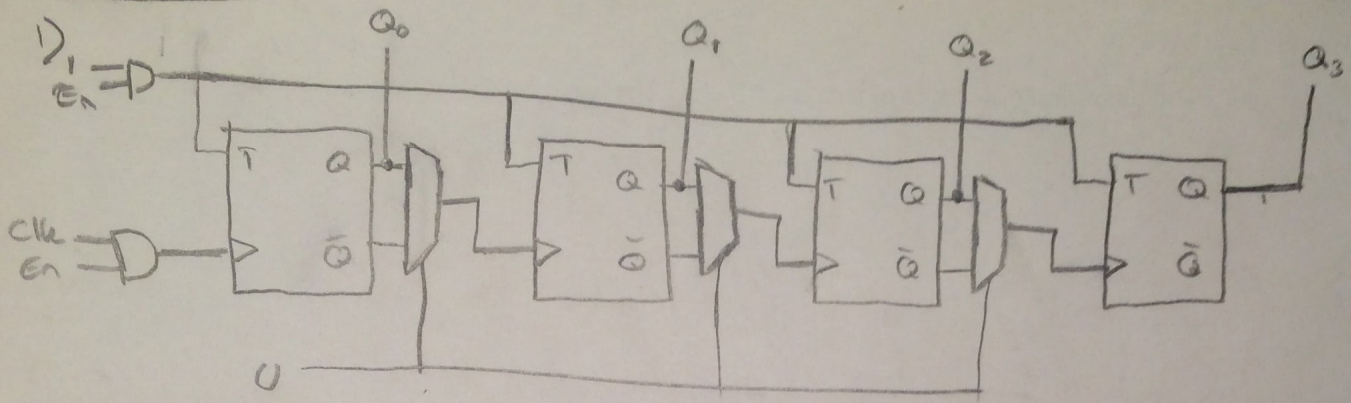
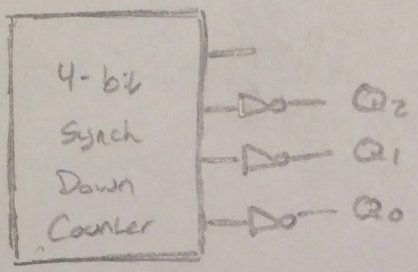
Class 29

Sean Gordon

1)



2)



Class 30

1) 0, 1, 2, 7 :

000

00 ⇒ TFF_0 will become 1 on first clock cycle

01 ⇒ TF_1 will become 1 on second cycle because of TFF_0, while TFF_0 will become 0

11 ⇒ TF_2 will become 1 on third cycle because of TFF_1, TFF_1 will not change; and TFF_0 becomes 1

2) $t_{SU} = 4$ $t_h = 4$ $t_{CQ} = 4$ AND = 3 XOR = 3 MUX = 5

a) $T_{longest} = \underset{\text{AND}}{(3 \cdot 3)} + \underset{\text{XOR}}{(1 \cdot 3)} + \underset{\text{MUX}}{(1 \cdot 5)} = 17\,ns$

$T_{MIN} = \underset{t_h}{4} + \underset{T_{SU}}{4} + 17 = 25\,ns$

$\frac{1}{25 \cdot 10^{-9}} = \boxed{40\ MHz}$

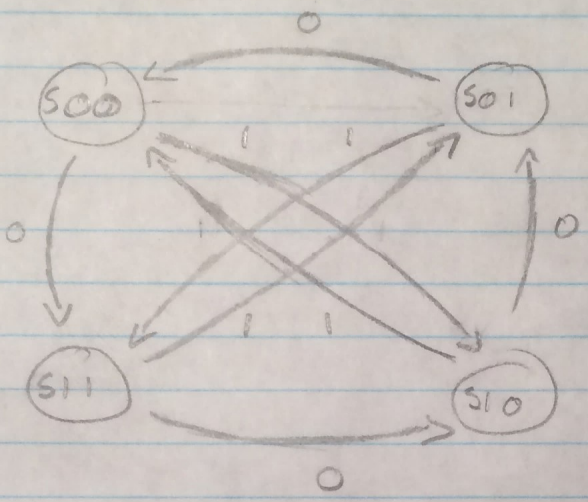
b) If time of longest delay '$t_{longest}$' is shorter than the min delay, there is a hold time violation.

$17 - 25 = -8 < 0$ ∴ there is a hold time violation

Class 31

1)

a)



w	x	y	x	y	z
0	0	0	1	1	1
0	0	1	0	0	0
0	1	0	0	1	0
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	1	1	0
1	1	0	0	0	0
1	1	1	0	1	0

b) $x = \bar{w}\bar{x}\bar{y} + \bar{w}xy + w\bar{x}\bar{y} + w\bar{x}y \Rightarrow$

$\bar{w}(\bar{x}\bar{y} + xy) + w\bar{x} \Rightarrow \bar{w}\,\overline{(x \oplus y)} + w\bar{x}$

$y = \bar{w}\bar{x}\bar{y} + \bar{w}x\bar{y} + w\bar{x}y + wxy \Rightarrow$

$\bar{y}(\bar{w}\bar{x} + \bar{w}x) + y(w\bar{x} + wx) \Rightarrow$

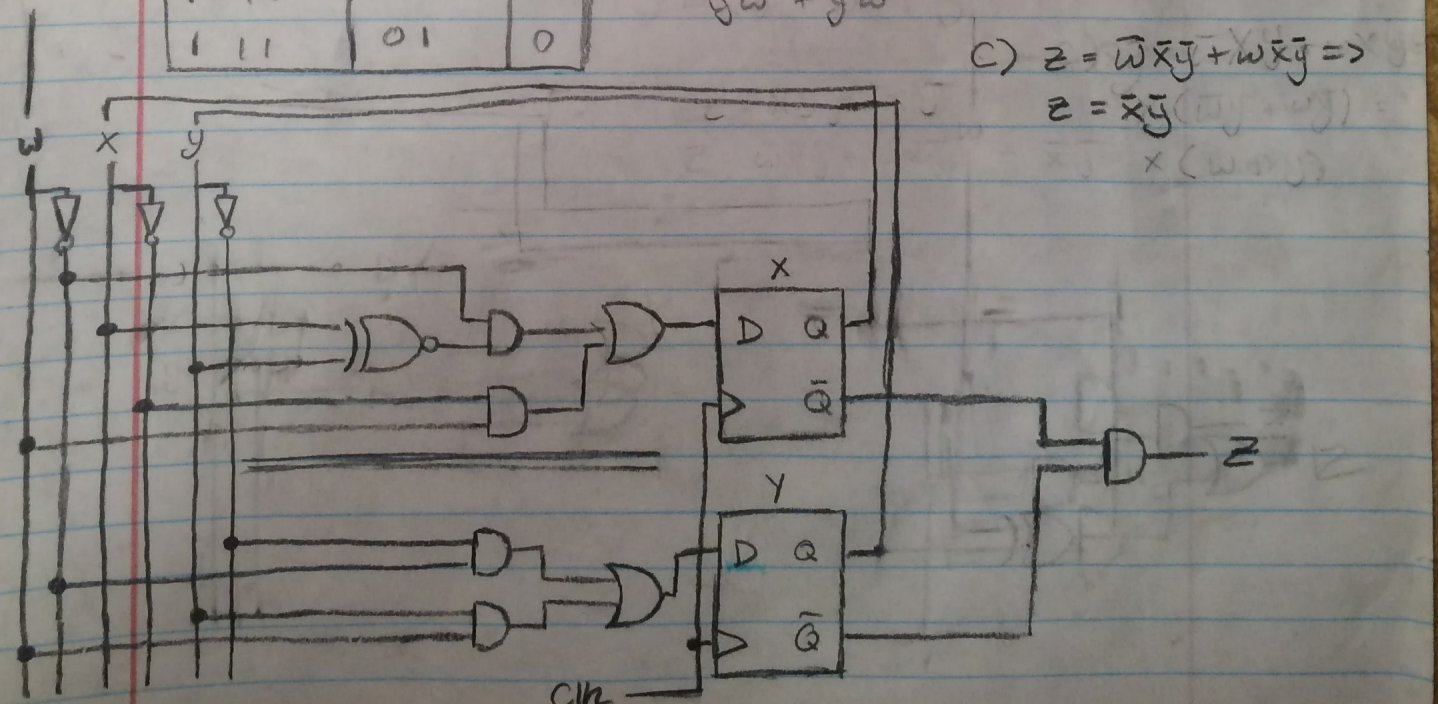
$\bar{y}\bar{w} + yw$

c) $z = \bar{w}\bar{x}\bar{y} + w\bar{x}\bar{y} \Rightarrow$

$z = \bar{x}\bar{y}$

$\times (w + y)$

d)



Class 31 (cont'd.)

2) a) S10 b) S11 c) S11

3) a)

present	w = 0	w = 1	Output $Z_2 Z_1 Z_0$
S_0	S_1	S_1	0 0 0
S_1	S_2	S_4	0 0 1
S_2	S_3	S_3	0 1 0
S_3	S_0	S_4	0 1 1
S_4	S_0	S_0	1 0 0

b)

Present $X_2 X_1 X_0$	w = 0 $Y_2 Y_1 Y_0$	w = 1 $Y_2 Y_1 Y_0$	Output $Z_2 Z_1 Z_0$
0 0 0	0 0 1	0 0 1	0 0 0
0 0 1	0 1 0	1 0 0	0 0 1
0 1 0	0 1 1	0 1 1	0 1 0
0 1 1	0 0 0	1 0 0	0 1 1
1 0 0	0 0 0	0 0 0	1 0 0

c) $Y_2 = w\bar{X}_2\bar{X}_1X_0 + w\bar{X}_2X_1X_0 = w\bar{X}_2X_0$

$Y_1 = \bar{w}\bar{X}_2\bar{X}_1X_0 + \bar{w}\bar{X}_2X_1\bar{X}_0 + w\bar{X}_2X_1\bar{X}_0 = \bar{w}\bar{X}_2\bar{X}_1X_0 + \bar{X}_2X_1\bar{X}_0$

$Y_0 = \bar{w}\bar{X}_2\bar{X}_1\bar{X}_0 + \bar{w}\bar{X}_2X_1\bar{X}_0 + w\bar{X}_2\bar{X}_1\bar{X}_0 + w\bar{X}_2X_1\bar{X}_0 = \bar{w}\bar{X}_2\bar{X}_0 + w\bar{X}_2\bar{X}_0 = \bar{X}_2\bar{X}_0$

$Z_2 = Y_2\bar{Y}_1\bar{Y}_0$

$Z_1 = \bar{Y}_2Y_1\bar{Y}_0 + \bar{Y}_2Y_1Y_0 = \bar{Y}_2Y_1$

$Z_0 = \bar{Y}_2\bar{Y}_1Y_0 + \bar{Y}_2Y_1Y_0 = \bar{Y}_2Y_0$