Boise State University
Department of Electrical and Computer Engineering
ECE 230 Digital Systems
Quiz 4 – September 17 2010

Name: Key

1. Design a digital circuit with output f and input x_1, x_0, y_1, y_0, Let $X = x_1x_0$ be a number, where the four possible values of X, namely, 00, 01, 10, and 11, represent the four numbers 0, 1, 2, 3, respectively. Similarly, $Y = y_1y_0$ represent another number with same four possible values. The output f should be 1 only if $X < Y$. Otherwise, f should be 0.

(a) Show the truth table for f.
(b) Show the simplest possible SOP f.
(c) Re-implement your SOP with NAND gate only.
(d) Calculate the cost of SOP, assuming that the input variables are available in both un-complemented and complemented forms.

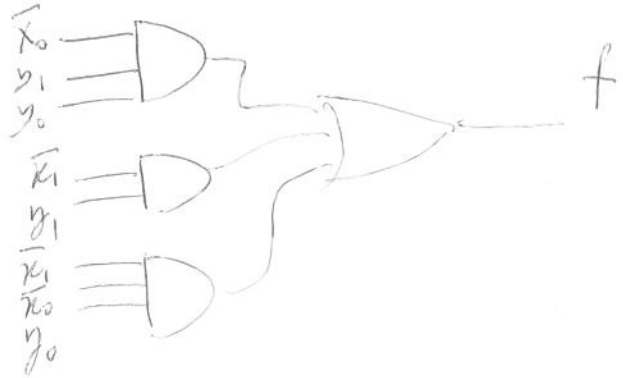
(a)

x_1	x_0	y_1	y_0	f
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

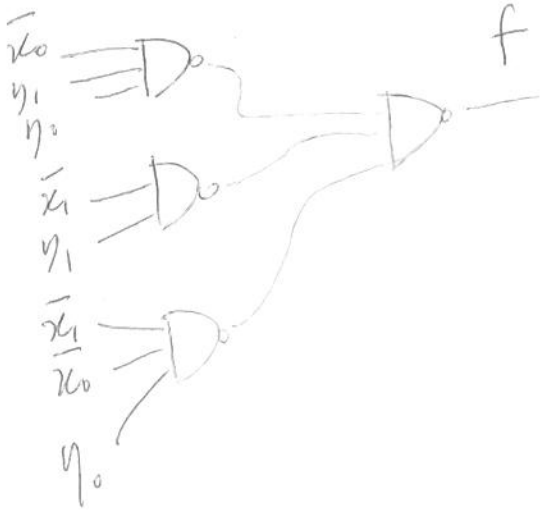
(b)

y_1y_0 \ x_1x_0	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	1	0	0
10	1	1	0	0

$f = \bar{x}_0 y_1 y_0 + \bar{x}_1 y_1 + \bar{x}_1 \bar{x}_0 y_0$



(c)



(d) cost = #inputs + #gates
= 11 + 4 = 15