

Solution to Final Exam

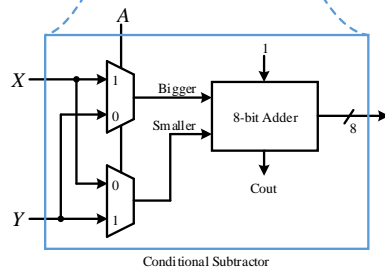
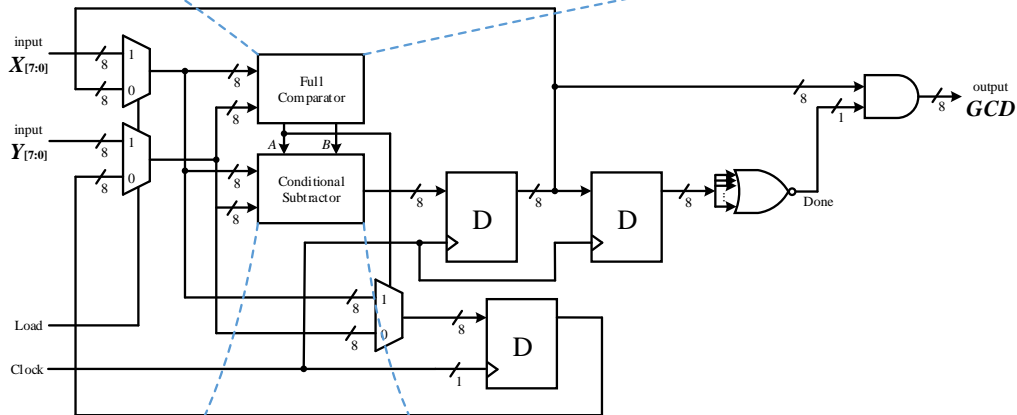
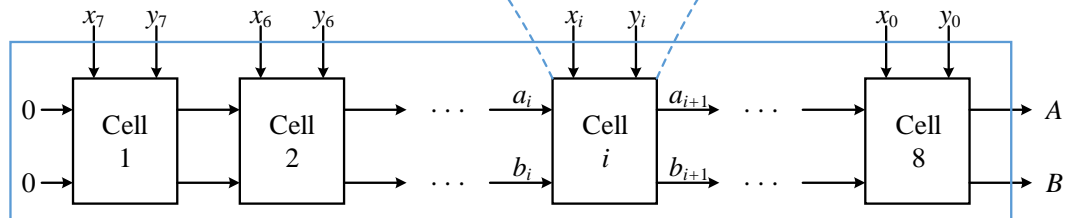
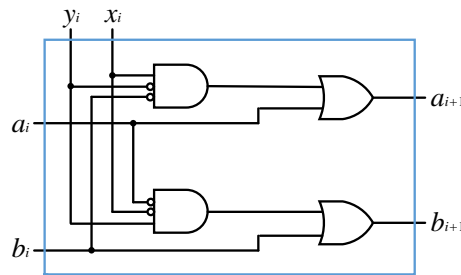
Dec. 18, 2014

1.

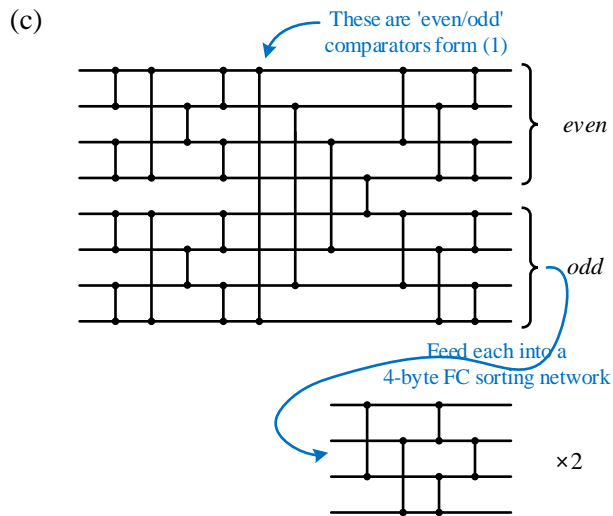
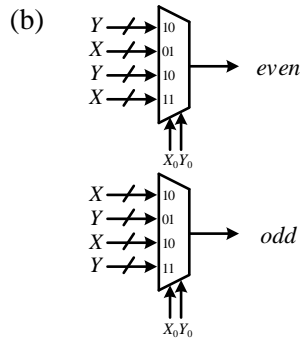
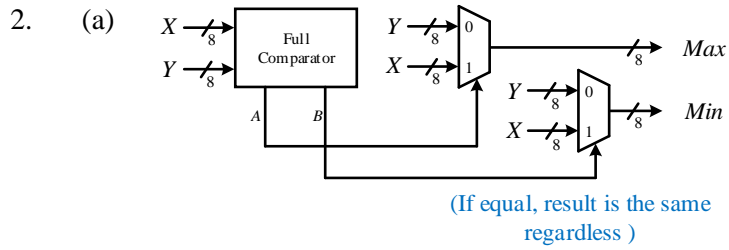
A_{in}	B_{in}	X	Y	A_{out}	B_{out}
0	0	0	0	0	0
0	0	0	1	0	1
0	0	1	0	1	0
0	0	1	1	0	0
0	1	0	0	0	1
0	1	0	1	0	1
0	1	1	0	0	1
0	1	1	1	0	1
1	0	0	0	1	0
1	0	0	1	1	0
1	0	1	0	1	0
1	0	1	1	1	0
1	1	0	0	x	x
1	1	0	1	x	x
1	1	1	0	x	x
1	1	1	1	x	x

$$A_{out} = A_{in} + \overline{B_{in}} X \overline{Y}$$

$$B_{out} = B_{in} + \overline{A_{in}} X Y$$



Conditional Subtractor



3.

$$f_1 = x_1x_2 + x_1\bar{x}_2x_3x_1 + x_1\bar{x}_2x_3\bar{x}_1x_2x_3$$

$$= x_1x_2 + x_1\bar{x}_2x_3 = x_1x_2 + x_1x_3$$

$$= x_1(x_2 + x_3)$$

$$f_3 = x_3(x_1 + x_2)$$

$$f_5 = x_2(x_1 + x_3)$$

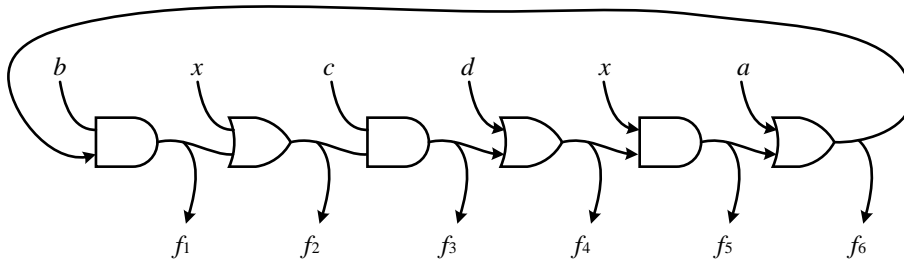
$$f_2 = x_2 + \bar{x}_2x_3x_1 + \bar{x}_2x_3\bar{x}_1x_2x_3$$

$$= x_2 + x_1x_3$$

$$f_4 = x_1 + x_2x_3$$

$$f_6 = x_3 + x_1x_2$$

4.

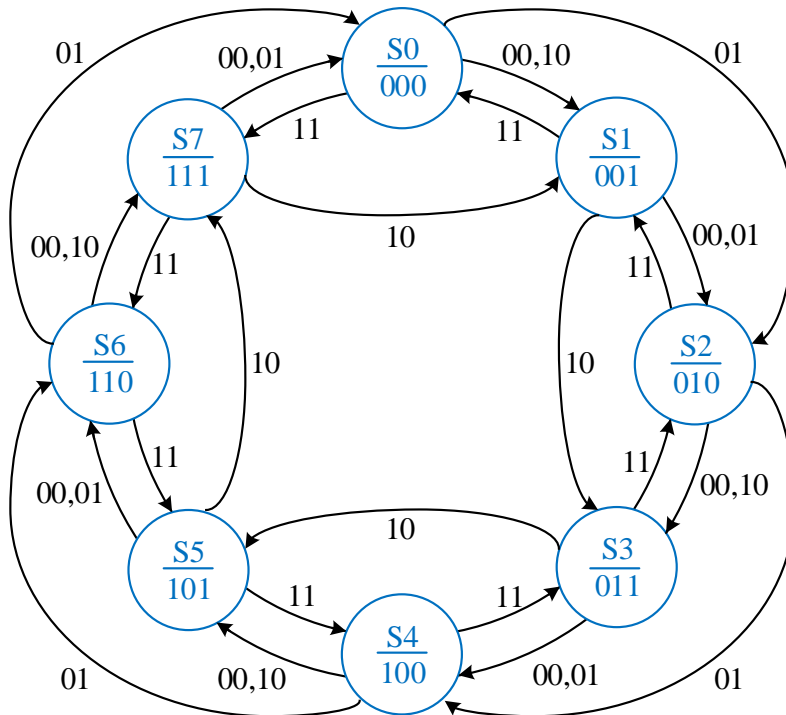


The non-trivial cases :

$$(c(ba + x) + d)x = \cancel{cbax} + cx + dx = x(c + d)$$

$$b(x(c + d) + a) + x = \cancel{bxc} + \cancel{bx d} + ba + x = ba + x$$

5. (a)



- (b) S0 : 00000001
 S1 : 00000010
 S2 : 00000100
 S3 : 00001000
 S4 : 00010000
 S5 : 00100000
 S6 : 01000000
 S7 : 10000000

- (c) $Q_0^+ = Q_6 \bar{X}Y + Q_7 \bar{X} + Q_1 XY$
 $Q_1^+ = Q_7 X\bar{Y} + Q_0 \bar{Y} + Q_2 XY$
 $Q_2^+ = Q_0 \bar{X}Y + Q_1 \bar{X} + Q_3 XY$
 $Q_3^+ = Q_1 X\bar{Y} + Q_2 \bar{Y} + Q_4 XY$
 $Q_4^+ = Q_2 \bar{X}Y + Q_3 \bar{X} + Q_5 XY$
 $Q_5^+ = Q_3 X\bar{Y} + Q_4 \bar{Y} + Q_6 XY$
 $Q_6^+ = Q_4 \bar{X}Y + Q_5 \bar{X} + Q_7 XY$
 $Q_7^+ = Q_5 X\bar{Y} + Q_6 \bar{Y} + Q_0 XY$

