Midterm #2

Guss Simpson

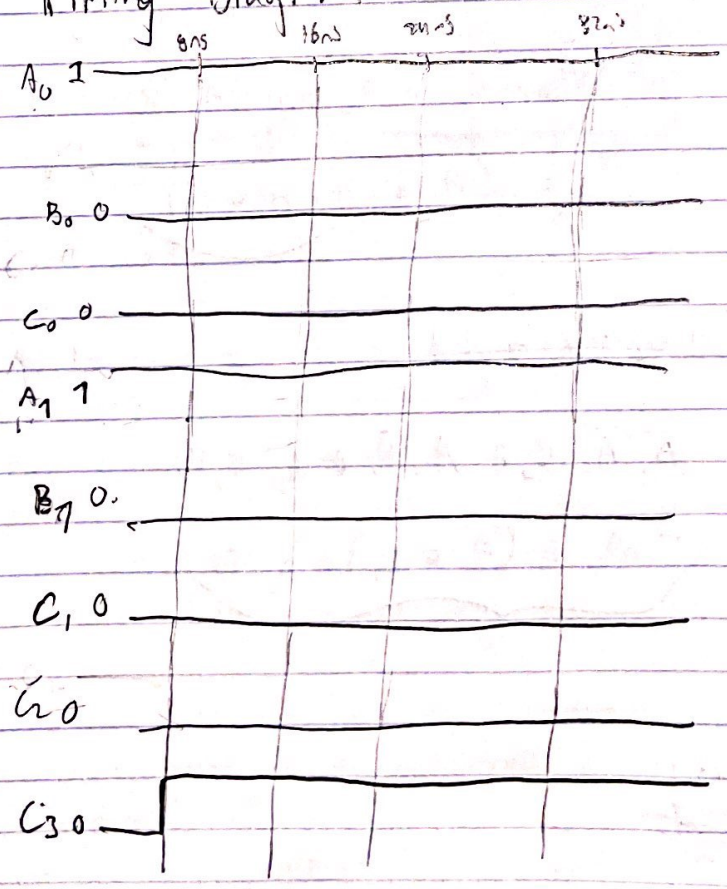
① Total delay 32 ns

a) $\frac{1}{32} = f_{max} \Rightarrow$ **31.25 MHz**

b) 8-bits, worst delay = 64 ns

f_{max} = 15.625 mHz

c) Timing Diagram



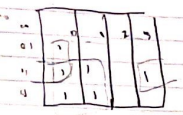
$C = C_{out}$

$S_3 S_2 S_1 S_0 = 0111$

(2)

a) $A > B$

$f(A,B) = (4, 8, 9, 12, 13, 14)$

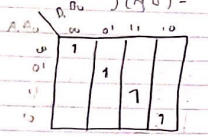


$\rightarrow A_0\bar{B}_1\bar{B}_0 + A_1\bar{B}_1 + A_1A_0\bar{B}_0$

$= A_0\bar{B}_0(A_0 + A_1) + A_1\bar{B}_1$

b) $A = B$

$f(A,B) = (0, 5, 10, 15)$



$\bar{A}_1\bar{A}_0\bar{B}_1\bar{B}_0 + A_1\bar{A}_0B_1\bar{B}_0 + A_1A_0B_1B_0 + \bar{A}_1\bar{A}_0B_1B_0$

$= (\bar{A}_0\bar{B}_0 + A_0B_0)(\bar{A}_1\bar{B}_1 + A_1B_1)$

$= (A_0 \odot B_0)(A_1 \odot B_1)$

c) $A < B$

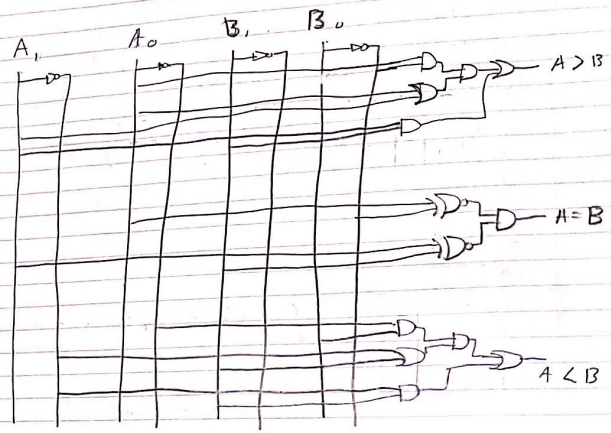
$f(A,B) = (1, 2, 3, 6, 7, 11)$

$\bar{A}_1\bar{A}_0B_0 + A_1\bar{B}_1 + \bar{A}_0B_1B_0$

$= \bar{A}_0B_0(\bar{A}_1 + B_1) + \bar{A}_1B_1$

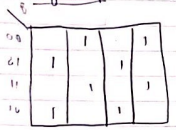
Next Page

d)



③ Binary = B
Gray = G

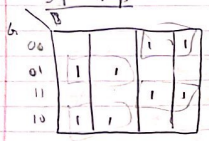
B_0 k-map



$G_0 \bar{G}_1 \bar{G}_2 \bar{G}_3 + \bar{G}_0 G_1 \bar{G}_2 \bar{G}_3 + \bar{G}_0 \bar{G}_1 G_2 \bar{G}_3 + \bar{G}_0 \bar{G}_1 \bar{G}_2 G_3 +$
$G_0 G_1 G_2 G_3 + G_0 G_1 \bar{G}_2 \bar{G}_3 + G_0 \bar{G}_1 \bar{G}_2 G_3 + \bar{G}_0 G_1 G_2 \bar{G}_3$

$\Rightarrow G_0 \oplus G_1 \oplus G_2 \oplus G_3$

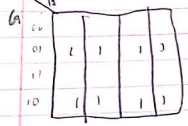
B_1 k-map



$G_1 \bar{G}_2 \bar{G}_3 + \bar{G}_1 G_2 \bar{G}_3 + G_1 G_2 G_3 + \bar{G}_1 \bar{G}_2 G_3$

$= G_1 \oplus G_2 \oplus G_3$

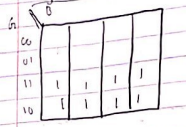
B_2 k-map



$G_2 \bar{G}_3 + \bar{G}_2 G_3$

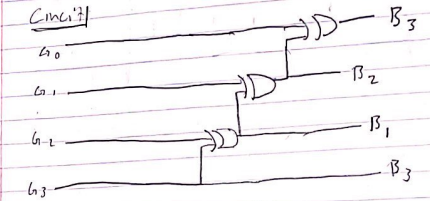
$= G_2 \oplus G_3$

B_3 k-map



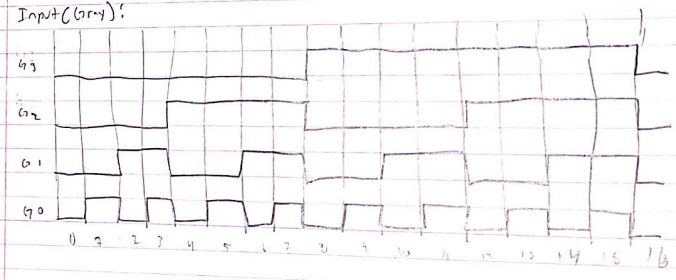
$B = G$
on B_3

Circuit



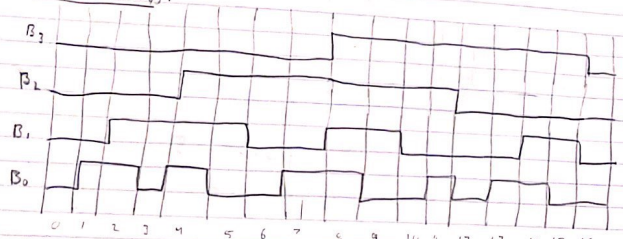
Time Diagram

Input (Gray):

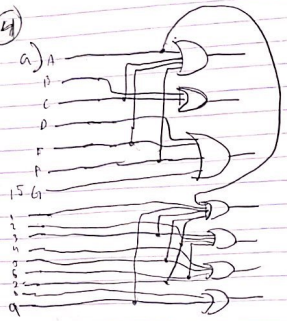


Time Diagram

output (Binary):



(4)

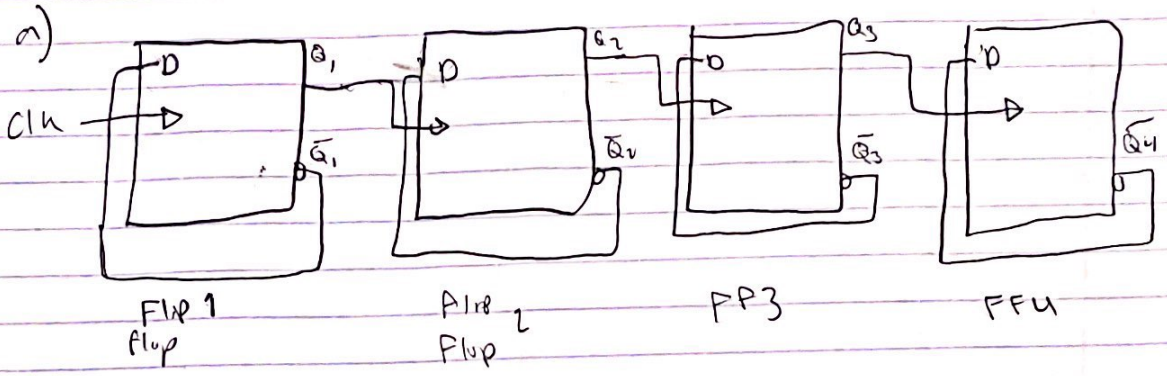


Next page

Ch. 7

(1)

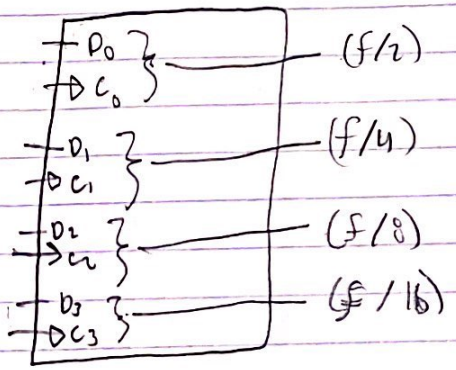
a)



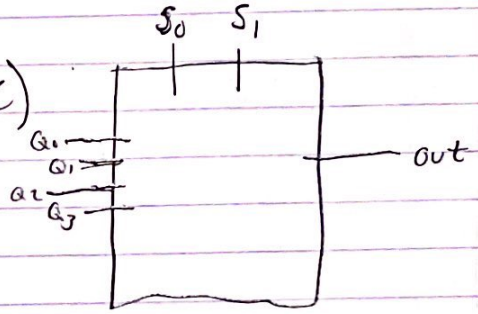
Flip Flop 1

Flip Flop 2

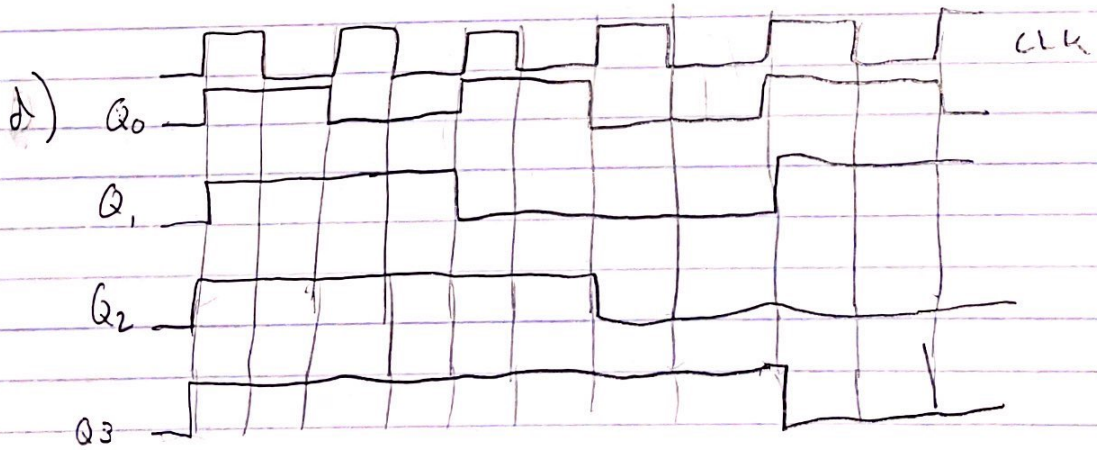
b)



c)



d)



Ch 8-9

① Truth table

Clk	Q_0	1	2	3	4	5	6	Q_7	Shift right	Shift left
0								1	1	0
1							1	0	1	0
2						1		0	1	0
3					1			0	1	0
4				1				0	1	0
5			1					0	1	0
6	1	1						0	1	0
7	1							0	1	0
8	1							0	0	1
9		1						0	0	1
10			1					0	0	1
11				1				0	0	1
12					1			0	0	1
13						1		0	0	1
14							1	0	0	1
15								1	0	1

Circuit

S=Shift