

Logic design (2016 fall)

Quiz # 12

Name: _____ ID: _____

Design a 3-bit counter counts in sequence : 001, 011, 010, 110, 111, 101, 100, (repeat) 001,

(a) (50%) Use D flip-flops.

cba	$c^+b^+a^+$
000	
001	
010	
011	
100	
101	
110	
111	

C⁺

		c	
		0	1
ba	00		
	01		
	11		
	10		

B⁺

		c	
		0	1
ba	00		
	01		
	11		
	10		

A⁺

		c	
		0	1
ba	00		
	01		
	11		
	10		

(b) (50%) Use J-K flip-flops.

cba	$c^+b^+a^+$
000	
001	
010	
011	
100	
101	
110	
111	

C^+

		c	
		0	1
ba	00		
	01		
	11		
	10		

B^+

		c	
		0	1
ba	00		
	01		
	11		
	10		

A^+

		c	
		0	1
ba	00		
	01		
	11		
	10		

J_c

		c	
		0	1
ba	00		
	01		
	11		
	10		

K_c

		c	
		0	1
ba	00		
	01		
	11		
	10		

J_B

		c	
		0	1
ba	00		
	01		
	11		
	10		

K_B

		c	
		0	1
ba	00		
	01		
	11		
	10		

J_A

		c	
		0	1
ba	00		
	01		
	11		
	10		

K_A

		c	
		0	1
ba	00		
	01		
	11		
	10		

(a)

CBA	$C^+B^+A^+$
000	XXX
001	011
010	110
011	010
100	001
101	100
110	111
111	101

C^+

		C	
B	A	0	1
00		X	0
01		0	1
11		0	1
10		1	1

$C^+ = CA + BA'$

B^+

		C	
B	A	0	1
00		X	0
01		1	0
11		1	0
10		1	1

$B^+ = C' + BA'$

A^+

		C	
B	A	0	1
00		X	1
01		1	0
11		0	1
10		0	1

$A^+ = C'B' + CB + B'A'$
 $A^+ = C'B' + CB + CA'$

For D flip-flop: 000 goes to 011 because $D_C D_B D_A = 011$

(b)

12.8 (a)

CBA	$C^+B^+A^+$
000	XXX
001	011
010	110
011	010
100	001
101	100
110	111
111	101

C^+

		C	
B	A	0	1
00		X	0
01		0	1
11		0	1
10		1	1

B^+

		C	
B	A	0	1
00		X	0
01		1	0
11		1	0
10		1	1

A^+

		C	
B	A	0	1
00		X	1
01		1	0
11		0	1
10		0	1

J_C

		C	
B	A	0	1
00		X	X
01		0	X
11		0	X
10		1	X

$J_C = A'$

K_C

		C	
B	A	0	1
00		X	1
01		X	0
11		X	0
10		X	0

$K_C = B'A'$

J_B

		C	
B	A	0	1
00		X	0
01		1	0
11		X	X
10		X	X

$J_B = C'$

K_B

		C	
B	A	0	1
00		X	X
01		X	X
11		0	1
10		0	0

$K_B = CA$

J_A

		C	
B	A	0	1
00		X	1
01		X	X
11		X	X
10		0	1

$J_A = C$

K_A

		C	
B	A	0	1
00		X	X
01		0	1
11		1	0
10		X	X

$K_A = C'B + CB'$