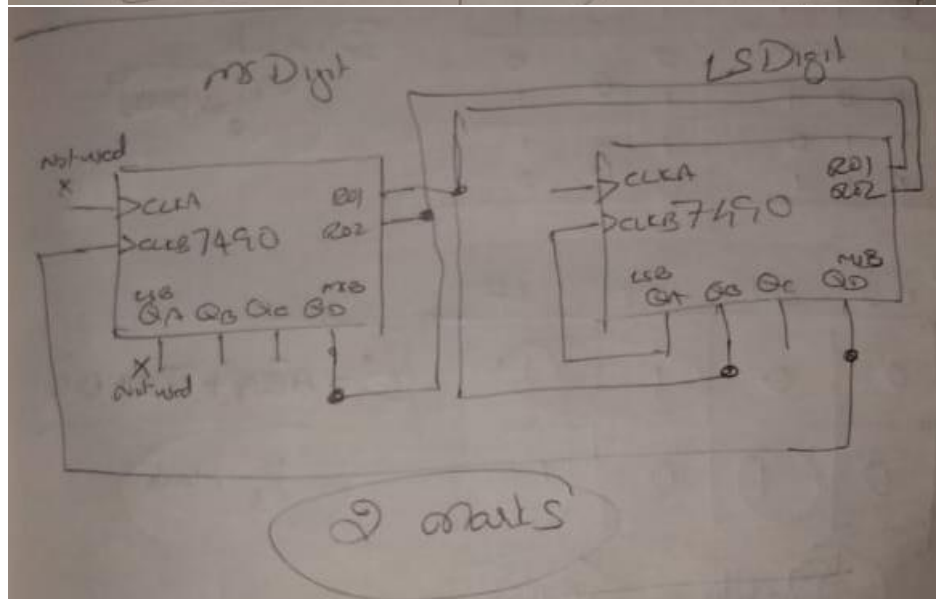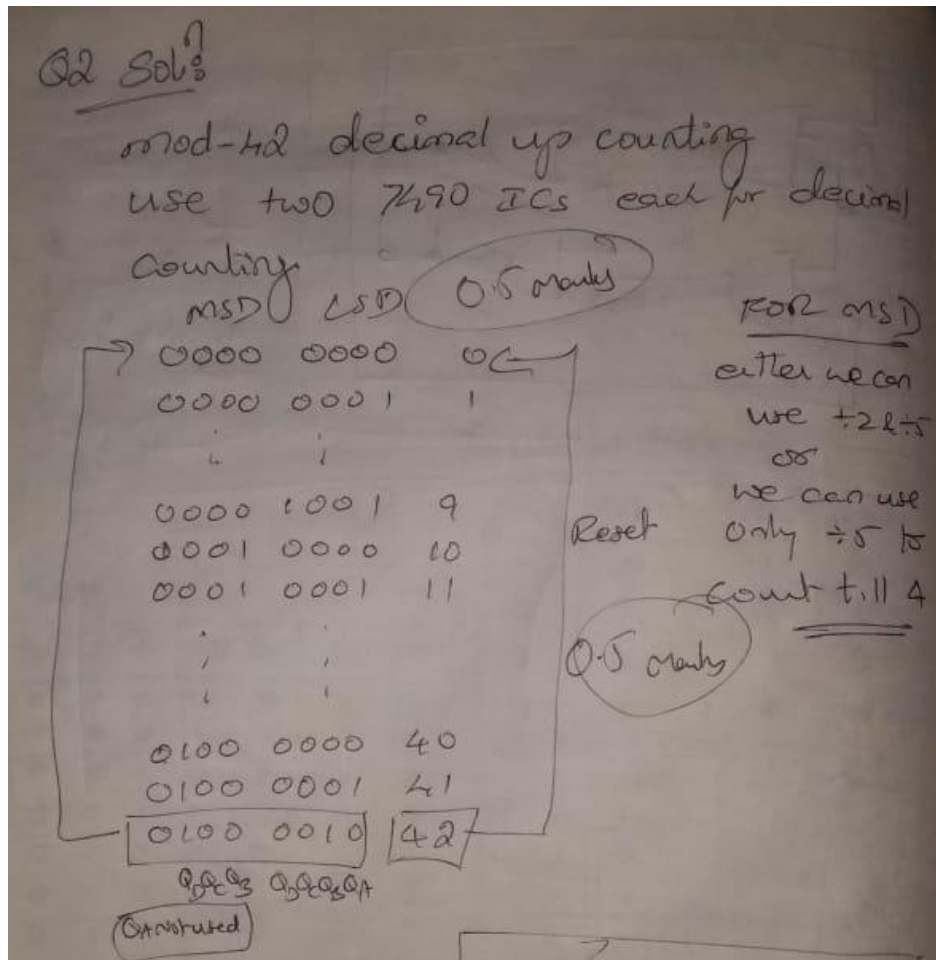**Q2.** Construct a mod-42 decimal up counting circuit using only asynchronous ICs. Draw the logic diagram.   3 Marks

Q2 Sol:

mod-42 decimal up counting
use two 7490 ICs each for decimal
counting

MSD LSD ⟨0.5 marks⟩

FOR MSD
either we can
use ÷2 & ÷5
or
we can use
only ÷5 to
count till 4

MSD	LSD		
0000	0000	0	
0000	0001	1	
⋮	⋮		
0000	1001	9	
0001	0000	10	Reset
0001	0001	11	
⋮	⋮		
0100	0000	40	
0100	0001	41	
0100	0010	42	

QₐQ_c Q_BQ_A

⟨Constructed⟩

⟨0.5 marks⟩

MS Digit   LS Digit

⟨2 marks⟩

Q4. Function table defines the working of a fictious AB flip flop. Design the AB flip flop using D flip flop and external gates. **3 Marks**

A	B	Q(t+1)
0	0	0
0	1	1
1	0	Q
1	1	Q'

A   Q
B
Clk

Q4.

A	B	Q(t)	Q(t+1)	input D
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	0	0
1	0	1	1 (Q)	1
1	1	0	1 (Q̄)	1
1	1	1	0 (Q̄)	0

Table ½ Mark

D input ½ marks

A\BQ	00	01	11	10
0	0	0	1	1
1	0	1	0	1

$D = \bar{A}BQ + \bar{A}B + B\bar{Q}$

½ marks

½ marks

Grouping ½ Mark

Entry

Circuit ½ marks

Q5. Design a T flip flop using a basic NOR latch and gates

Q5 Design a T flip flop using a basic NOR latch

Functional Table of T Flip/flop

Clk	T	Q(t+1)
0	X	No change
1	0	No change
1	1	Toggle ½

NOR-Latch Active high latch

Set	Reset	Q(t+1)
0	0	Q(t) No change
0	1	0 Reset
1	0	1 Set
1	1	Invalid

CLK	T	Q(t)	Q(t+1)	Set	Rcnt
0	0	0	0	0	X
0	0	1	1	X	0
0	1	0	0	0	X
0	1	1	1	X	0
1	0	0	0	0	X
1	0	1	1	X	0
1	1	0	1	1	0 ½
1	1	1	0	0	1

Excitation table

Q(t)	Q(t+1)	Set	Rcnt
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0 ½

Set T,Q \ 00	01	11	10
0	X	X	0
0	X	0	1 ½

Set = CLK·T·Q̄ ½

Reset CLK \ T,Q 00	01	11	10
0	X	0	0	X ½
1	X	0	1	0

Reset = CLK·T·Q ½

½ Marks