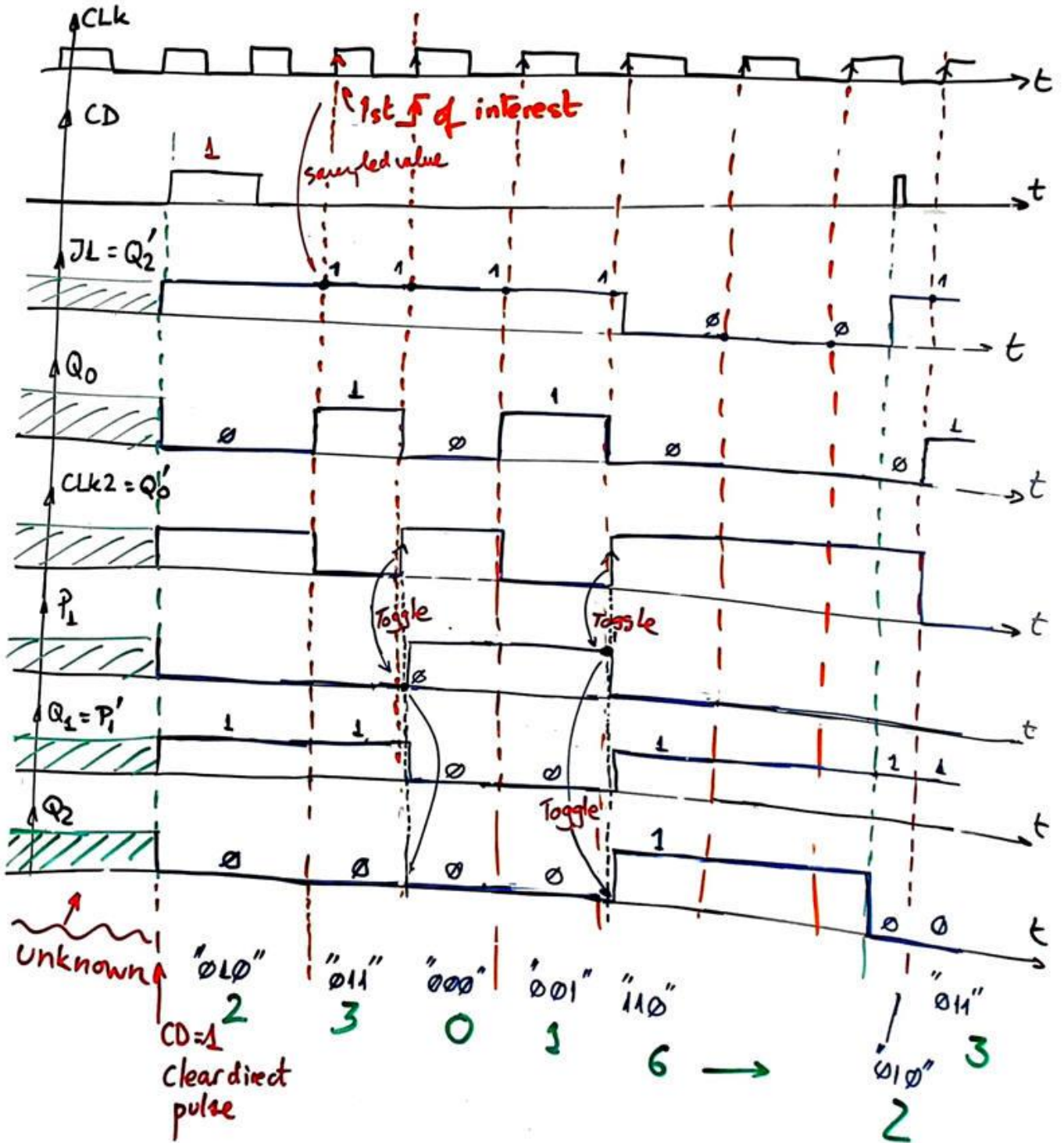
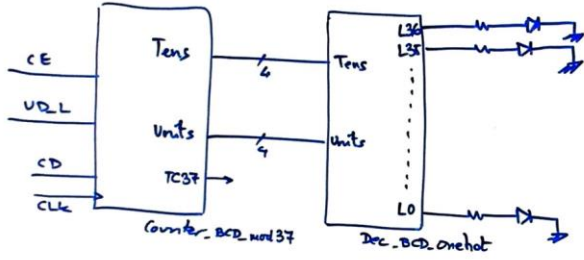


Ideas on the exam solution
 Problem 1 (full discussion in [P5](#))



Problem 2



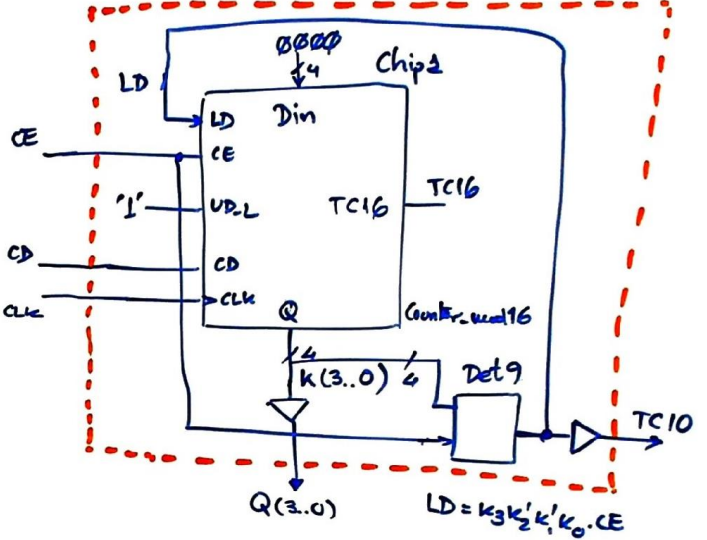
Two digit modulo 37 BCD up/down counter function table

CE	UD.L	T ⁺	U ⁺	Function
0	x	T	U	Do nothing
1	1	$(T U) + 1$		mod 37 BCD
1	0	$(T U) - 1$		mod 37 BCD

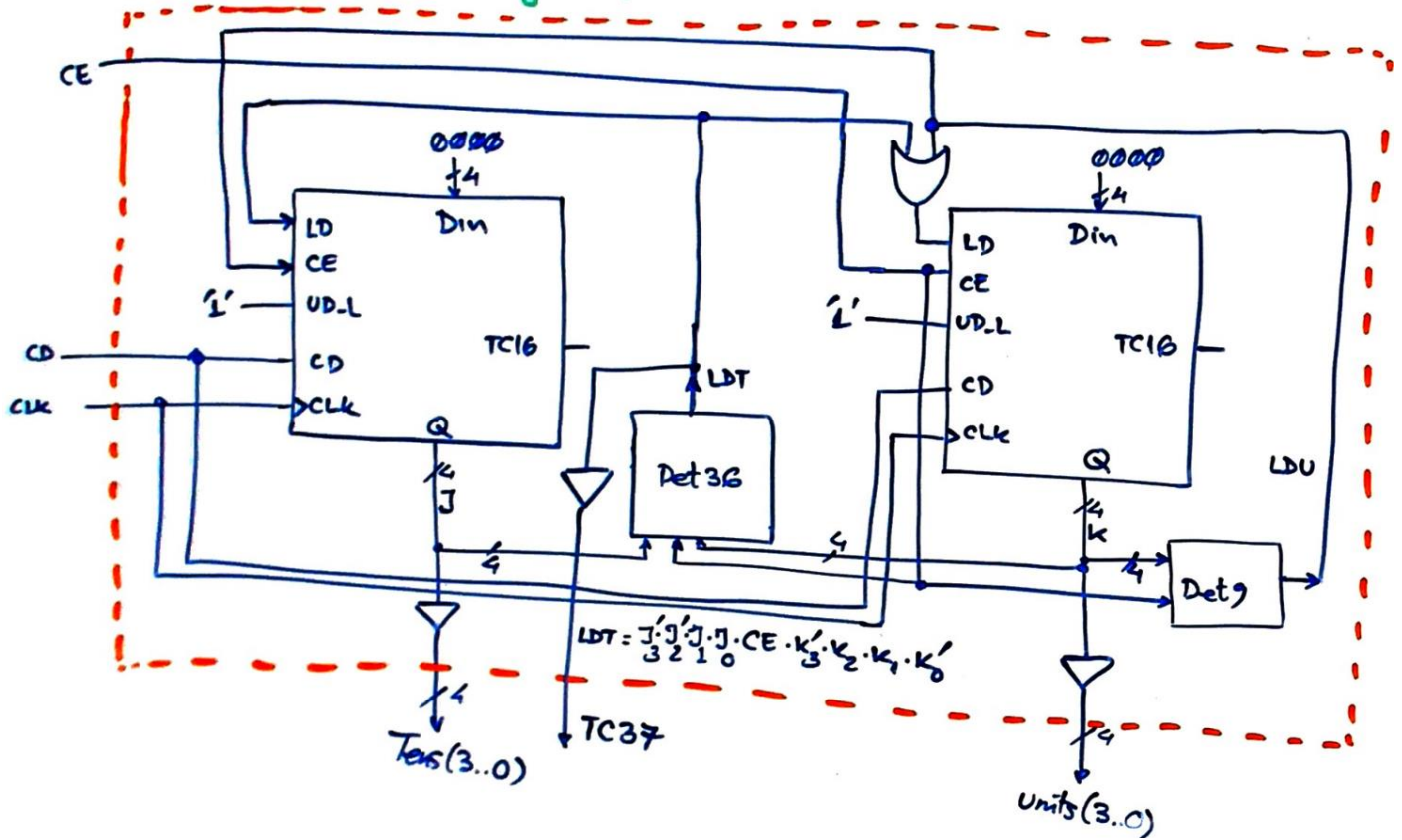
Decoder truth table

T	U	L36	L35	...	L1	L0
0	0	0	0	...	0	1
0	1	0	0	...	0	0
...
3	5	0	1	0	...	0
3	6	1	0	...	0	0
3	7	x	x	...	x	x
9	9	x	x	...	x	x

BCD 1-digit up counter

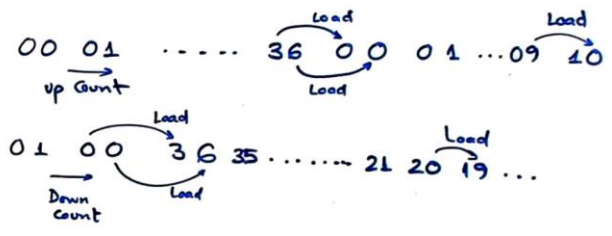


BCD 2-digit up counter modulo 37

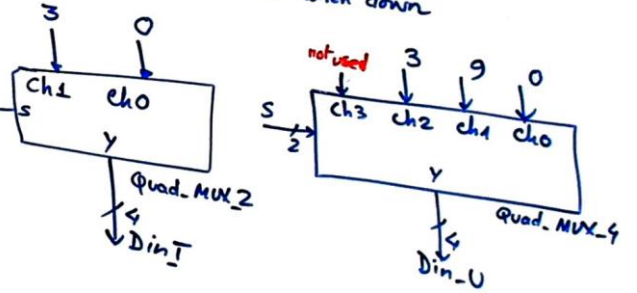


using MUX and selection logic several numbers can be loaded

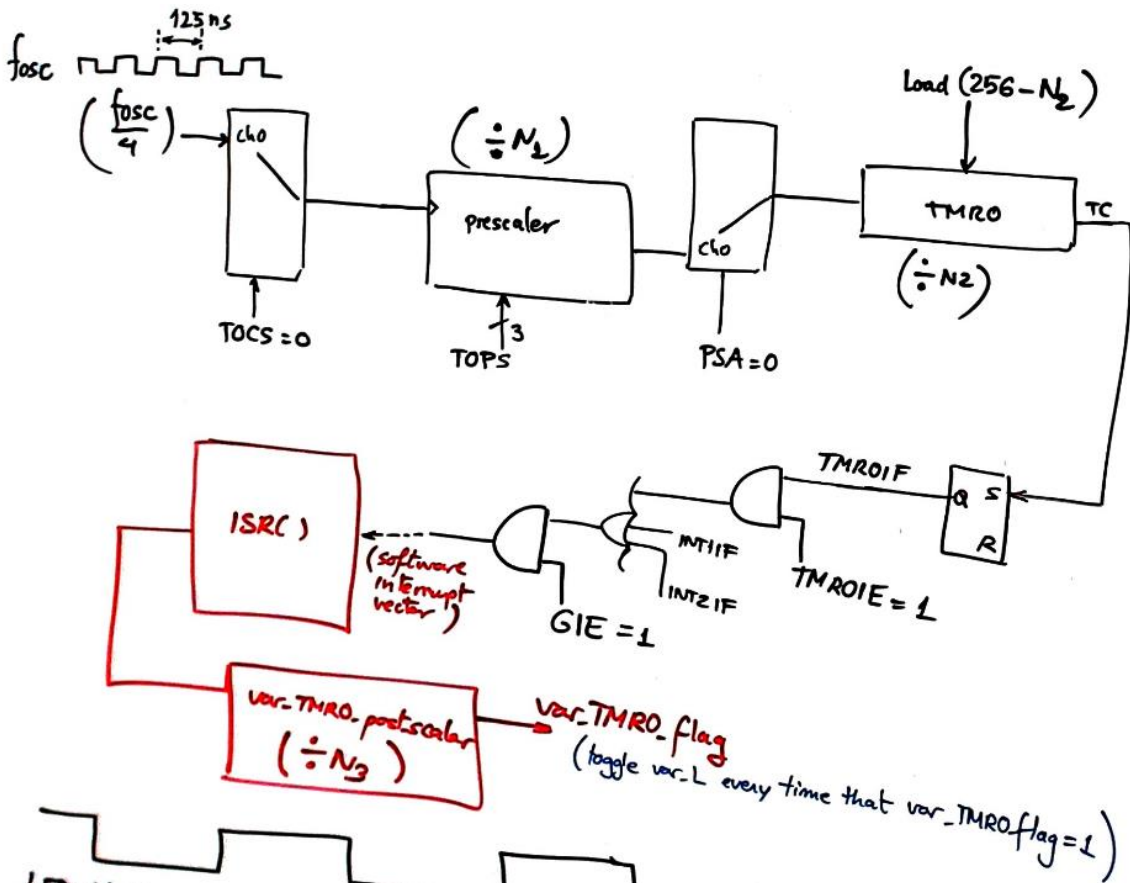
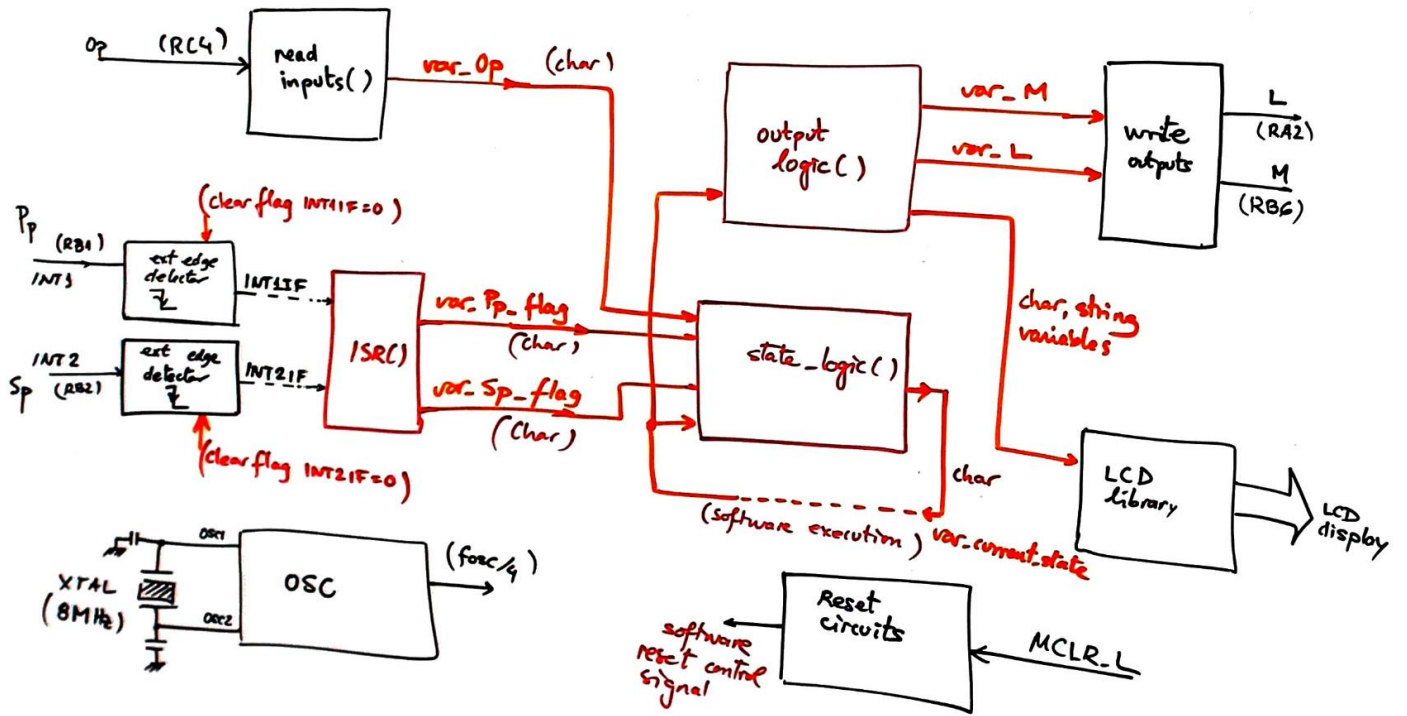
When 36 and UP → LDT → 0
 LDU → 0
 when 00 and DOWN → LDT = 3
 LDU = 6



Din units Load 0 when UP
 Load 9 or 6 when DOWN
 Din tens Load 0 when UP
 Load 3 when DOWN



Problem 3



$$T_p = 200 \text{ ms} = \left(\frac{4}{f_{osc}} \right) \cdot N_1 \cdot N_2 \cdot N_3 \cdot \underbrace{100}_{\text{post-scaler, max-value}} = (2 \text{ ms}) \cdot 100$$

$\underbrace{\left(\frac{4}{f_{osc}} \right) \cdot N_1 \cdot N_2}_{\text{TMROIF every 2ms}}$
 $N_1 = 32$
 $N_2 = 125$