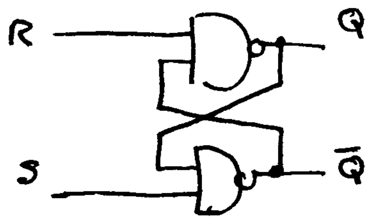
Electronics
Homework Set #7

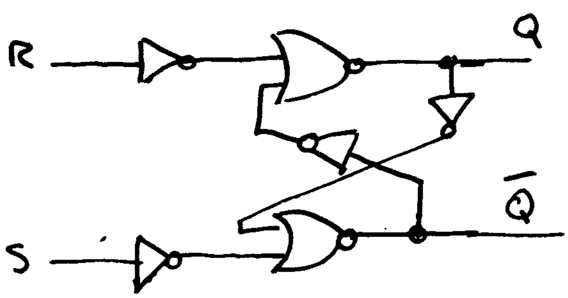
1.) a.)



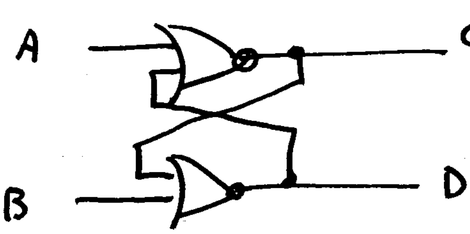
	R	S	Q	$\bar{Q}$
	0	0	1	1
	0	1	1	0
①	1	1	1	0
	1	0	0	1
①	1	1	0	1

① the R=S=1 state is a no-change state.

b.) one way (b) to replace the NANDS with equivalent using NOR's:



a more basic way is to analyze NOR's in the "Flip-flop configuration":

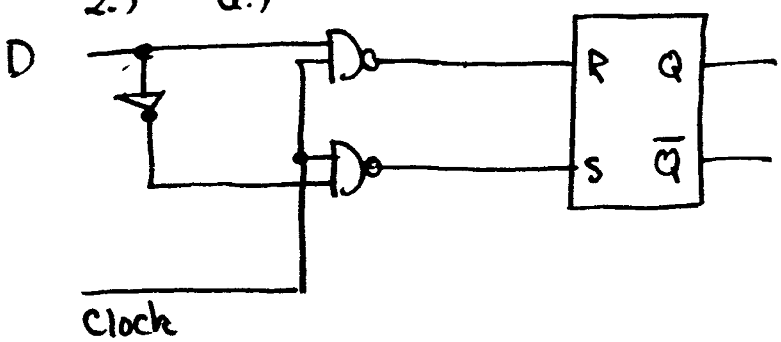


	A	B	C	D
	1	1	0	0
	0	1	1	0
①	0	0	1	0
	1	0	0	1
①	0	0	0	1

although ~~except for~~ the specific entries ~~being~~ are different, the essential features of the RSFF are present here, especially the "no-change" character.

① A=B=0 is the no-change state

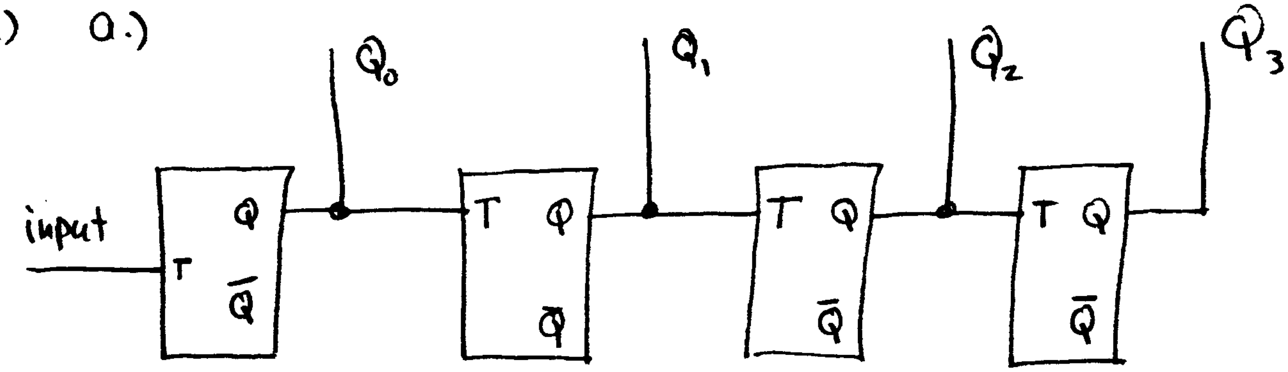
2.) a.)

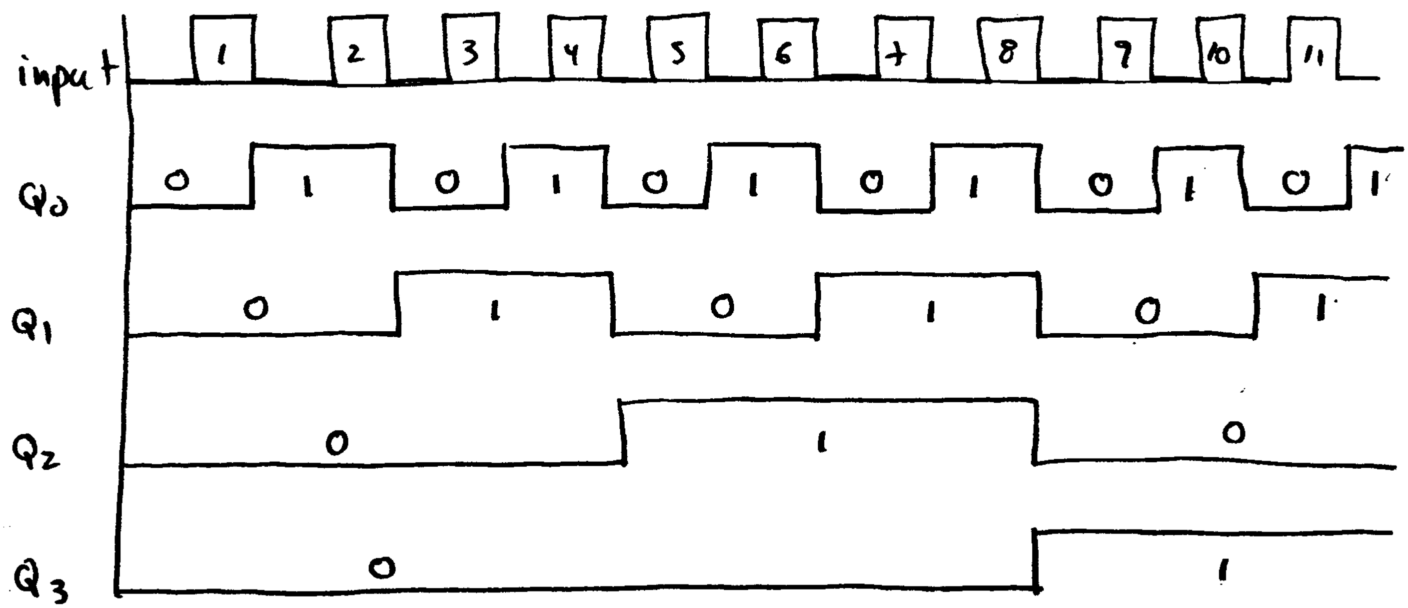


b.) when $C=1$, the Q output is in the same state as the D input. when $C \to 0$, the Q output is "frozen" at the value (state) of the D input at the time of the transition. thus the value of D is <u>stored</u>.

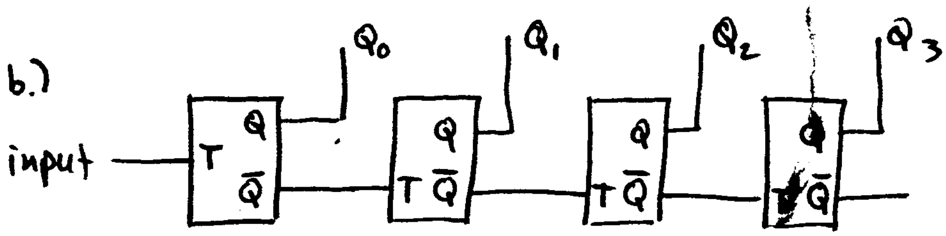
3.) "Toggle" means to reverse states. specifically, TFF's toggle on each input pulse.

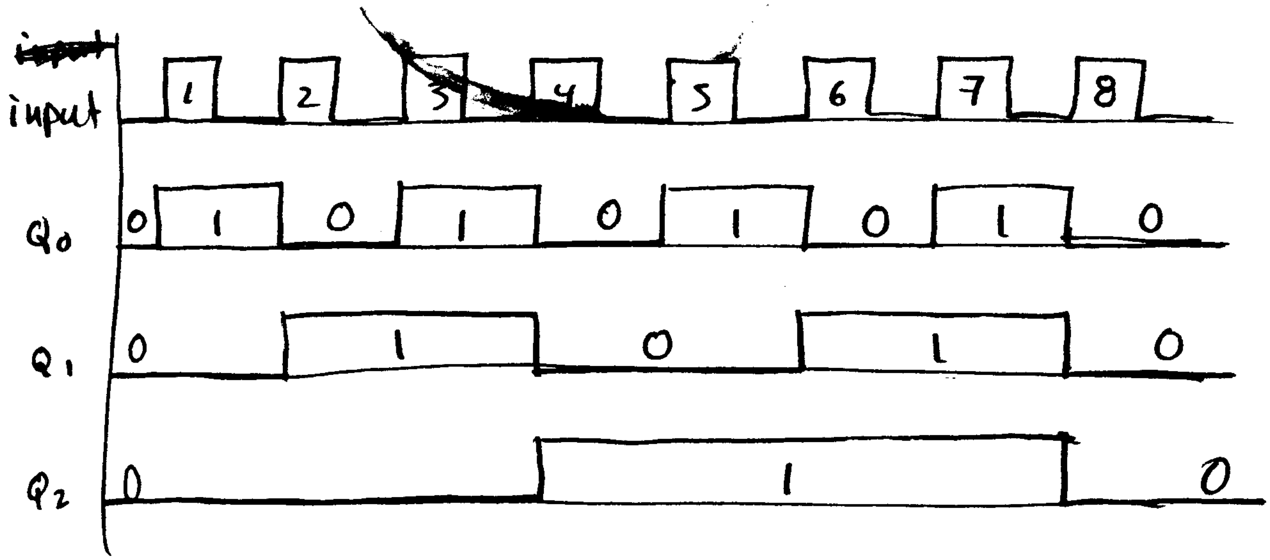
4) a.)


Q0
Q1
Q2
Q3
input
T
Q
Q̄


input
Q0
Q1
Q2
Q3
1
2
3
4
5
6
7
8
9
10
11

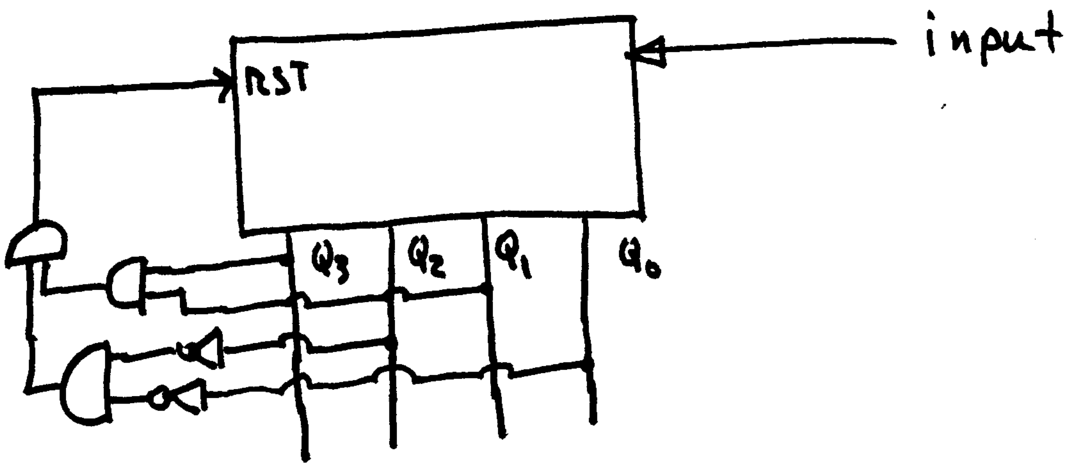
b.)


Q0
Q1
Q2
Q3
input
T
Q
Q̄


input
Q0
Q1
Q2
1
2
3
4
5
6
7
8

5.) Basic idea: reset = 1 when $Q_0 = 0$, $Q_1 = 1$, $Q_2 = 0$, $Q_3 = 1$ } $1010|_2 = 10|_{10}$

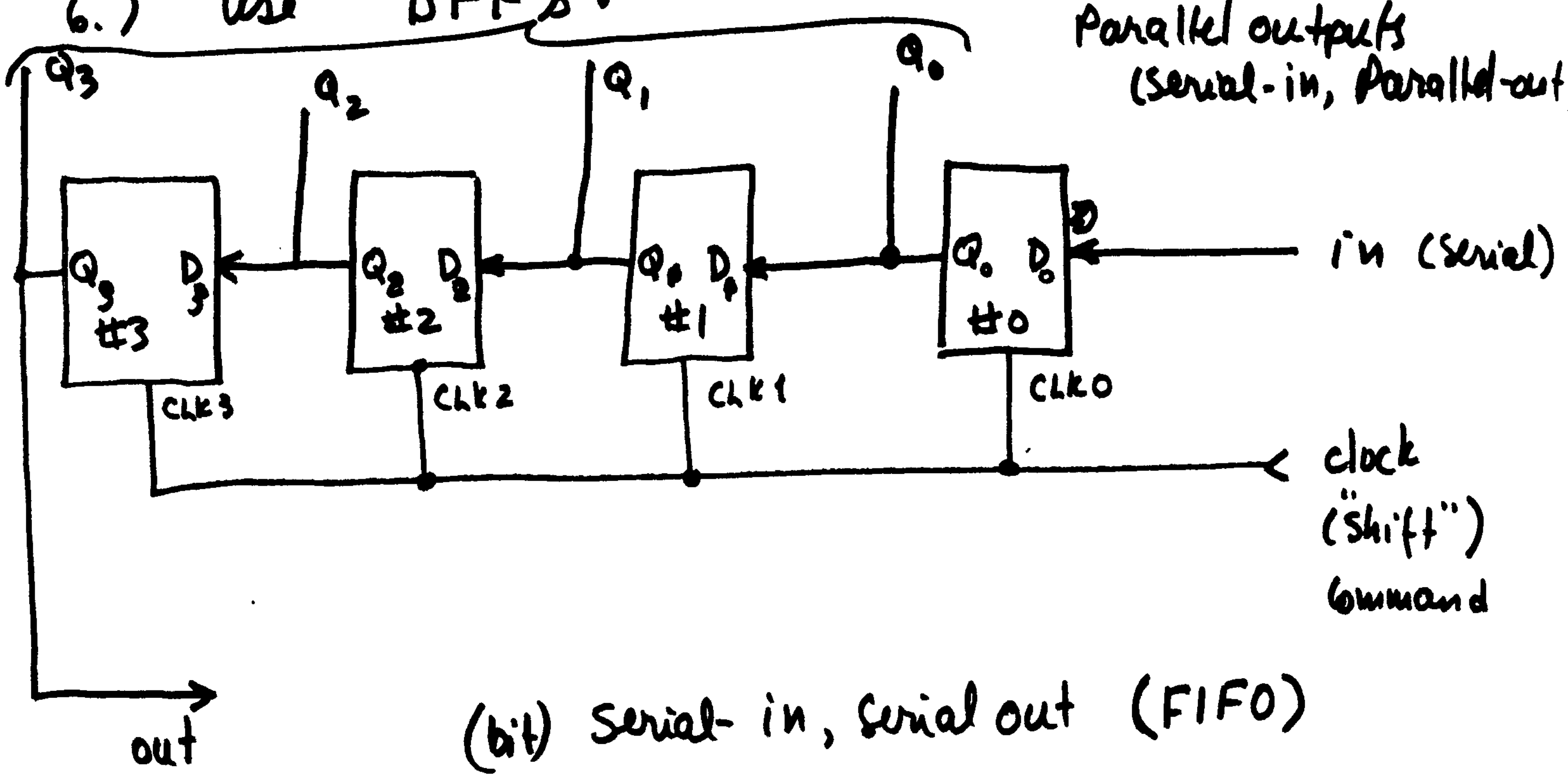
$\therefore RST = Q_3 \cdot \overline{Q_2} \cdot Q_1 \cdot \overline{Q_0}$



alternate: RST = 1 when $Q_0 = 1$, $Q_1 = 0$, $Q_2 = 0$, $Q_3 = 1$, $in = 1$ } $1001|_2 = 9|_{10}$ and input.

Note also that it is unnecessary to test 2 outputs in each case as the 1st time in a sequence that $Q_3 = 1$ and $Q_1 = 1$ (1st solution) occurs is the case of interest so the 1st solution is equivalent to $RST = Q_3 \cdot Q_1$, while the "alternate" is $RST = Q_3 \cdot Q_0 \cdot IN$. (Both solutions permit glitches, by the way, and are not the best engineering.)

6.) use DFF's:



(bit) serial-in, serial out (FIFO)