 Review Exercises #2 6/4/04

1. <u>Multiplying two 2-bit unsigned numbers</u> (H.+H. 8.14, p. 493)

Mult. table:

d_1d_0 \ c_1c_0	00	01	11	10
00	0000	0000	0000	0000
01	0000	0001	0011	0010
11	0000	0011	1001	0110
10	0000	0010	0110	0100

$= b_3 b_2 b_1 b_0$

<u>Karnaugh maps for each bit</u>:

<u>1-bit b_0</u>

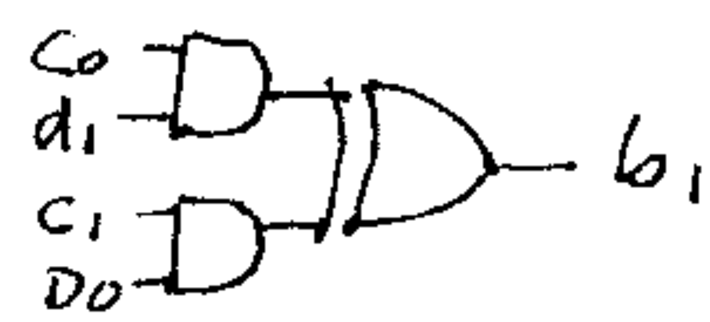
d_1d_0 \ c_1c_0	00	01	11	10
00	0	0	0	0
01	0	1	1	0
11	0	1	1	0
10	0	0	0	0

$\boxed{b_0 = c_0 \cdot d_0}$

<u>2-bit b_1</u>

d_1d_0 \ c_1c_0	00	01	11	10
00	0	0	0	0
01	0	0	1	1
11	0	1	0	1
10	0	1	1	0

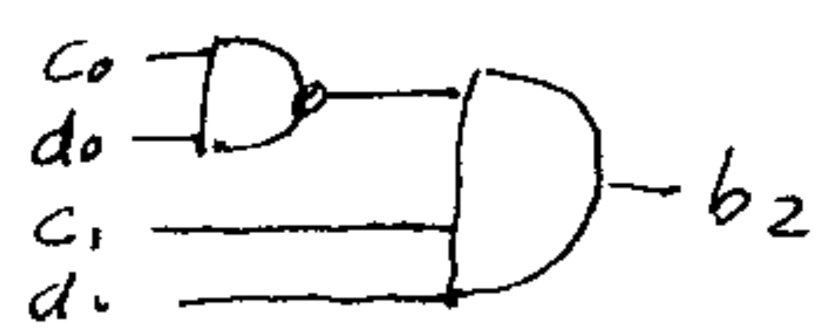
$\boxed{b_1 = c_1 d_0 \oplus d_1 c_0}$



<u>4-bit b_2</u>

d_1d_0 \ c_1c_0	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	0	0	0	1
10	0	0	1	1

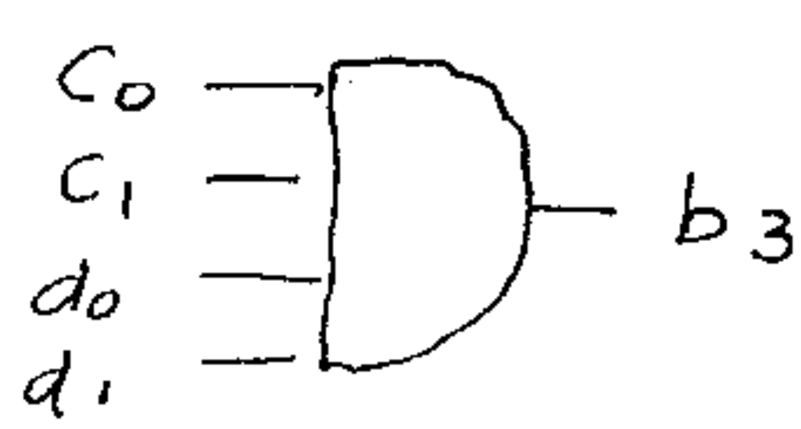
$\boxed{b_2 = c_1 d_1 \overline{c_0 d_0}}$



<u>8-bit b_3</u>

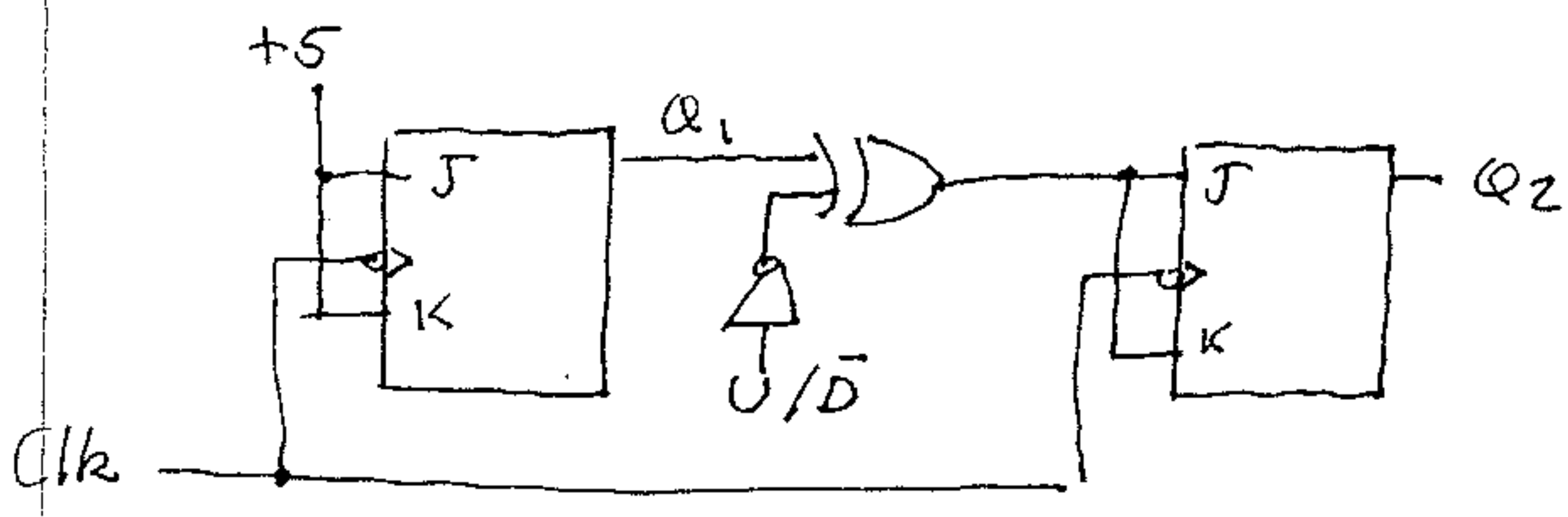
d_1d_0 \ c_1c_0	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	0	0	1	0
10	0	0	0	0

$\boxed{b_3 = c_1 c_0 d_1 d_0}$

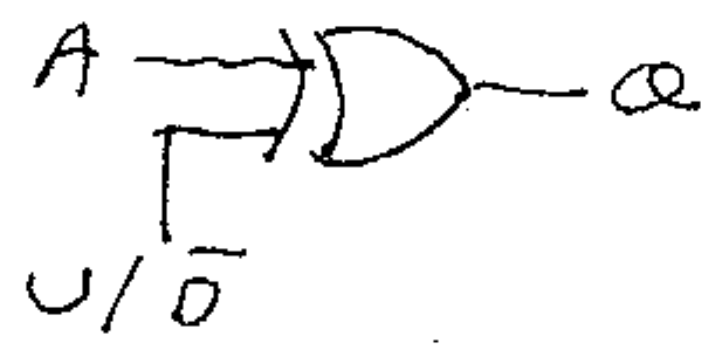


 Review Exercise # 2

2. Synchronous 2-bit $U/\bar{D}$ counter (H.+H., 8.25, p.514):



U: counts up
$\bar{D}$: counts down



U: $A=1 \Rightarrow Q=0$
$A=0 \Rightarrow Q=1$
$\bar{D}$: $A=1 \Rightarrow Q=1$
$A=0 \Rightarrow Q=0$

3. Prime number finder (1 through 15):

A_2A_1 \ A_4A_3		00	01	11	10
00		X	0	0	0
01	(odd)	1	1 (5)	1 (13)	0 (9)
11	(odd)	1	1 (7)	0 (15)	1 (11)
10		1	0 (6)	0	0

$\overline{A_4 \oplus A_1}$

$\bar{A}_4\bar{A}_3$ $\bar{A}_4 A_1$

$$\boxed{P = \bar{A}_4(A_1 + \bar{A}_3) + \overline{A_4 \oplus A_1}}$$

This is one of several solutions. Another is

A_2A_1 \ A_4A_3	00	01	11	10
00	X	0	0	0
01	1	1	1	0
11	1	1	0	1
10	1	0	0	0

$\bar{A}_4\bar{A}_3$ $\bar{A}_4 A_1$ $A_3\bar{A}_2A_1$ $A_2A_1\bar{A}_3$

so $$\boxed{P = \bar{A}_4(\bar{A}_3 + A_1) + A_1(\bar{A}_3A_2 + \bar{A}_2A_3) = \bar{A}_4(A_3 + A_1) + A_1(A_2 \oplus A_3)}$$