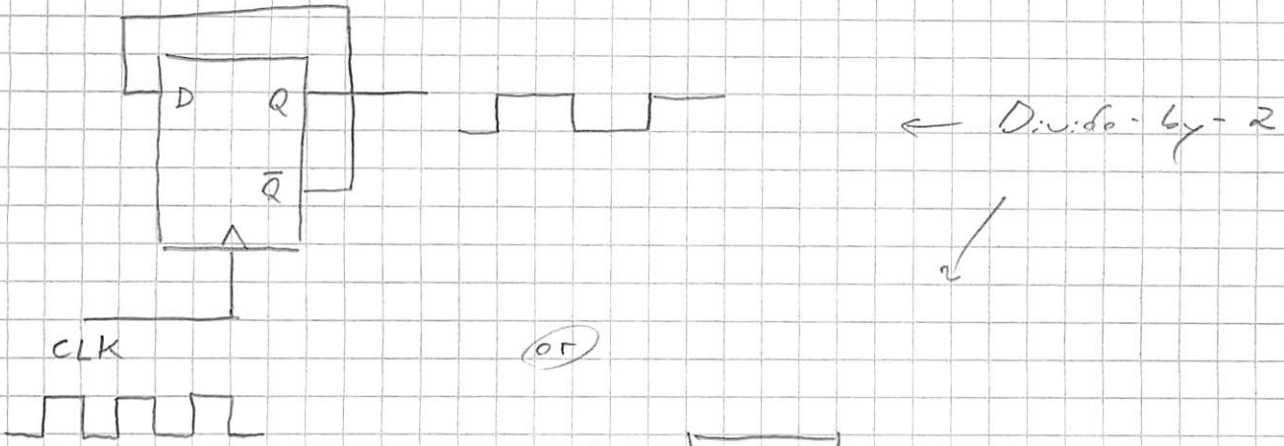
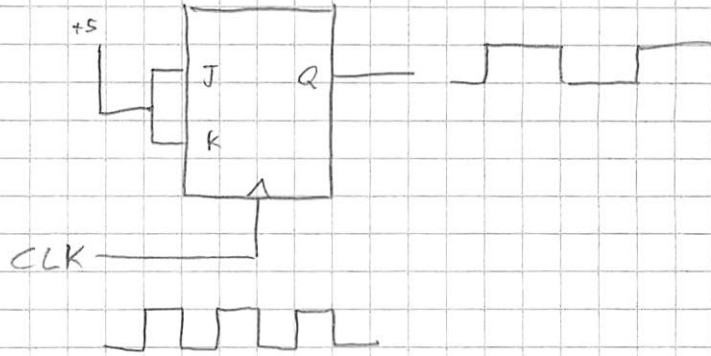


Applications : Counters

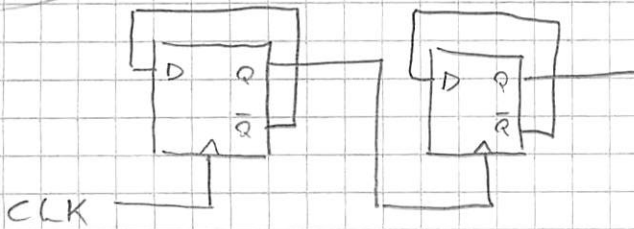


or



ripple-type

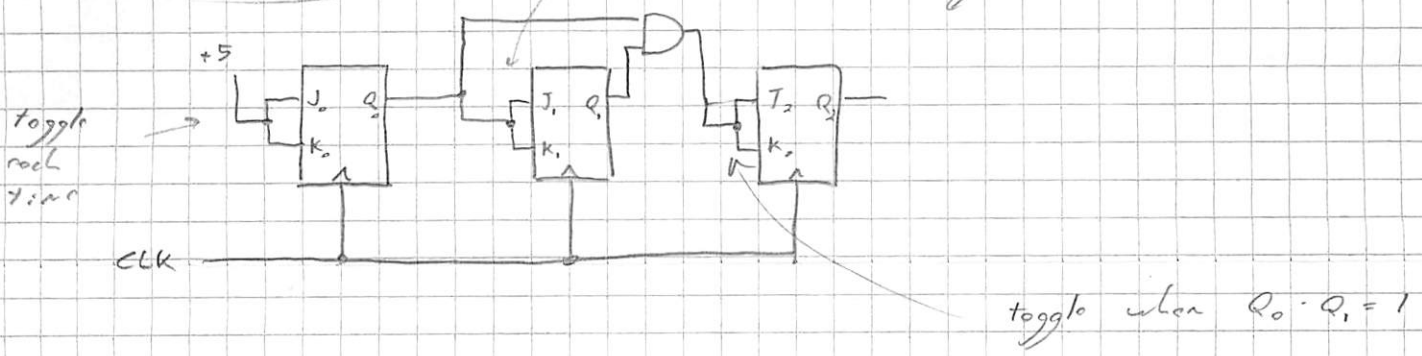
Divide-by-4



synchronous type

toggle when $Q_0 = 1$

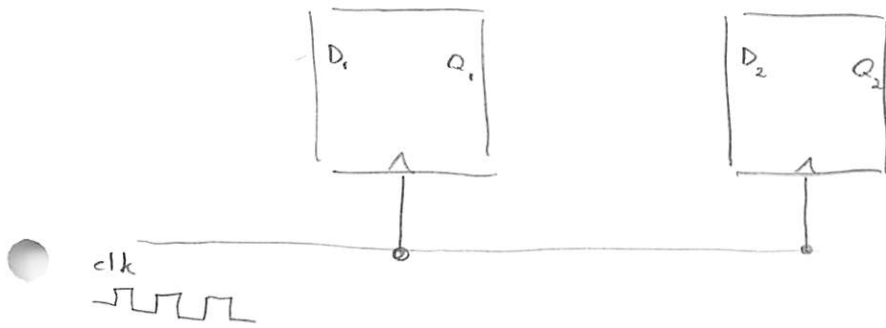
Divide-by-8



Show Slides ...

Example: Synchronous divide-by-3

Make divide-by-3 w/ 2 D-type flip-flops, synchronously clocked. $D_1, D_2 = \text{inputs}$; $Q_1, Q_2 = \text{outputs}$.



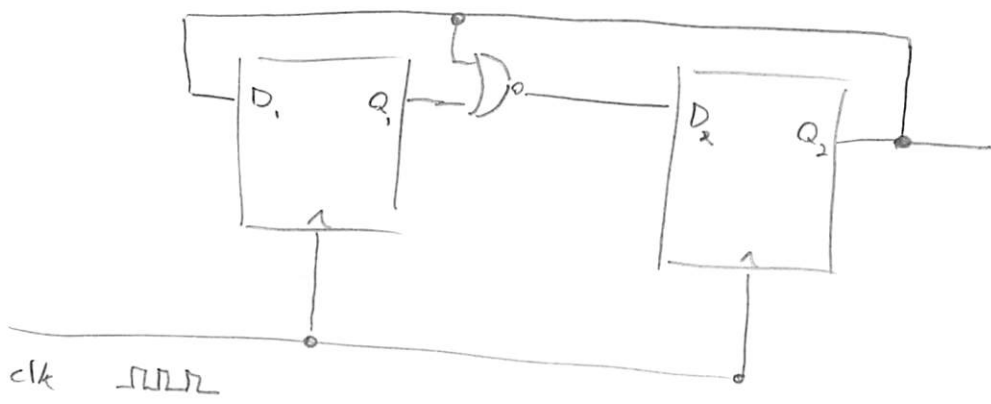
① Class the 3 states:

Q_1	Q_2	
0	0	
0	1	
1	0	
0	0	(1 st state)

② Find combinatorial logic to realize sequence of states

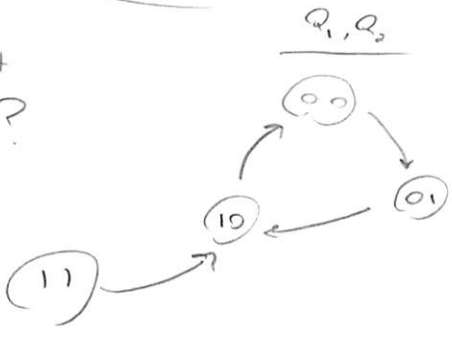
Q_1	Q_2	D_1	D_2
0	0	0	1
0	1	1	0
1	0	0	0

} $D_1 = Q_2$
 $D_2 = \overline{(Q_1 + Q_2)}$



State diagram

What about
 $Q_1=1, Q_2=1$?



Shift Registers

Shift signals in time \rightarrow parallel-to-serial
 \rightarrow serial-to-parallel

