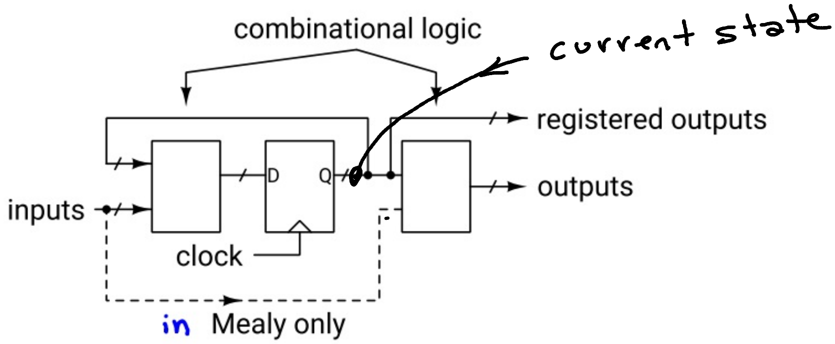
State Machines

Exercise 1: Which signal in the above diagram represents the current state?



Exercise 2: Which outputs change on the rising clock edge? Which change when the input changes?

- Q — state
- only on a Mealy SM do outputs change when i/p's change.

Exercise 3: Why?

for Moore SM each o/p is a function of the state so need one state per o/p value.

Exercise 4: If we used 8-bits of state information, how many states could be represented? What if we used 8 bits of state but used a "one-hot" encoding?

binary: $2^8 = 256$ possible states 00 → FF
0-255

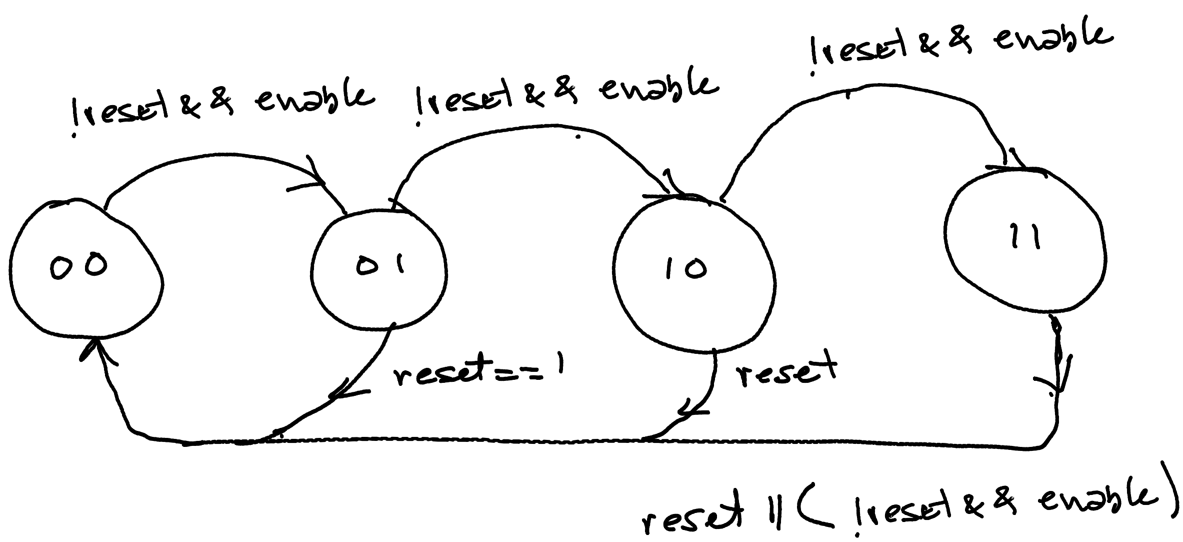
one-hot: 0000 0001 } 8 possible states
⋮
1000 0000
[0000 0000] X → not one-hot

Exercise 5: What happens if both reset and enable are asserted?

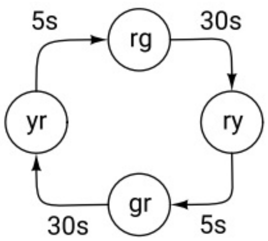
resets to 00

Exercise 6: Draw the state transition diagram.

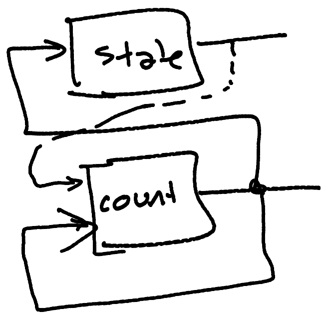
count		input		next count	
[1]	[0]	reset	enable	[1]	[0]
X	X	1	X	0	0
a	b	0	0	a	b
0	0	0	1	0	1
0	1	0	1	1	0
1	0	0	1	1	1
1	1	0	1	0	0



Exercise 7: Write the state transition table for each state machine.



state	count	next state
rg	0	ry
- ry	0	gr.
gr	0	yr
- yr	0	rg.
S	≠ 0	S



count	count , state ?		next count
0	0	ry, yr	29
	0	gr, rg	4
n (≠0)	X	X	n-1

count	state next	count next
0	gr, rg	29
	ry, yr	4

Exercise 8: What is the size of the expression `sqrt*sqrt`? Of `{8'b0,sqrt}*sqrt`?

sqrt is 8 bits

sqrt * sqrt (8, 8) 8 bits

max(8, 8) = 8

{8'b0, sqrt} 8 + 8 = 16 bits

{8'b0, sqrt} * sqrt ⇒ max(16, 8) = 16 bits.

(16 bits) (8 bits)

Exercise 9: Draw the state transition diagram (use $\Delta = 0$ and $\Delta \neq 0$ as the states).