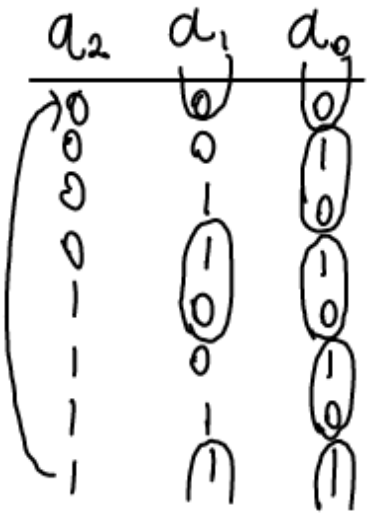
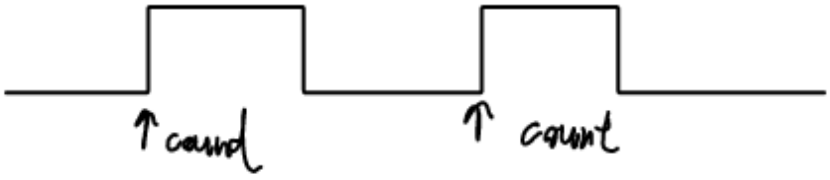
Last Time:

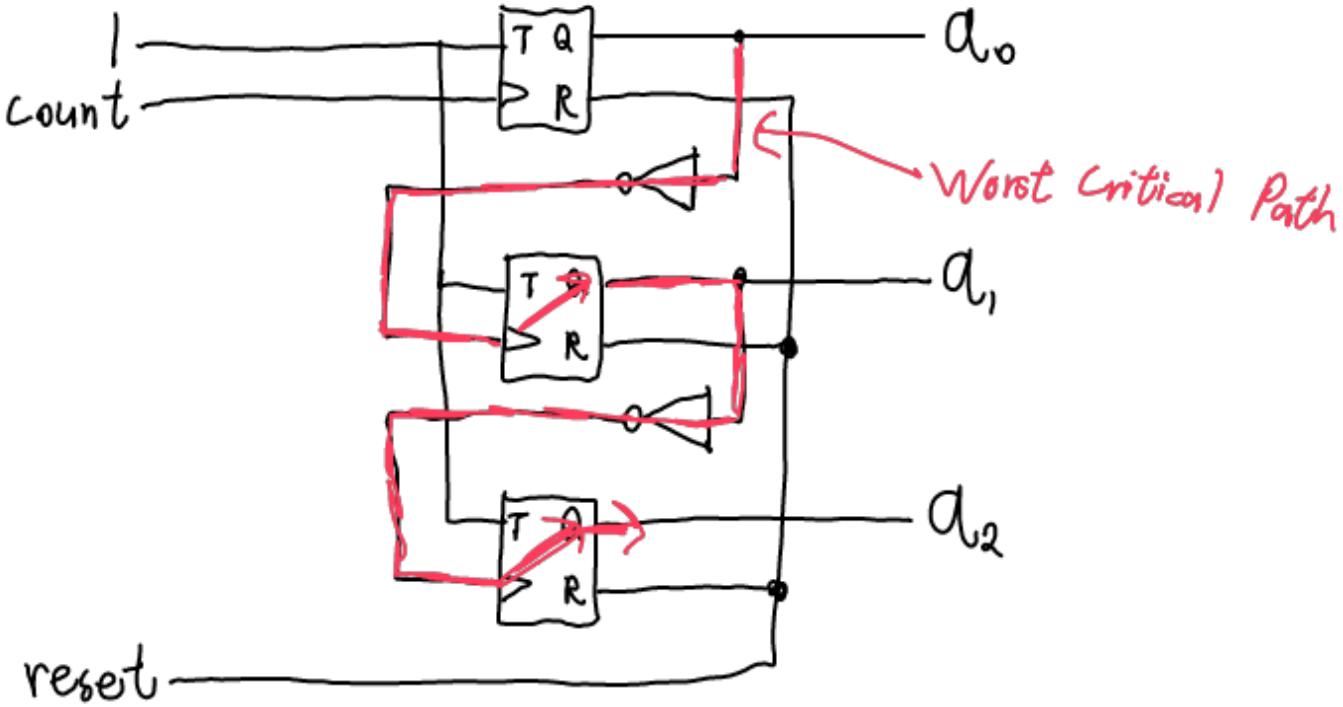


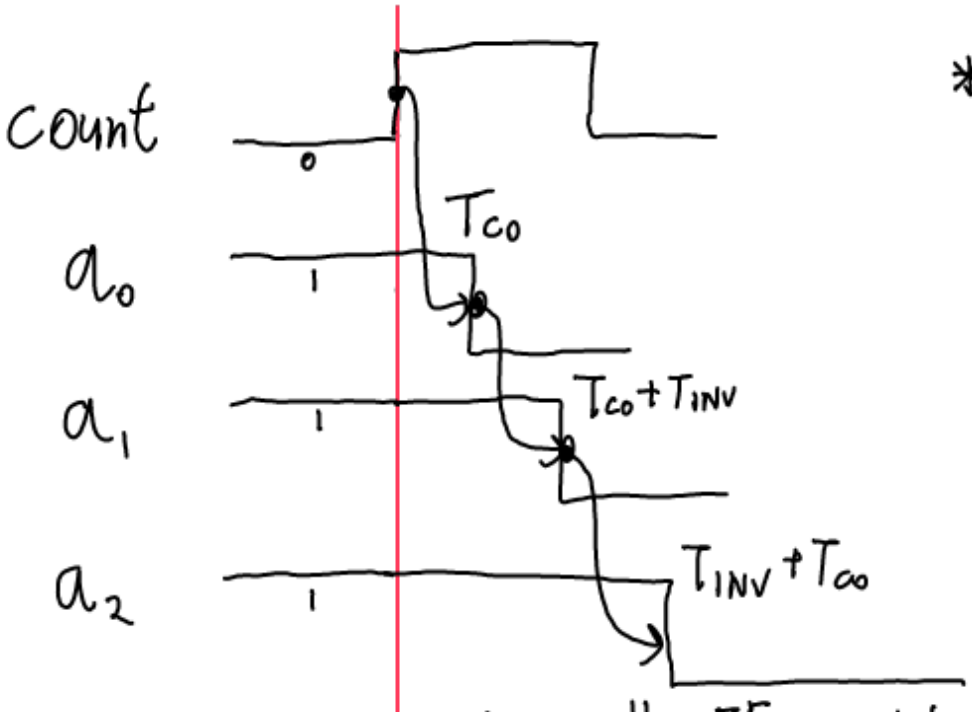
a_0 always flips

a_1 flips when a_0 goes $1 \to 0$

a_2 flips when a_1 goes $1 \to 0$







* Ripple Counter
  - ⇒ Very Slow for large counters.
  - ⇒ Called <u>asynchronous</u> since each FF has a different clock.

* Can we make all FF update at the same time?

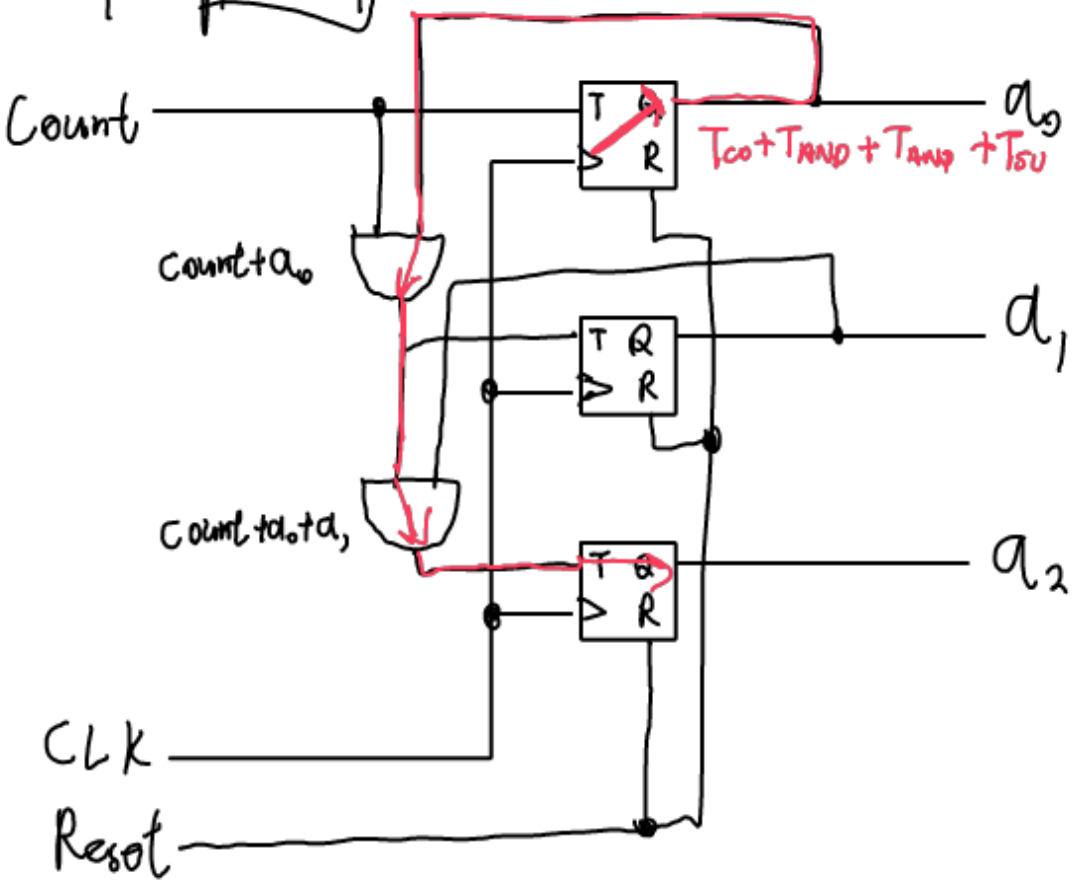
Synchronous Binary Counter - Same clock for all FFs.

a_2	a_1	a_0
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

a_0 always flips

a_1 flips when $a_0 = 1$

a_2 flips when $a_1 a_0 = 11$



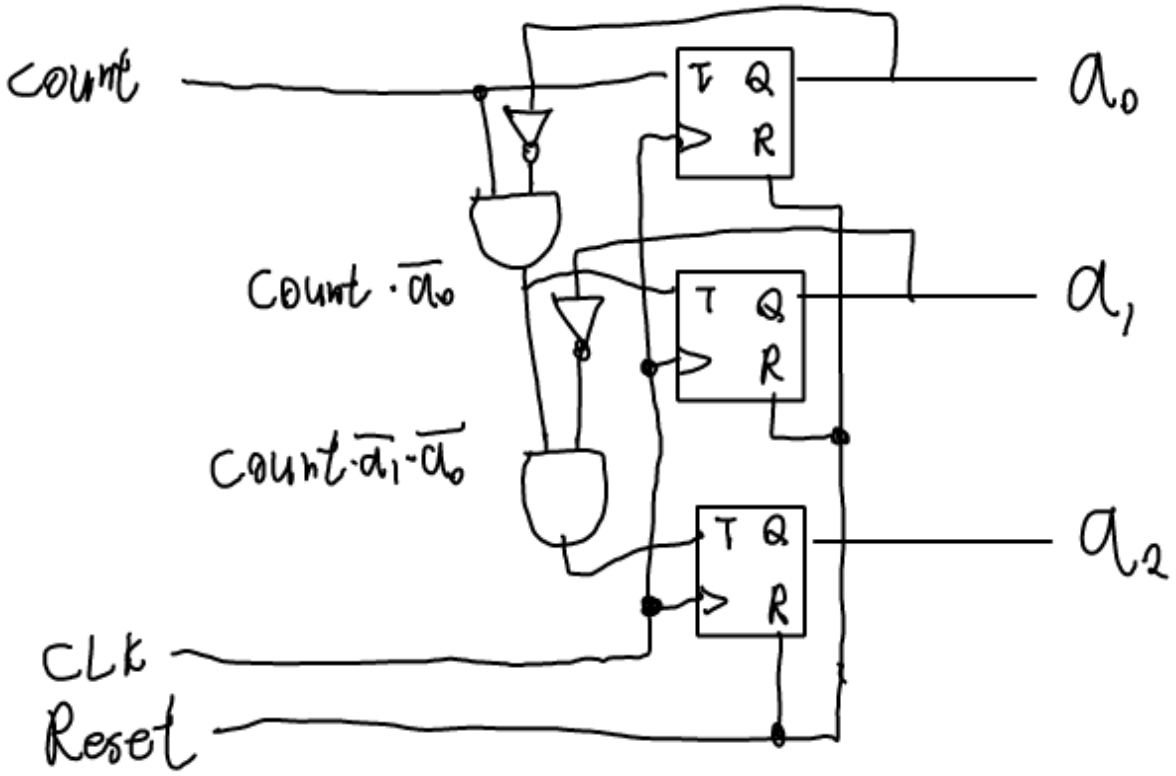
Down Counter

a_2	a_1	a_0
1	1	1
1	1	0
1	0	1
1	0	0
0	1	1
0	1	0
0	0	1
0	0	0

a_0 always toggle

a_1 toggles when $a_0 = 0$

a_2 toggles when $a_1 a_0 = 00$



Let's make a circuit that can count up, count down, or hold.

up	down	
0	0	hold
0	1	down
1	X	up

circuit on website