

MIDTERM

CSE 140 – Summer Session 2 – 2016

Instructor: Pietro Mercati

Name:

PID:

Person on the left:

Person on the right:

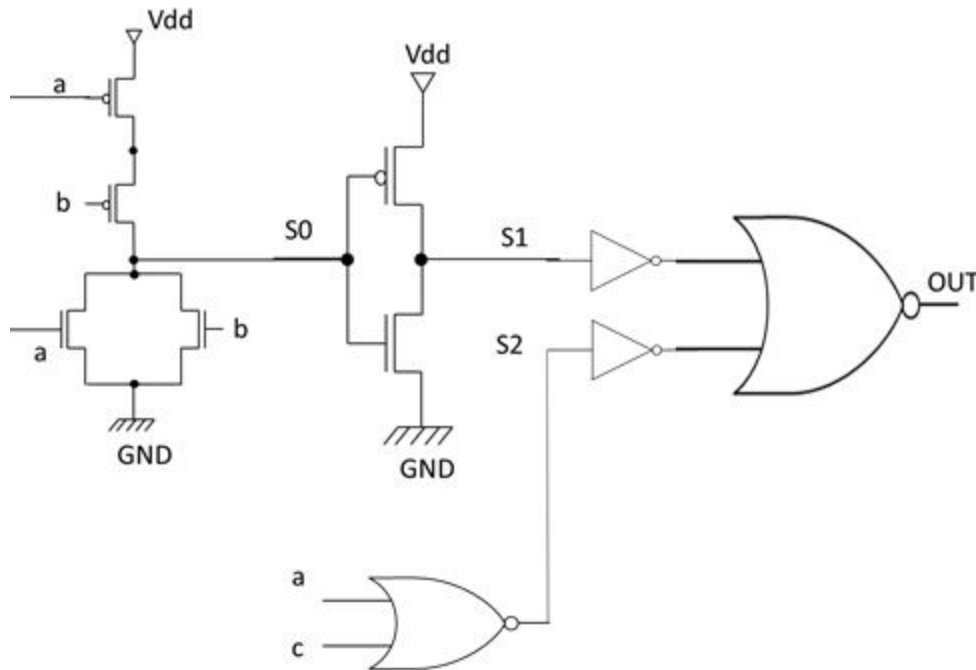
	A	B	C	Total
Problem 1	4	4	2	10
Problem 2	4	4	2	10
Problem 3	4	4	2	10
Problem 4	2	4	4	10

NAME:

PID:

Problem 1:

a) Write the expression for signals S0, S1, S2, OUT in the following circuit, as specified below. Write them as a function of the variables specified between the parentheses. Black dots in the figure highlight wire connections.



$$S0(a,b) = (a+b)' \text{ or } a'.b'$$

$$S1(a,b) = (a+b) \text{ or } (a'.b')'$$

$$S2(a,c) = (a+c)' \text{ or } a'.c'$$

$$OUT(a,b,c) = a'.b.c'$$

NAME:

PID:

b) Complete the truth table for the same circuit.

a	b	c	OUT
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

c) Provide the expression for the same function in terms of canonical SOP and POS.

$$\text{SOP} = a'bc'$$

$$\text{POS} = (a+b+c).(a+b+c').(a+b'+c').(a'+b+c).(a'+b+c').(a'+b'+c).(a'+b'+c')$$

NAME:

PID:

Problem 2:

a) Given the following expression in terms of canonical product of sums (POS), complete the truth table.

$$f(a,b,c) = \prod M(1,2,5) + \sum d(6)$$

a	b	c	OUT
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	X
1	1	1	1

b) Convert the truth table into a K-map:

c\ab	00	01	11	10
0	1	0	X	1
1	0	1	1	0

c) Derive the minimal SOP expression for the same function from the K-map:

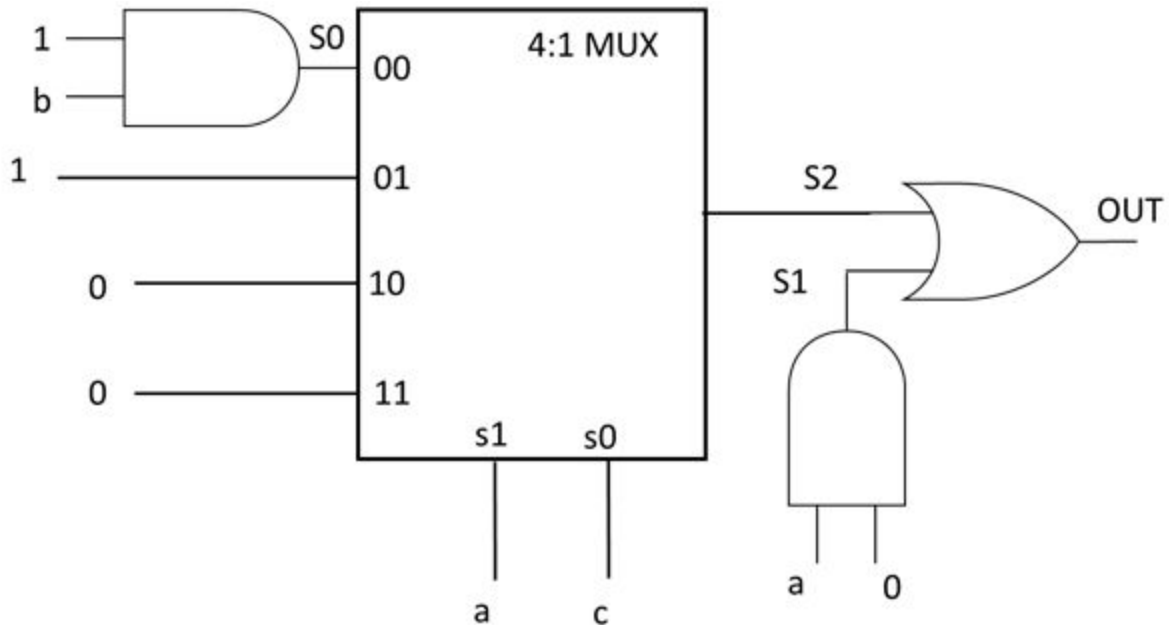
$$f(a,b,c) = bc + b'c' \text{ SOP}$$

NAME:

PID:

Problem 3:

a) Given the following circuit, write the corresponding expression for the signals specified below in terms of the variables specified between parentheses.



$$S0(b) = b \cdot 1 = b$$

$$S1(a) = a \cdot 0 = 0$$

$$S2(a,c) = a'c'b + a'c$$

$$OUT(a,b,c) = a'c'b + a'c$$

NAME:

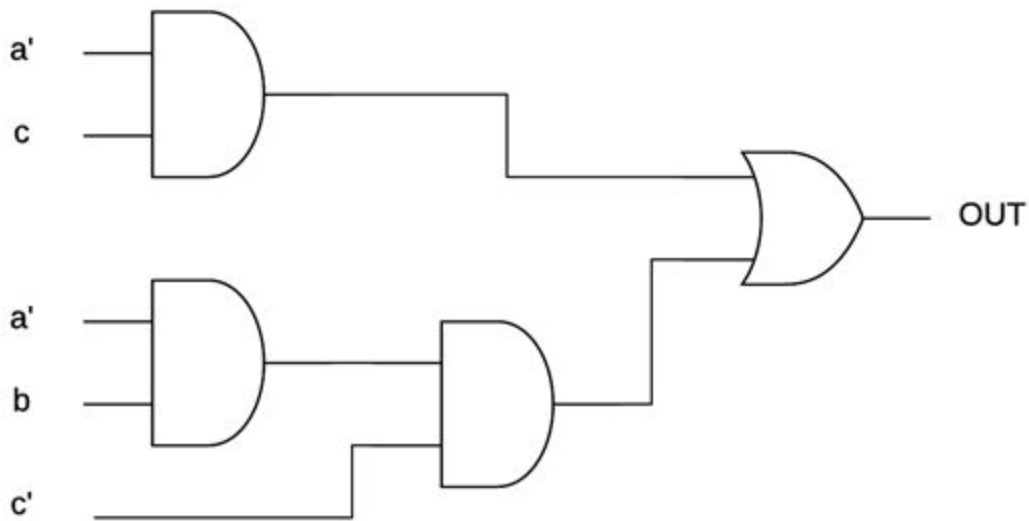
PID:

b) Complete the truth table for the same circuit.

a	b	c	OUT
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

c) Insert the correct literals into the empty boxes on the left so that the circuit below implements the same function (literals can be true or negated).

$$\text{OUT} = a'c + a'bc'$$



NAME:

PID:

Problem 4:

a) Given the following truth table, derive the corresponding canonical SOP expression.

a	b	c	OUT
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

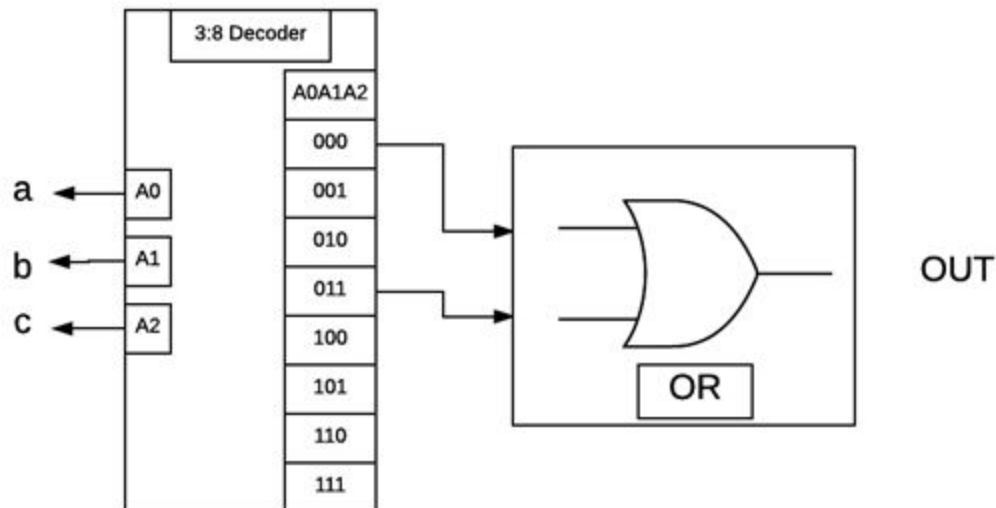
$$\text{SOP} = a'b'c' + a'bc$$

NAME:

PID:

b) Implement the function in the 3:8 DECODER below:

- insert the input literals in the empty boxes on the left
- complete the right connections with the box on the right and
- insert the correct logic gate to implement the function derived from the truth table.



c) Using a K-map, derive the minimal POS expression for the same function assuming also the presence of additional don't cares.

c\ab	00	01	11	10
0	1	X	0	0
1	0	1	0	X

$$F(a,b,c) = a' \cdot (c' + b)$$