ENEL 353 Section 02 Lecture

Fri Dec 6 2019

All term work, except Lab 4, has been marked.

Exam Review problems

Sequence detection, part a – done Dec 4

part b – let's skip this

Timing Problem (Review Slides 8-10)

Part a.

For path from R1 to R2 through Bear and Dog

$$t_{pd} \leq T_c - t_{pcq} - t_{setup} - t_{skew}$$

$$t_{pd\_Bear} + t_{pd\_Dog} \leq 320ps - 55ps - 40ps - 20ps$$

$$t_{pd\_Dog} \leq 205ps - t_{pd\_Bear}$$

$$\leq 205ps - 60ps = \underline{145ps}$$

Extension to part a.

t_{pd} from all paths through CL must be $\leq 205ps$

from R1 to R2

through Bear and Dog: already known to be OK

through Bear and Cat $60 + 100 = 160ps$ OK

from R2 to R3

through Yak: $t_{pd} = 190ps$ OK

from R3 to R1

through Ape: $t_{pd} = 200ps$ OK

Part b.

For the path straight from R2 to R3

$$t_{ccq} + \cancel{t_{pd}}^{0} \geq t_{hold} + t_{skew}$$

$$t_{skew} \leq t_{ccq} - t_{hold} = 27ps - 15ps$$

$$\boxed{t_{skew} \leq 12ps}$$

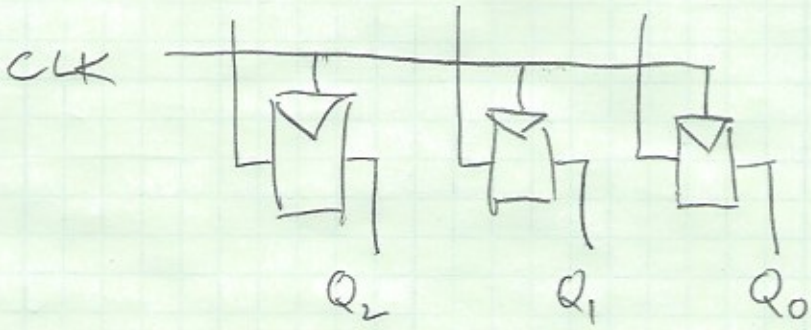
Extension

Put buffers on the bus that goes straight from R2 to R3.

Question 6 from Fall 2014 exam

Signal	0 or 1?	reason
E1	1	want bitline to drive I/O pin 1
E0	0	don't want contention between bitline 0 and system input B
S	0	want input B to be an input of the next state logic

Part b. First, choose DFFs for state bits ...



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$A_3 = Q_2, A_2 = Q_1, A_1 = Q_0, A_0 = B$

Example step in solution

$$Q_2' = Q_2\bar{Q}_1\bar{Q}_0 + Q_2\bar{Q}_1 B + Q_1 Q_0 \bar{B}$$

$$= m_{1000} + m_{1001} + m_{1001} + m_{1011} + m_{0110} + m_{1110}$$

Let's not write out the entire solution ...

Question 8 (c) from 2014

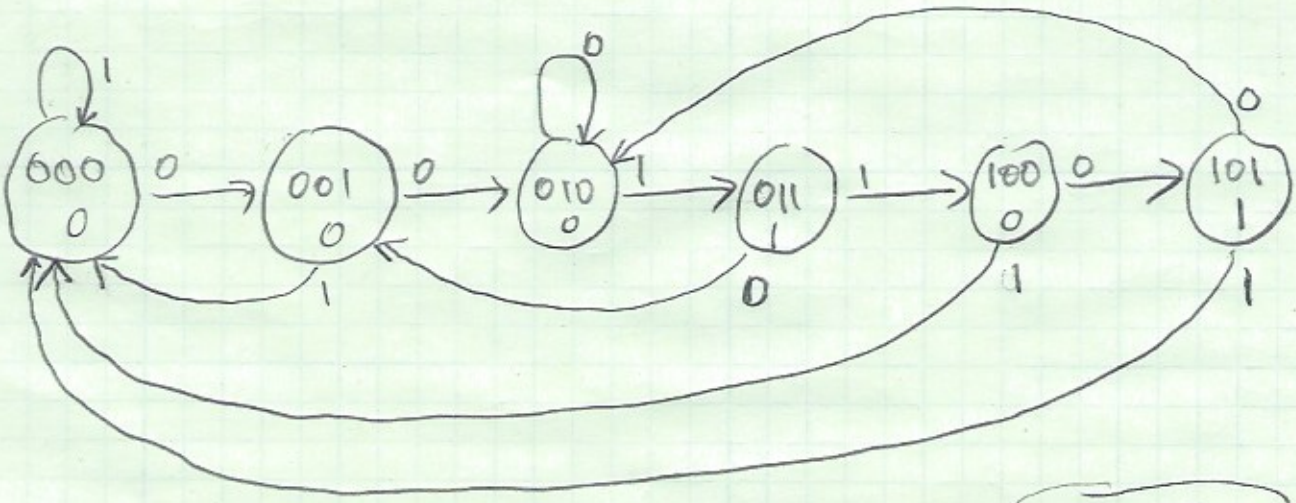
Part (a) – ways to get output $Y=1$

state 010
- 0, then 0 on last 2 rising edges of CLK
- A is currently 1

state 100
- 0, then 0, then 1, then 1 on last 4 rising edges of CLK
- A is currently 0

Moore machine

$Y=1$ if – 0, then 0, then 1 on last 3 rising edges of CLK
- 0, then 0, then 1, then 1, then 0 on last 5 rising edges of the clock



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