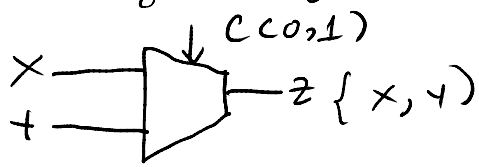
Q_1 : Given a MUX which has X and Y as input signals
In case that Y is selected, the control input $C = 1$
In case that X is selected, the control input $C = 0$

a) Create the truth table on the given MUX
b) write an expression for Z in form of SoP
c) Simplify the expression in part (b) by using k-map
d) Design a logical circuit for Z using 2-inputs NOR gate



Q_2: Implement the following expression with a MUX
a) $F = \Sigma(0, 2, 5, 7, 11, 14)$ SoP

b) $F = \Pi(3, 8, 12)$ POS

Solution

Q1

a)

Input			output
X	Y	C	Z
X	X	0	X
Y	X	1	Y

Input			Output	
X	Y	C	Z	
0	0	0	0	
0	0	1	0	
0	1	0	1	X
0	1	1	0	
1	0	0	0	
1	0	1	1	X
1	1	0	1	X
1	1	1	1	X

b) $Z = \overline{X}\,Y\,\overline{C} + X\,\overline{Y}\,C + X\,Y\,\overline{C} + X\,Y\,C$

c) $Z = X\overline{C} + YC$

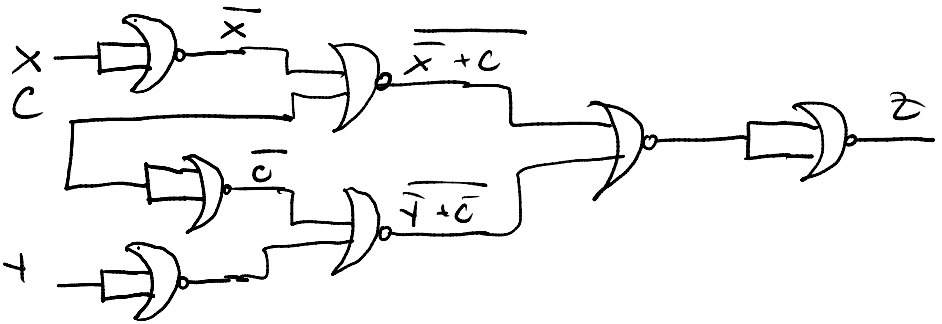
X Y \ C	0	1
0 0	0	0
0 1	0	1
1 1	1	1
1 0	1	0

d)

$Z = \overline{\overline{Y}C} + \overline{X\overline{C}}$

$= \overline{\overline{Y} + \overline{C}} + \overline{\overline{X} + C}$

$= \overline{\overline{X} + C} + \overline{\overline{Y} + \overline{C}}$


x
c
y
$\bar{x}$
$\overline{\bar{x}+c}$
$\bar{c}$
$\overline{\bar{y}+\bar{c}}$
z

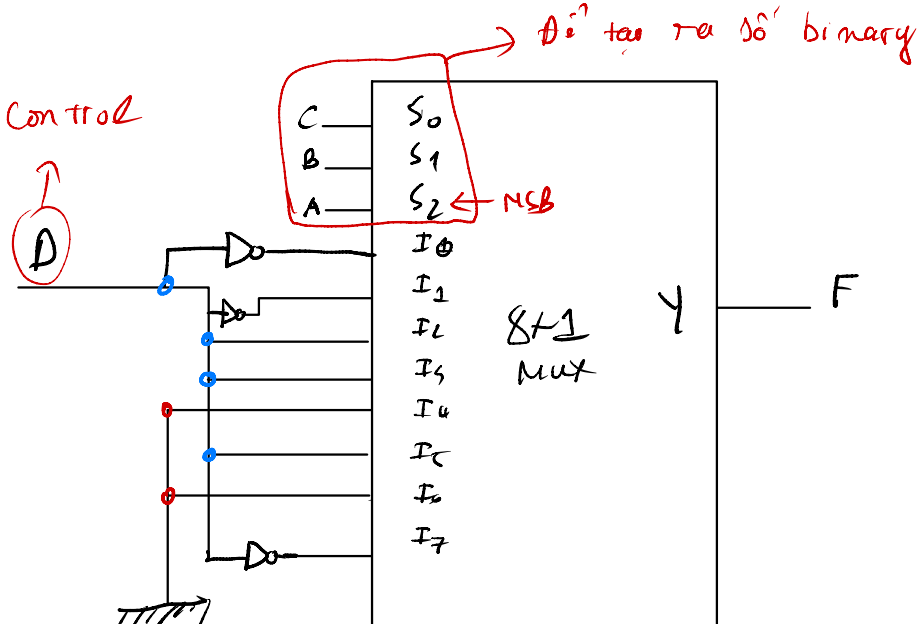
Q_2 :

a) $f = \Sigma(0, 2, 5, 7, 11, 14)$ $\quad 2^n \geq m$

$2^n \geq 14 \Rightarrow n = 4$

Input (MSB → LSB) | Output

	A	B	C	D	Y		
0	0	0	0	0	1	$F = D'$	I_0
1	0	0	0	1	0		
2	0	0	1	0	1	$F = D'$	I_1
3	0	0	1	1	0		
4	0	1	0	0	0	$F = D$	I_2
5	0	1	0	1	1		
6	0	1	1	0	0	$F = D$	I_3
7	0	1	1	1	1		
8	1	0	0	0	0	$F = 0$	I_4
9	1	0	0	1	0		
10	1	0	1	0	0	$F = D$	I_5
11	1	0	1	1	1		
12	1	1	0	0	0	$F = 0$	I_6
13	1	1	0	1	0		
14	1	1	1	0	1	$F = D'$	I_7
15	1	1	1	1	0		



b) $F = \pi(3, 8, 12)$,

	Input A	B	C	D	Output Y	
0	0	0	0	0	1	F = 1
1	0	0	0	1	1	
2	0	0	1	0	1	F = D'
3	0	0	1	1	0	
4	0	1	0	0	1	F = 1
5	0	1	0	1	1	
6	0	1	1	0	1	F = 1
7	0	1	1	1	1	
8	1	0	0	0	0	F = D
9	1	0	0	1	1	
10	1	0	1	0	1	F = 1
11	1	0	1	1	1	
12	1	1	0	0	0	F = D
13	1	1	0	1	1	
14	1	1	1	0	1	F = 1
15	1	1	1	1	1