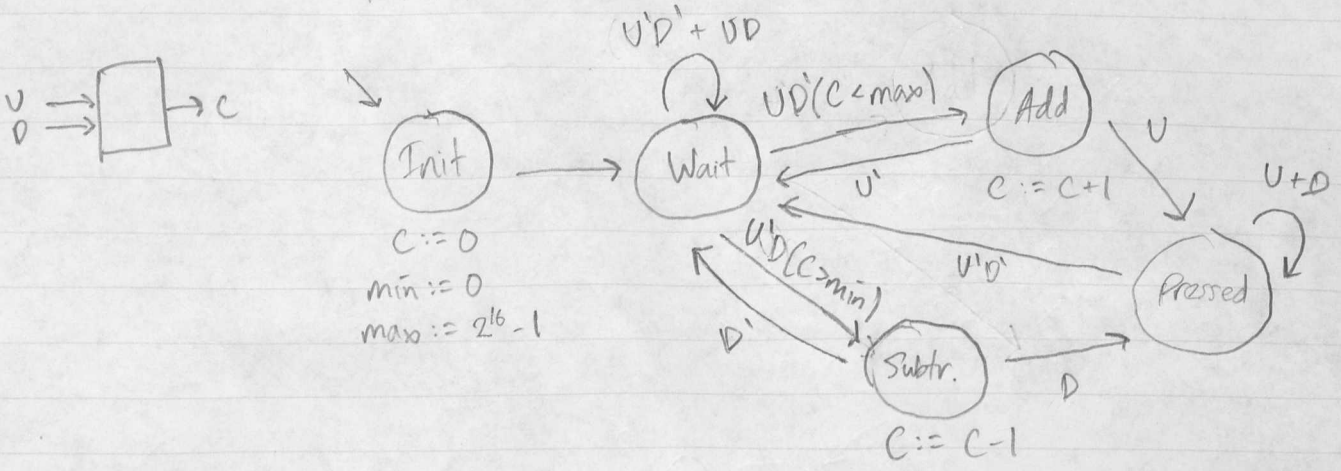
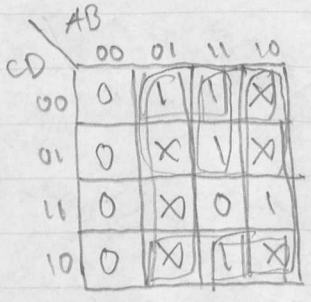
Elvin Hung eh26557

HW 5

1.



2. 1.

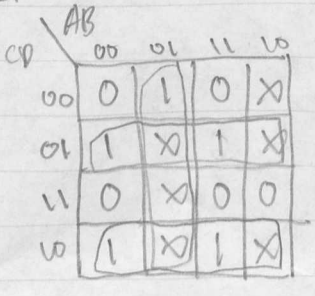


Prime Implicants: BC', AC', AB', AD', BD', A'B

F = AB' + BC' + BD'
= AB' + AC' + AD' + A'B

minterm m_{11} makes AB' essential

2.



Prime Implicants: A'B, CD', C'D

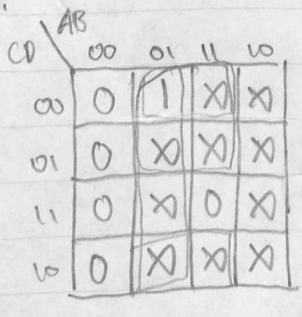
F = A'B + CD' + C'D

m_4 makes A'B essential

m_1, m_{13} make C'D essential

m_2, m_{14} make CD' essential

3.



Prime Implicants: BC', A'B, BD'

F = BC'

4.

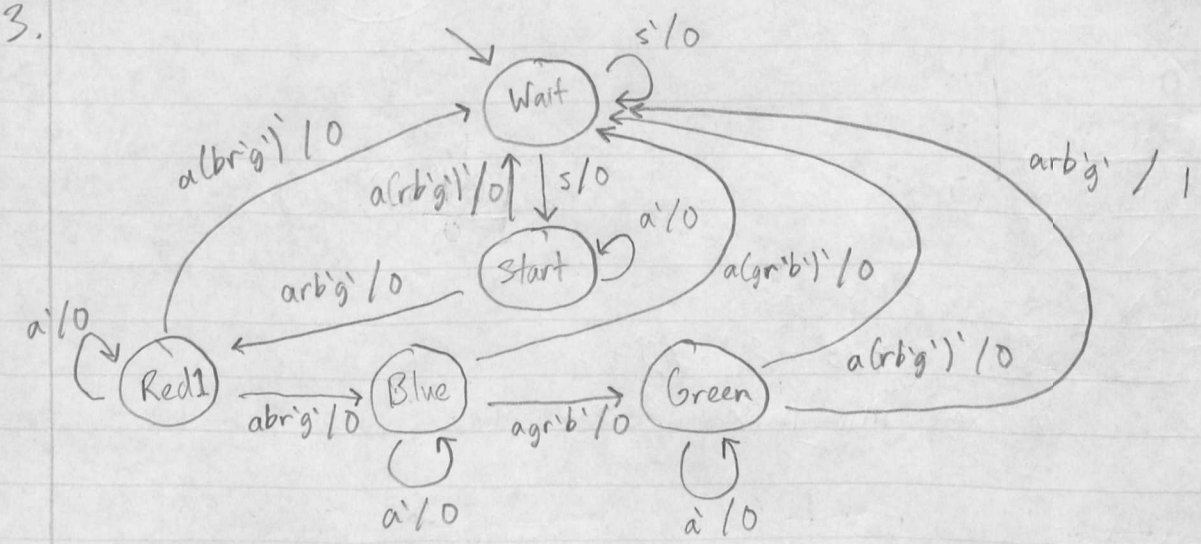
CD \ AB	00	01	11	10
00	X	1	0	X
01	X	X	0	X
11	0	X	1	0
10	X	X	0	X

Prime Implicants: $A'B$, $A'C'$, $A'D'$, $\underline{BCD}$

$F = A'B + BCD$

minterm m_{15} makes BCD essential

3.



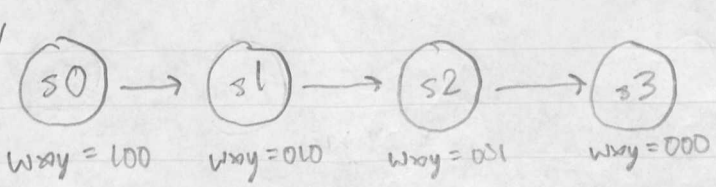
4.

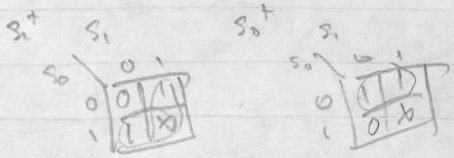
	a	b	c	d	e	f	g
b	X						
c	X	X					
d	X	X	h=f, b=h				
e	X	d=f	X	X			
f	X	X	h=f, b=g	h=g	X		
g	h=g	X	X	X	X	X	
h	h=a	X	X	X	X	X	g=a

a=g
a=h
b=e
d=f

Present State	Next State x=0	Next State 1	Present Output x=0	Present Output 1
a	a	c	1	0
b	c	d	0	1
c	a	b	0	0
d	d	a	0	0

5.





i. 2-bit binary encoding

Present State					Next State	
S_1	S_0	W	X	Y	S_1^+	S_0^+
0	0	1	0	0	0	1
0	1	0	1	0	1	0
1	0	0	0	1	1	1
1	1	0	0	0	X	X

$W = S_1' S_0'$ $\quad S_1^+ = S_1 + S_0$

$X = S_1' S_0$ $\quad S_0^+ = S_0'$

$Y = S_1 S_0'$

Most literals

ii. output encoding

Present State						Next State		
S_2	S_1	S_0	W	X	Y	S_2^+	S_1^+	S_0^+
1	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1
0	0	1	0	0	1	0	0	0
0	0	0	0	0	0	X	X	X

$W = S_2$ $\quad S_2^+ = 0$

$X = S_1$ $\quad S_1^+ = S_2$

$Y = S_0$ $\quad S_0^+ = S_1$

Least literals

iii. one-hot encoding

Present State							Next State			
S_3	S_2	S_1	S_0	W	X	Y	S_3^+	S_2^+	S_1^+	S_0^+
0	0	0	1	1	0	0	0	0	1	0
0	0	1	0	0	1	0	0	1	0	0
0	1	0	0	0	0	1	1	0	0	0
1	0	0	0	0	0	0	X	X	X	X

$W = S_0$ $\quad S_3^+ = S_2$

$X = S_1$ $\quad S_2^+ = S_1$

$Y = S_2$ $\quad S_1^+ = S_0$

$S_0^+ = 0$

One more literal than output encoding

6.

Present State			Next State		
S_2	S_1	S_0	S_2^+	S_1^+	S_0^+
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	1	0	1
0	1	1	X	X	X
1	0	0	X	X	X
1	0	1	1	1	0
1	1	0	0	0	1
1	1	1	X	X	X

S_2^+

S_1S_0 \ S_2	0	1
00	0	X
01	0	1
11	X	X
10	1	0

S_1^+

S_1S_0 \ S_2	0	1
00	1	X
01	0	1
11	X	X
10	0	0

S_0^+

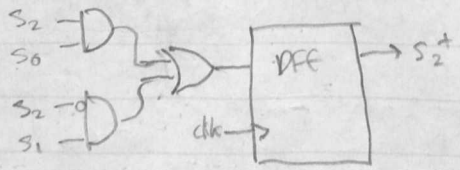
S_1S_0 \ S_2	0	1
00	0	X
01	0	0
11	X	X
10	1	1

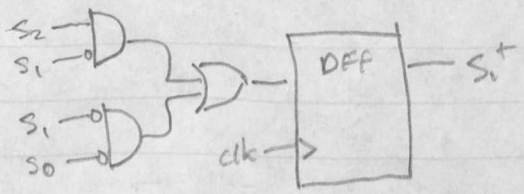
$S_2^+ = S_2S_0 + S_2'S_1$

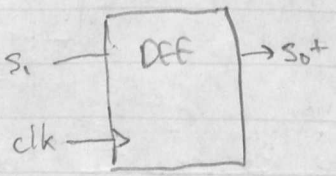
$S_1^+ = S_2S_1' + S_1'S_0'$

$S_0^+ = S_1$

a. D-ff







b. T-ff $T_2 = S_1$

$T_1 = S_2 + S_0'$

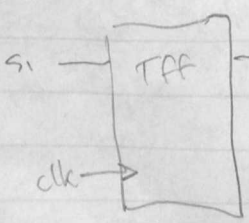
$T_0 = S_1 + S_0$

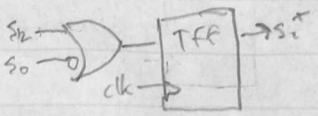
T_1

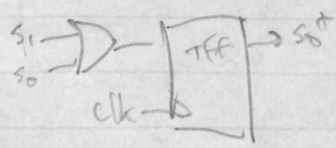
S_1S_0 \ S_2	0	1
00	1	X
01	0	1
11	X	X
10	1	1

T_2

S_1S_0 \ S_2	0	1
00	0	X
01	0	0
11	X	X
10	1	1







T_0

S_1S_0 \ S_2	0	1
00	0	X
01	1	1
11	X	X
10	1	1