University of California at Berkeley
College of Engineering
Department of Electrical Engineering and Computer Science

EECS150, Spring 2012

Homework Assignment 10: Counter, LFSR and K map
Due April 23^{rd}, 2pm

1. Design a four bit counter which counts in gray code. Gray code is a binary numeral system where two successive values differ in only one bit. For 4 bits, the following sequence is generated using the counter.

   4'b0000, 4'b0001, 4'b0011, 4'b0010, 4'b0110, 4'b0111,4'b0101, 4'b0100, 4'b1100, 4'b1101, 4'b1111, 4'b1110, 4'b1010, 4'b1011, 4'b1001, 4'b1000.

   Your counter should have a reset and enable input, and the flip-flops given do not have clock enable. Draw the gate level diagram and try to optimize your design.

2. Design a circuit that can generate both 5 bit and 7 bit pseudo-random numbers. A control signal would switch the circuit between the 5-bit mode and 7-bit mode. When the circuit is used for generating 5 bit numbers, the top two bits of the output should remain low. Try to minimize the amount of hardware used.

3. Show the Sum of Products and Product of Sums forms corresponding to the following truth tables, simplify them using K map.

(a)

a b	c d	out
00	00	-
00	01	1
00	10	1
00	11	1
01	00	1
01	01	-
01	10	0
01	11	0
10	00	-
10	01	0
10	10	1
10	11	0
11	00	0
11	01	0
11	10	0
11	11	0

(b)

a b	c d	out
00	00	1
00	01	0
00	10	0
00	11	0
01	00	1
01	01	0
01	10	1
01	11	0
10	00	1
10	01	1
10	10	1
10	11	1
11	00	-
11	01	0
11	10	0
11	11	-

(c)

a b	c d	e	out
00	00	0	0
00	01	0	0
00	10	0	0
00	11	0	0
01	00	0	0
01	01	0	1
01	10	0	1
01	11	0	0
10	00	0	0
10	01	0	1
10	10	0	0
10	11	0	1
11	00	0	0
11	01	0	-
11	10	0	1
11	11	0	0
00	00	1	0
00	01	1	1
00	10	1	1
00	11	1	0
01	00	1	0
01	01	1	1
01	10	1	-
01	11	1	0
10	00	1	0
10	01	1	0
10	10	1	1
10	11	1	1
11	00	1	0
11	01	1	1
11	10	1	1
11	11	1	-