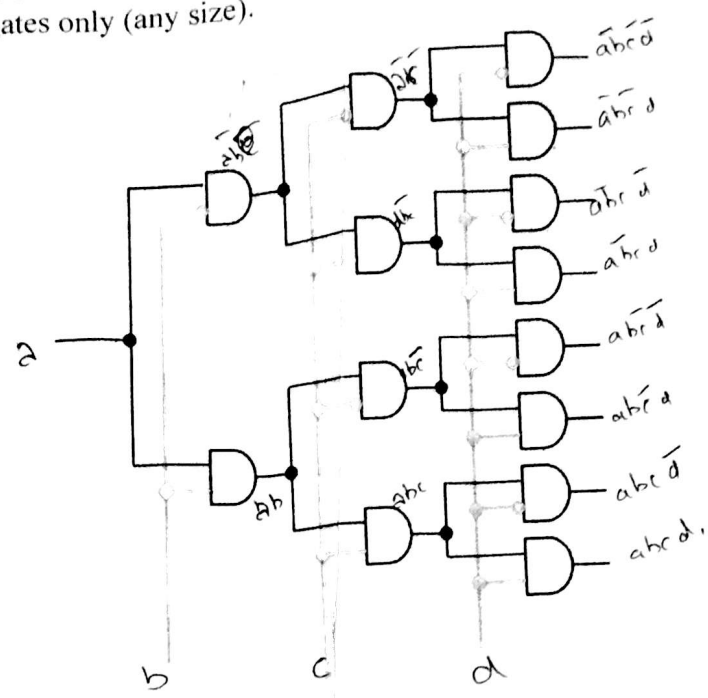**COL215 Digital Logic and System Design**
Minor Test 1

28.08.2016

Max Marks: 10

1. What does the circuit shown below do? Write a VHDL description for it. Give an equivalent circuit using NAND gates only (any size).


[3]

2. Truth table for a Boolean function f of 4 variables x_1, x_2, x_3 and x_4 is shown.

a) Find minimum SOP expression for this function using Karnaugh Map.

b) Find minimum POS expression for this function using Karnaugh Map.

c) Transform the POS form obtained in (b) into an SOP form algebraically.

d) Check if result of (c) fully or partially matches result of (a).

[3]

x_1 x_2 x_3 x_4	f
0 0 0 0	1
0 0 0 1	-
0 0 1 0	1
0 0 1 1	-
0 1 0 0	1
0 1 0 1	0
0 1 1 0	-
0 1 1 1	-
1 0 0 0	1
1 0 0 1	1
1 0 1 0	1
1 0 1 1	0
1 1 0 0	0
1 1 0 1	1
1 1 1 0	0
1 1 1 1	1
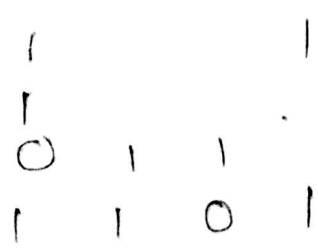
3. A 4 bit Gray code counter is to be designed which cycles through the sequence 0000, 0001, 0011, 0010, 0110, 0111, 0101, 0100, 1100, 1101, 1111, 1110, 1010, 1011, 1001, 1000. Do you see any interesting property of this sequence? There is an input w that controls the counting. When w = 1, the counting progresses. When w = 0, counting stays still. Draw a state transition diagram and use it to design the counter.

[4]

$T_0 = 1.w$

$T \quad x_1 x_2' x_3' + x_1 x_2 x_4$
$\quad\quad + x_1' x_3' x_4'$