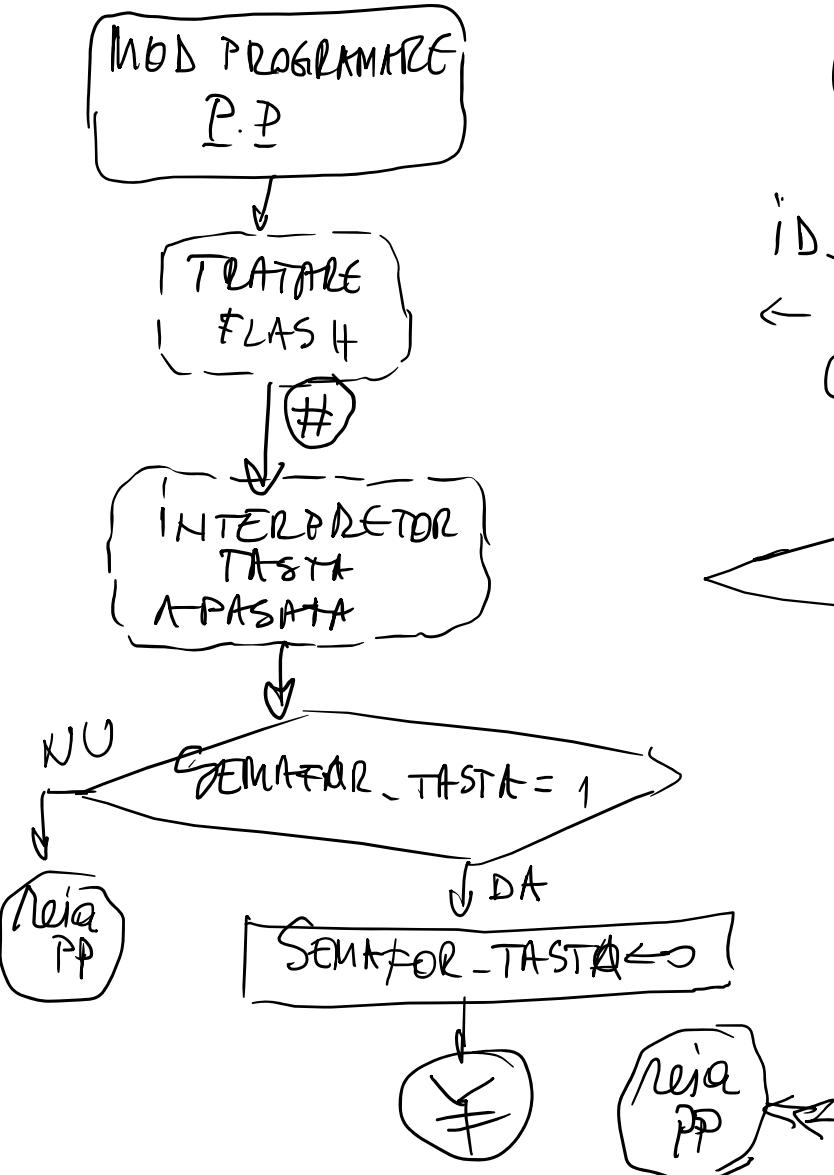
Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
D0-D7	Imagini SW format 7 sg pentru celulele LED	7f(h) – CC; 00(h) - AC	octet (8)	30(h) – 37(h)
DBINO-DBIN7	Imagini SW format binar pentru celulele LED	08(h)	octet (8)	38(h) – 3f(h)
COLO-COL3 (COL)	Imagini SW pentru comenzi pe coloanele comune	01(h) – AC; 0e(h) - CC	4 biti – accesibili individual	20(h) – zona adresabila pe Bit (00h, 01h, 02, 03h)
COLOANA	Indica ce coloana se actioneaza	01(h) – AC; 0e(h) - CC	Octet	40(h)
COD_BALEIAJ	Codul transmis pe liniile matricii de taste	0E(h) ; 0E – 0D – 0B – 07	Octet (4 biti)	41(h)
APAS	Semafor inceput apasare tasta	0	bit	21(h) – bit 08h
CONTOR15ms	Contor 15 ms	X (valori intre 0 si 3)	octet	42(h)
TASTA_APAS	Semafor tasta correct apasata	0	bit	21(h) – bit 09h
RELAX	Semafor inceput relaxare tasta	0	Bit	21(h) – bit 0Ah
COD_TASTA_COL	Codul de coloana matrice taste initial	x	Octet (4 biti)	43(h)
MEM_COL	Codul de coloana matrice taste dupa 15 ms	x	Octet (4 biti)	44(h)

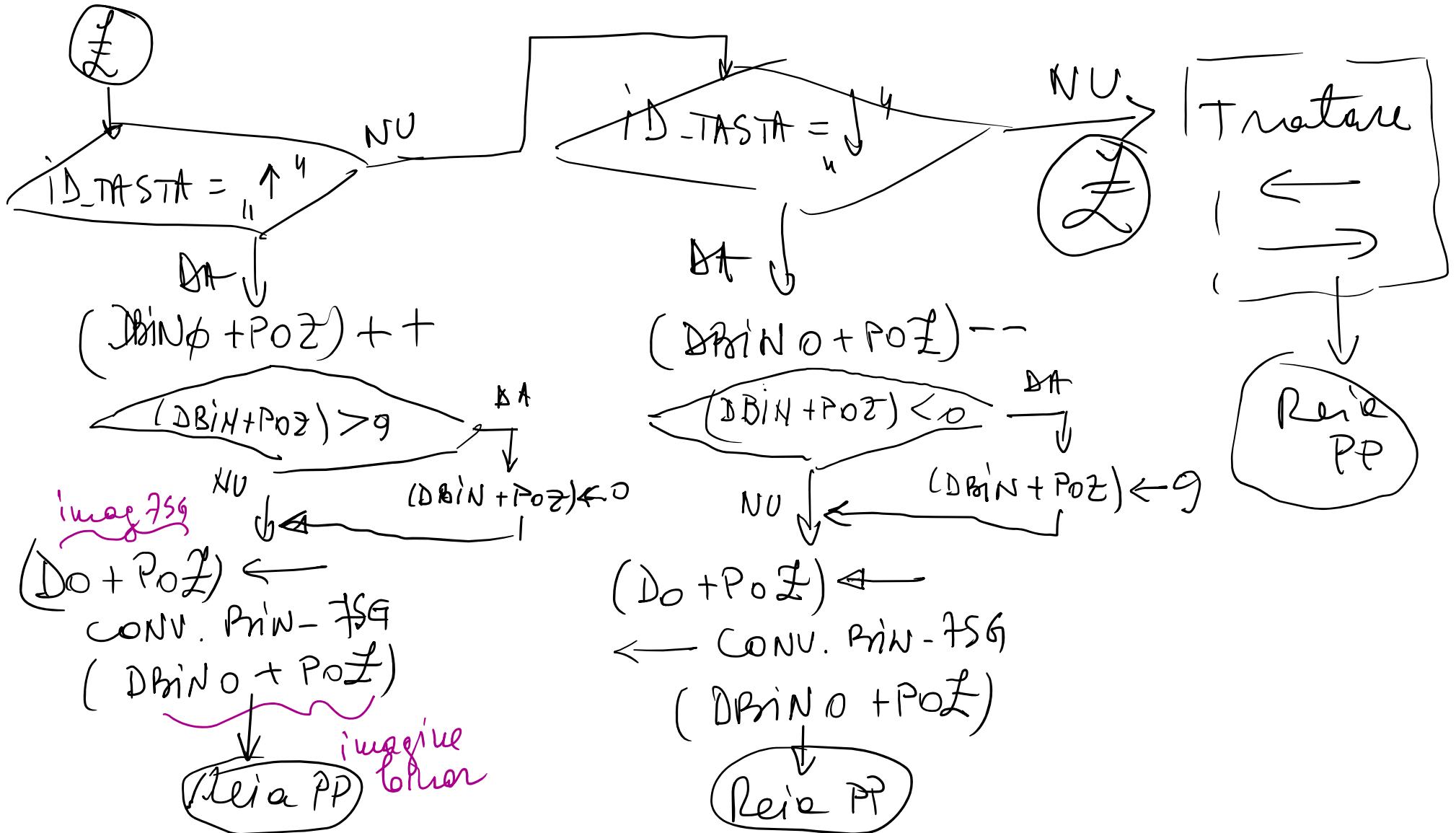
END 26 mar 2024

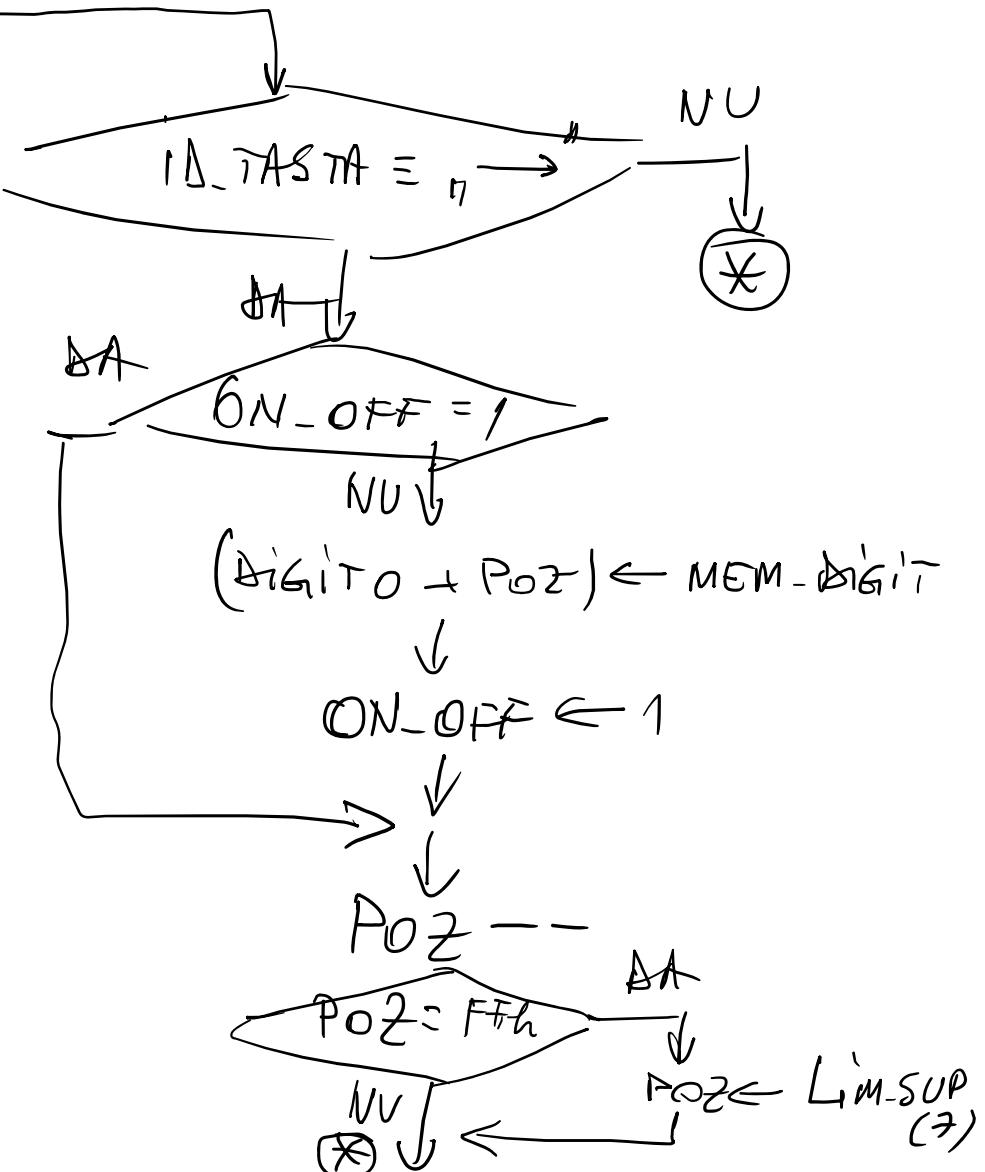
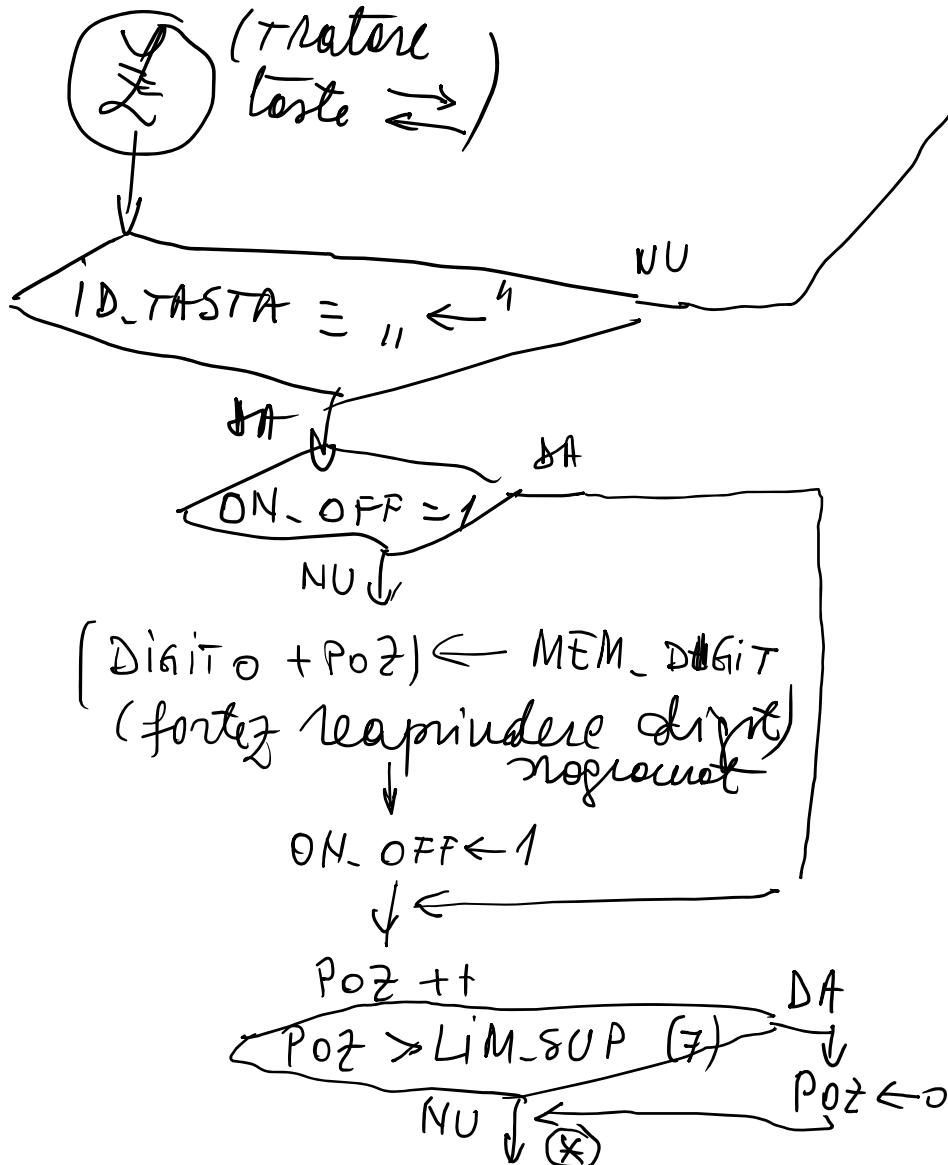
Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
SEMAFOR_TASTA	Tasta apasata corect identificata (catre programul principal)	0	bit	21(h) – bit 0Bh
MOD	Imagine SW a modului de operare curent	0	bit	21(h) – bit 0Ch
SEMAFOR_DEPLASARE	Indica momentul de timp cand se face deplasare stanga (mod op. norm)	0	bit	21(h) – bit 0Dh
SEMAFOR_FLASH	Indica momentul de clipere digit programat (mod prog)	0	bit	21(h) – bit 0Eh
Mem_7sg	Memoreaza o variabila imagine 7 sg pentru digitii deplasati	x	octet	45(h)
Mem_bin	Memoreaza o variabila imagine bin pentru digitii deplasati	x	octet	46(h)
Contor_depl	Cronometrare timp deplasare	Trebuie calculate din datele de proiectare (de ex. la viteza de 5 caractere /sec, semnaiizarea trebuie facuta la 1/5 = 200ms ... 40 = 28h)	Octet	47(h)











PAS 1

- Sch. HW - ravanca frusts !

PAS 2

- organigraue SW

PAS 3

- Implementare in
trasej A SM în
organigrauelor

Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
D0-D7	Imagini SW format 7 sg pentru celulele LED	7f(h) – CC; 00(h) - AC	octet (8)	30(h) – 37(h)
DBINO-DBIN7	Imagini SW format binar pentru celulele LED	08(h)	octet (8)	38(h) – 3f(h)
COLO-COL3 (COL)	Imagini SW pentru comenzi pe coloanele comune	01(h) – AC; 0e(h) - CC	4 biti – accesibili individual	20(h) – zona adresabila pe Bit (00h, 01h, 02, 03h)
COLOANA	Indica ce coloana se actioneaza	01(h) – AC; 0e(h) - CC	Octet	40(h)
COD_BALEIAJ	Codul transmis pe liniile matricii de taste	0E(h) ; 0E – 0D – 0B – 07	Octet (4 biti)	41(h)
APAS	Semafor inceput apasare tasta	0	bit	21(h) – bit 08h
CONTOR15ms	Contor 15 ms	X (valori intre 0 si 3)	octet	42(h)
TASTA_APAS	Semafor tasta correct apasata	0	bit	21(h) – bit 09h
RELAX	Semafor inceput relaxare tasta	0	Bit	21(h) – bit 0Ah
COD_TASTA_COL	Codul de coloana matrice taste initial	x	Octet (4 biti)	43(h)
MEM_COL	Codul de coloana matrice taste dupa 15 ms	x	Octet (4 biti)	44(h)

Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
SEMAFOR_TASTA	Tasta apasata corect identificata (catre programul principal)	0	bit	21(h) – bit 0Bh
MOD	Imagine SW a modului de operare curent	0	bit	21(h) – bit 0Ch
SEMAFOR_DEPLASARE	Indica momentul de timp cand se face deplasare stanga (mod op. norm)	0	bit	21(h) – bit 0Dh
SEMAFOR_FLASH	Indica momentul de clipere digit programat (mod prog)	0	bit	21(h) – bit 0Eh
Mem_7sg	Memoreaza o variabila imagine 7 sg pentru digitii deplasati	x	octet	45(h)
Mem_bin	Memoreaza o variabila imagine bin pentru digitii deplasati	x	octet	46(h)
Contor_depl	Cronometrare timp deplasare	Trebuie calculate din datele de proiectare (de ex. la viteza de 5 caractere /sec, semnaiizarea trebuie facuta la 1/5 = 200ms ... 40 = 28h)	Octet	47(h)

Nume variabila	Semnificatie	Valoarea de initializare	Mod de reprezentare	Adresa de stocare in memorie RAM
First_flash	Inceputul clipirii	0	bit	21(h) – bit 0Fh
On_off	Imaginea sw a digitului care clipeste	0 – off; 1 - on	bit	22(h) – bit 10h
poz	Indica digitalul care se programeaza (clipeste)	0 (are valori intre 0 si 7 – nr digit)	octet	48(h)
Mem_digit	Imagine sw a digit programat (format 7sg)	x	octet	49(h)
Contor_flash	Contorizeaza timpul de flash	Da, trebuie calculate (val.init)	octet	4A(h)
ID_tasta	Codul de identificare a tastei apasate (erunione intre cod_baleiaj si cod_tasta_col)	X (trebuie realizat tabelul de corespondenta dintre tasta si variabila ID_tasta)	octet	4B(h)

END proiect 5 mai 2024