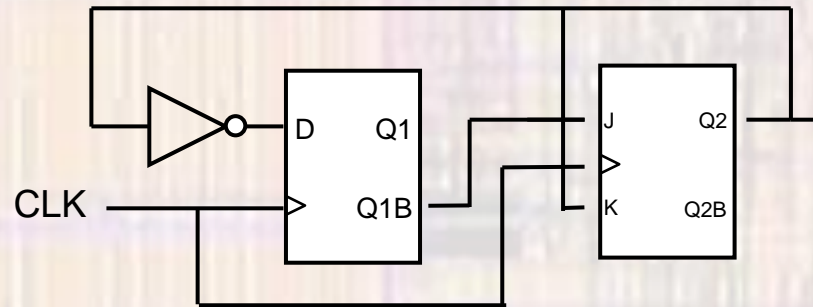


Flip-Flop Circuit Operation

Last updated 1/12/21

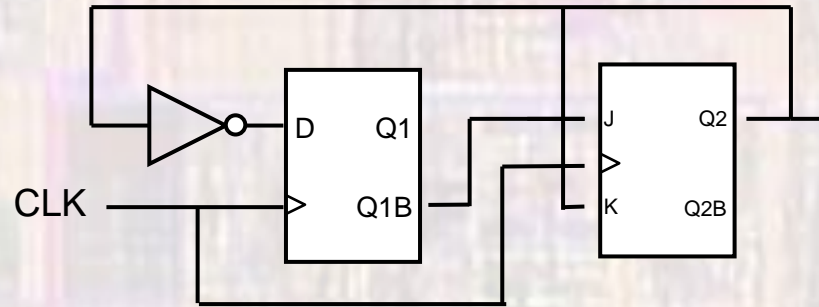
Flip-Flop Circuit Operation

- Flip-Flops - Example



Flip-Flop Circuit Operation

- Flip-Flops - Example



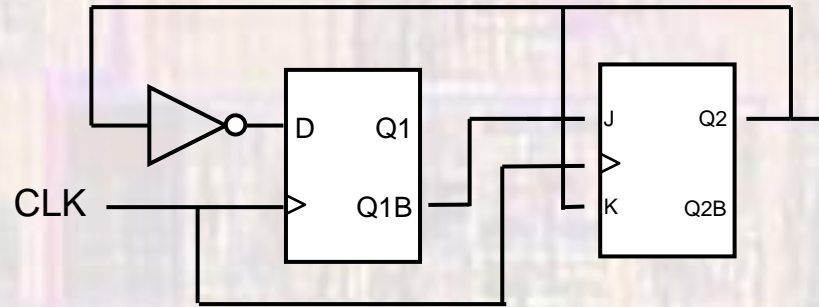
Initial State

	D	J	K	Q1	Q1B	Q2	Q2B
Initial				1			0
After clk1							
After clk2							
After clk3							

You must know these to analyze the circuit

Flip-Flop Circuit Operation

- Flip-Flops - Example



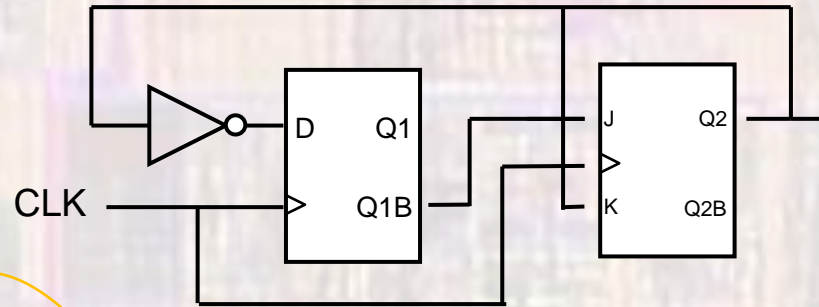
Initial State

	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
				1	0	1	0
After clk1							
After clk2							
After clk3							

known

Flip-Flop Circuit Operation

- Flip-Flops - Example



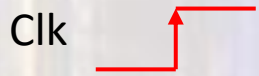
Initial State

	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1							
After clk2							
After clk3							

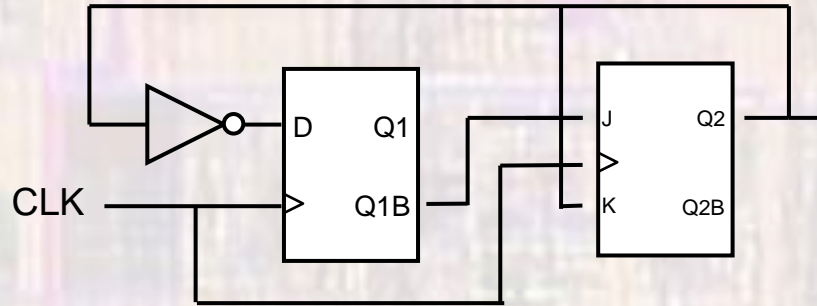
Asynchronous

Flip-Flop Circuit Operation

- Flip-Flops - Example



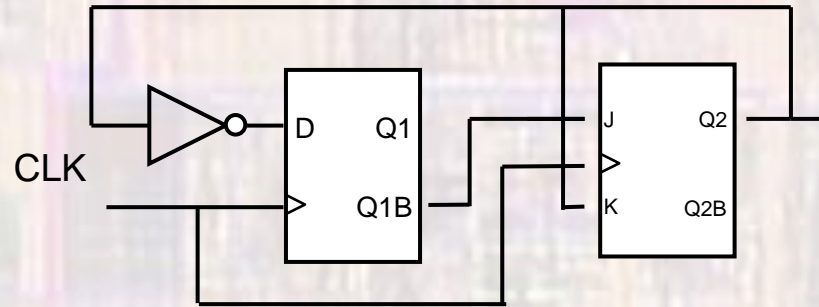
Synchronous Propagation



	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1				0	1	0	1
After clk2							
After clk3							

Flip-Flop Circuit Operation

- Flip-Flops - Example

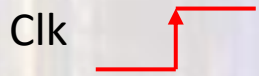


Asynchronous Propagation

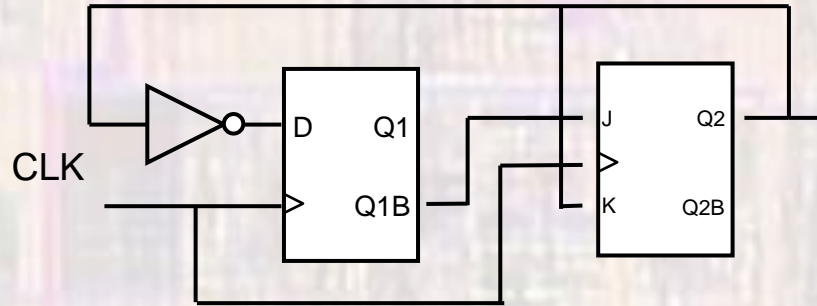
	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1				0	1	0	1
	1	1	0				
After clk2							
After clk3							

Flip-Flop Circuit Operation

- Flip-Flops - Example



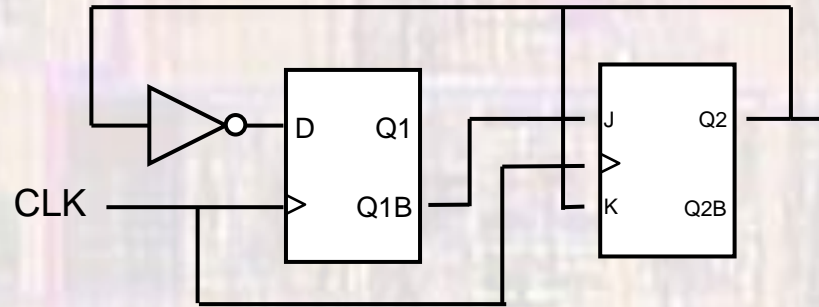
Synchronous Propagation



	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1				0	1	0	1
	1	1	0				
After clk2				1	0	1	0
After clk3							

Flip-Flop Circuit Operation

- Flip-Flops - Example




Asynchronous Propagation

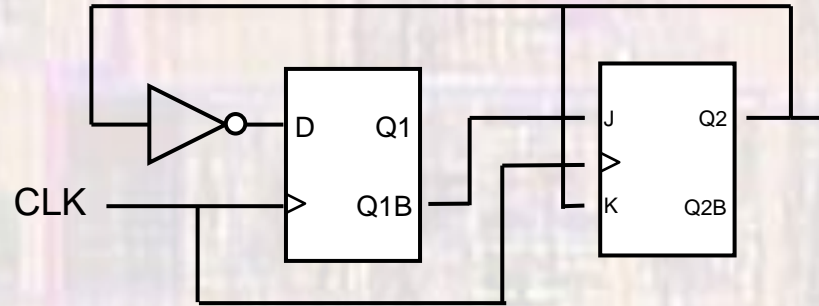
	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1				0	1	0	1
	1	1	0				
After clk2				1	0	1	0
	0	0	1				
After clk3							

Flip-Flop Circuit Operation

- Flip-Flops - Example

Clk 

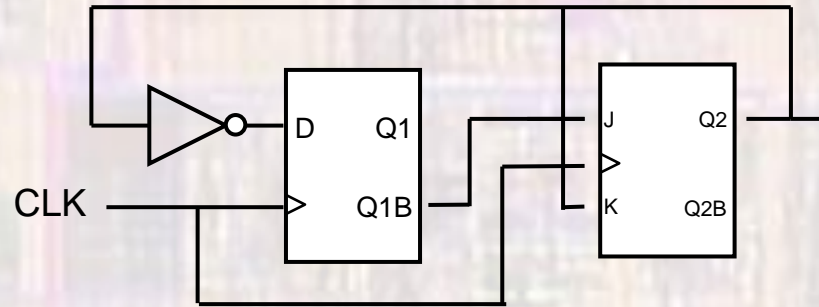
Synchronous Propagation



	D	J	K	Q1	Q1B	Q2	Q2B
Initial							
	0	0	1	1	0	1	0
After clk1				0	1	0	1
	1	1	0				
After clk2				1	0	1	0
	0	0	1				
After clk3				0	1	0	1

Flip-Flop Circuit Operation

- Flip-Flops - Example

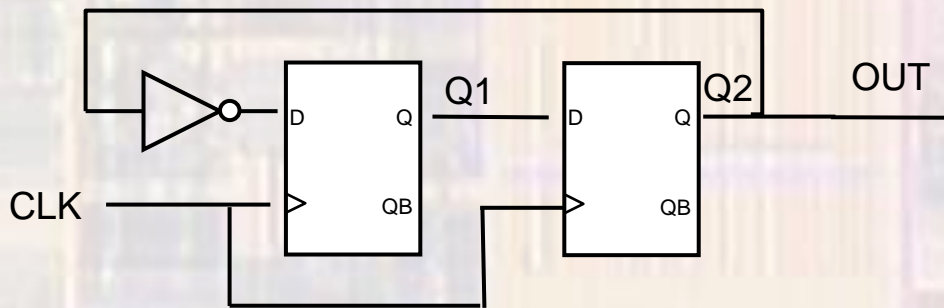


Asynchronous Propagation

D	J	K	Q1	Q1B	Q2	Q2B
Initial						
0	0	1	1	0	1	0
After clk1						
			0	1	0	1
1	1	0				
After clk2						
			1	0	1	0
0	0	1				
After clk3						
			0	1	0	1
1	1	0				

Flip-Flop Circuit Operation

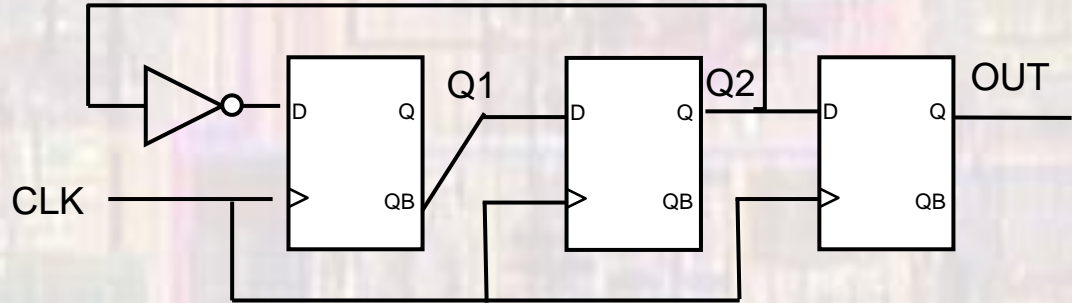
- Example – 2
 - Assume all Flip-Flops have been reset



	D1	D2	Q1	Q2	OUT
Initial			0	0	0
async	1	0	0	0	
After Clk 1			1	0	0
async	1	1	1	0	
After Clk 2			1	1	1
async	0	1	1	1	
After Clk 3			0	1	1
async	0	0	0	1	
After Clk 4			0	0	0
async	1	0	0	0	
After Clk 5			1	0	0
async	1	1	1	0	
After Clk 6			1	1	1
async	0	1	1	1	

Flip-Flop Circuit Operation

- Example – 3
 - Assume all reset



	D1	D2	D3	Q1	Q1B	Q2	OUT
Initial				0	1	0	0
async	1	1	0				
After Clk 1				1	0	1	0
async	0	0	1				
After Clk 2				0	1	0	1
async	1	1	0				
After Clk 3				1	0	1	0
async	0	0	1				
After Clk 4				0	1	0	1
async	1	1	0				
After Clk 5				1	0	1	0
async	0	0	1				
After Clk 6				0	1	0	1
async	1	1	0				