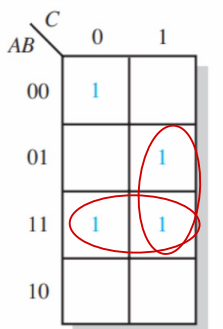
Lab Task:

Question 01:

Using K-MAP, write down minimum SOP and actual expression for each case. Create Truth Table of Actual expression and implement Both actual and reduced expression on Logisim.

1.



Actual

$\bar{A}\bar{B}\bar{C} + \bar{A}BC + ABC + AB\bar{C}$

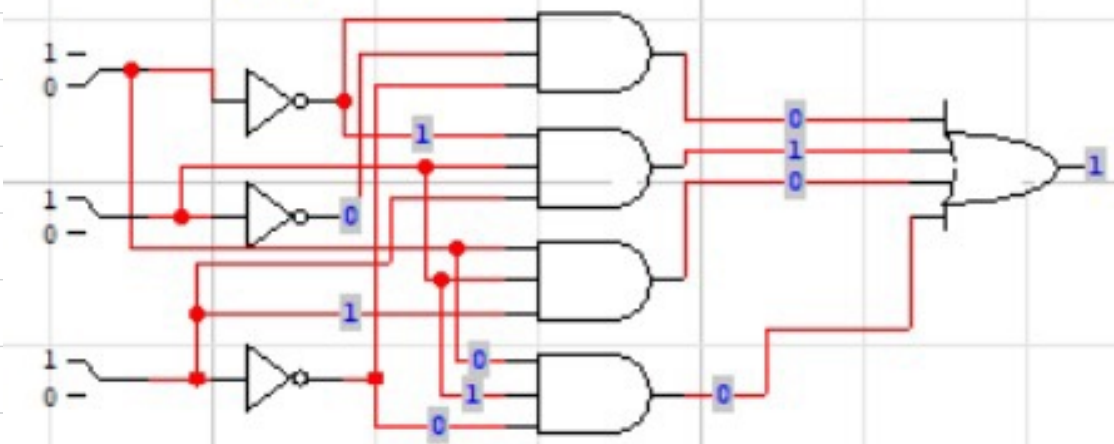
Reduced

$\bar{A}\bar{B}\bar{C} + BC + AB$

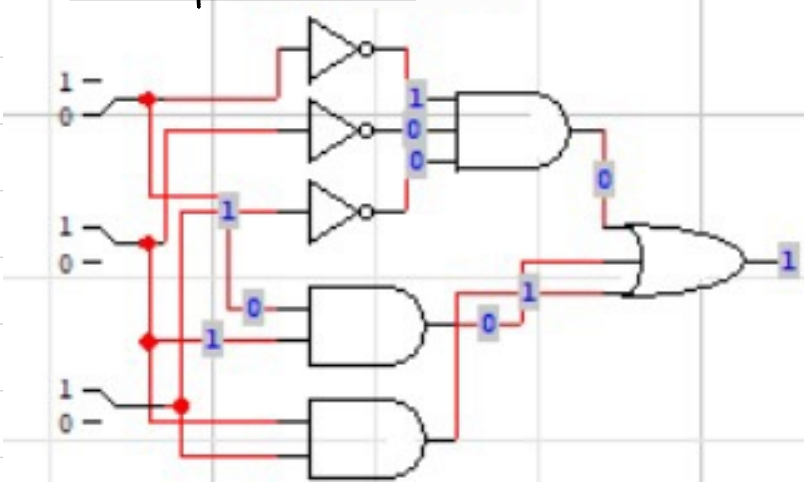
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Q1 part 1

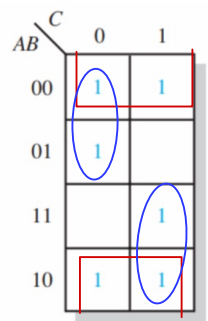
Actual



Simplified



(2)



Actual

$\bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + ABC + A\bar{B}\bar{C} + A\bar{B}C$

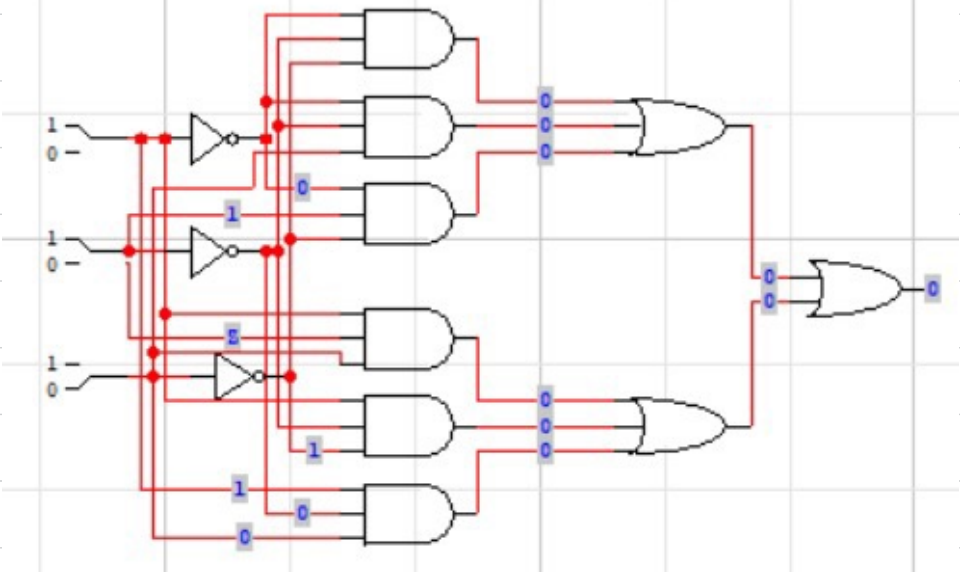
Reduced

$\bar{B} + \bar{A}\bar{C} + AC$

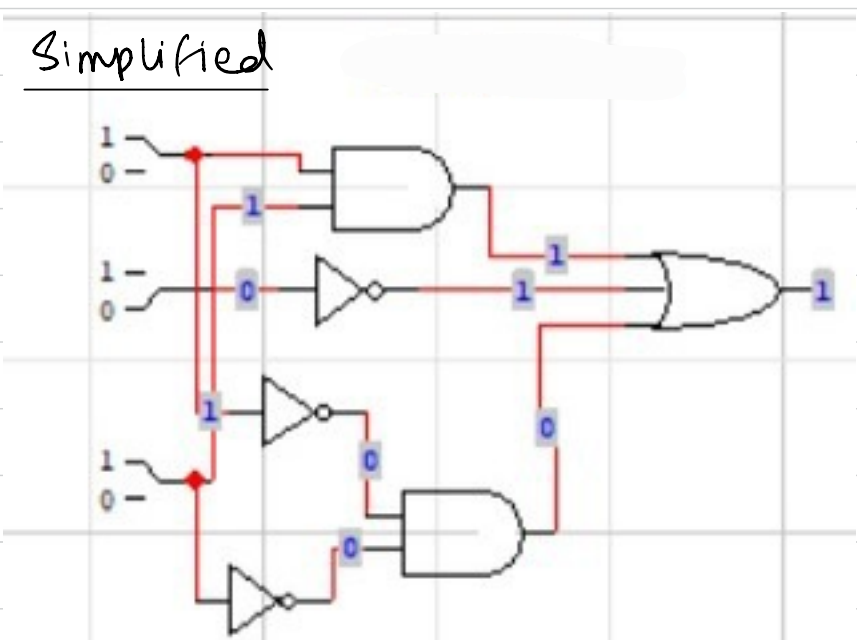
A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Q1 part 2

Actual



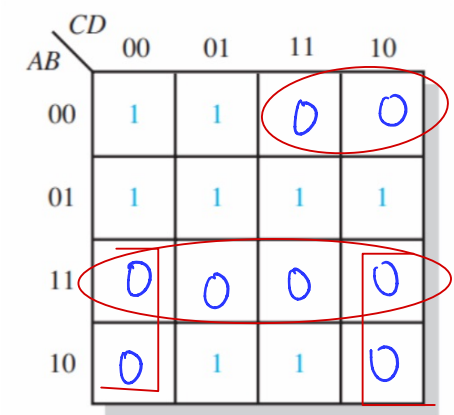
Simplified



Question 02:

Make a POS Simplified Expression of the following. Note the Blank spaces represent 0.

1.



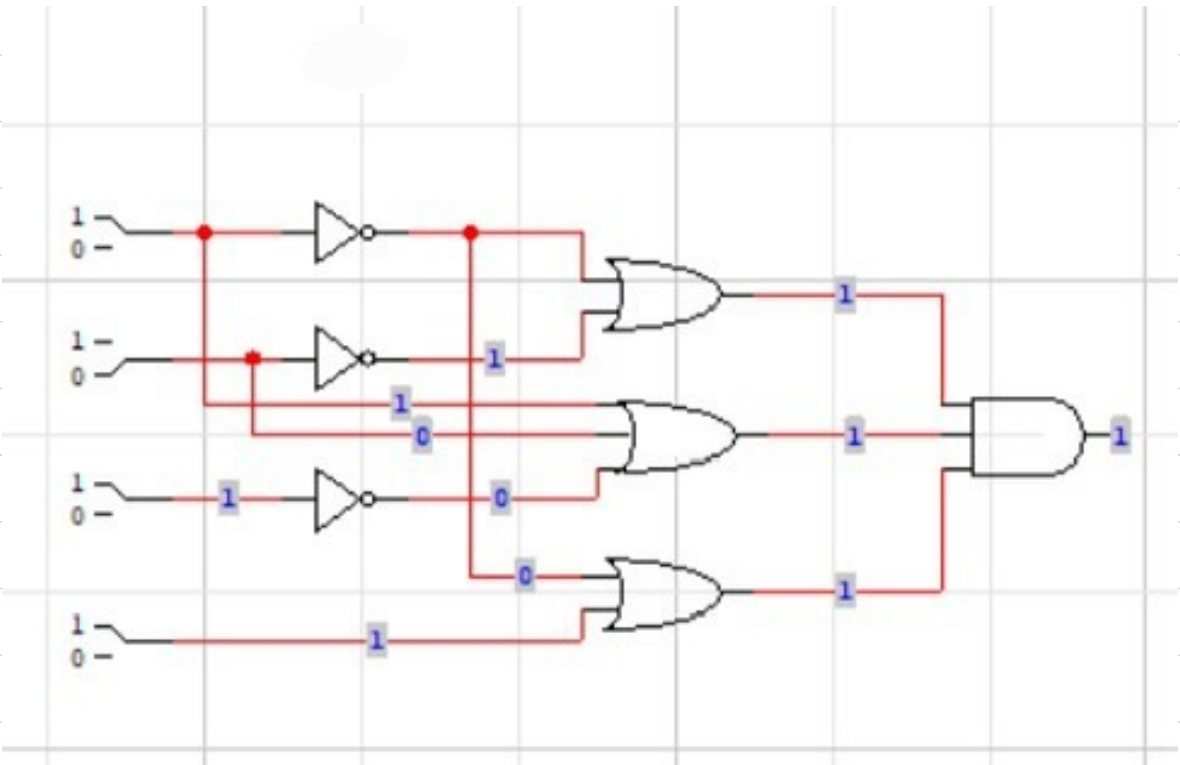
Actual

$$(A + B + \bar{C} + D)(A + B + \bar{C} + \bar{D})$$
$$(\bar{A} + \bar{B} + C + D)(\bar{A} + \bar{B} + C + \bar{D})$$
$$(\bar{A} + \bar{B} + C + D)(\bar{A} + \bar{B} + \bar{C} + D)$$
$$(\bar{A} + B + C + D)(\bar{A} + B + \bar{C} + D)$$

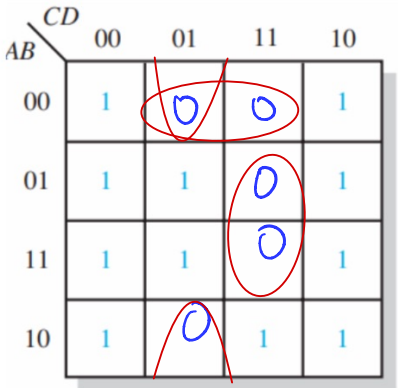
Reduced

$$(\bar{A} + \bar{D})(A + B + \bar{C})(\bar{A} + \bar{B})$$

A	B	C	D	X
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
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


1
0
1
0
1
0
1
0
1
1
0
1
0
0
1
1
1
1
1

2.



AB \ CD	00	01	11	10
00	1	0	0	1
01	1	1	0	1
11	1	1	0	1
10	1	0	1	1

Actual

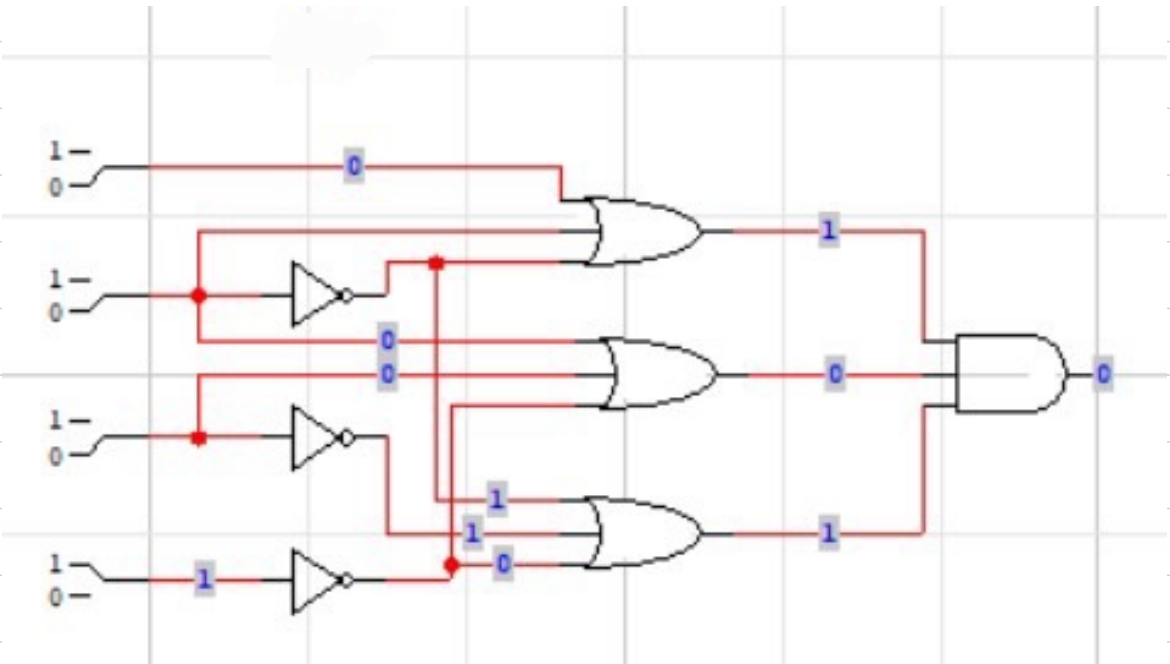
$(A + B + C + \bar{D})(A + B + \bar{C} + \bar{D})$
$(A + \bar{B} + \bar{C} + \bar{D})(\bar{A} + \bar{B} + \bar{C} + \bar{D})$

$(\bar{A} + B + C + \bar{D})$

Reduced

$(B + C + \bar{D})(A + B + \bar{D})$
$(\bar{B} + \bar{C} + \bar{D})$

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

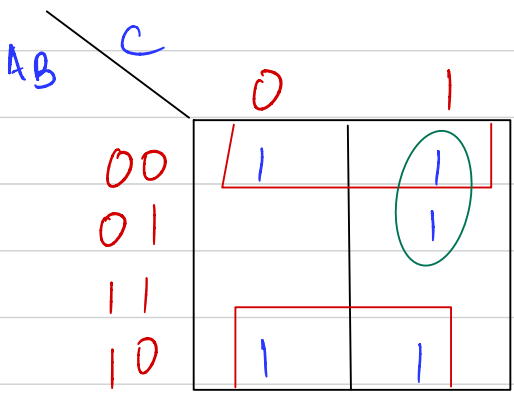

1
0
1
0
1
0
1
0
0
1
0
0
1
1
0
1
0
1
0
0

Question: 3 Use K-MAP to minimize the given SOP expression. Implement the minimized SOP on Logisim and Complete Truth Table.

$$A\bar{B}C + \bar{A}BC + \bar{A}\bar{B}C + \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C}$$

$A\bar{B}C$ + $\bar{A}BC$ + $\bar{A}\bar{B}C$ + $\bar{A}\bar{B}\bar{C}$ + $A\bar{B}\bar{C}$

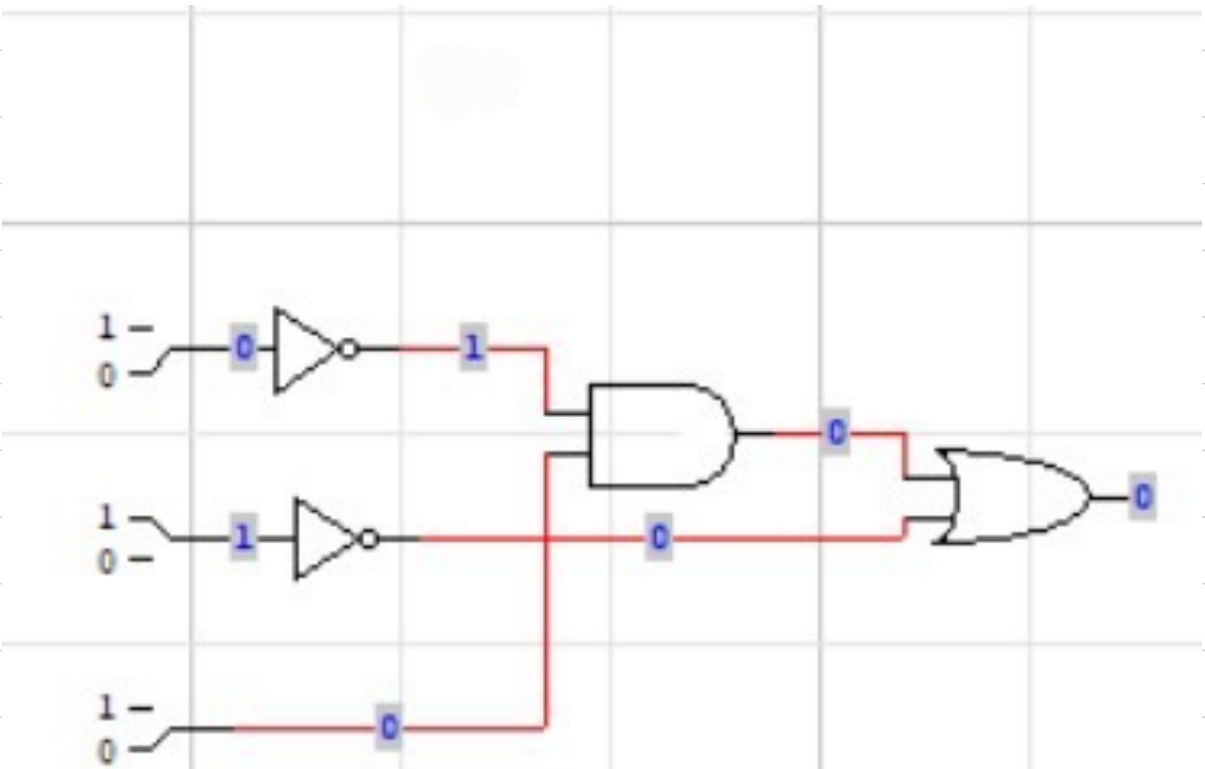
101 011 001 000 100



A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Simplified

$\bar{B} + \bar{A}C$

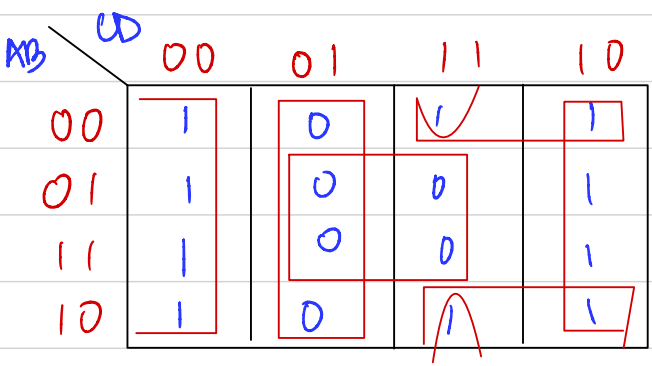

1
0
0
1
1
0
1
0
0
1
0
0
0

Question: 04 Use K-MAP to minimize the given SOP expression. Implement the minimized SOP on Logisim and Complete Truth Table. Also verify if and POS expression can be made using the derived K-Map if yes Built one and its circuit on the software.

$A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + AB\bar{C}\bar{D} + \bar{A}\bar{B}CD + A\bar{B}CD + \bar{A}\bar{B}C\bar{D} + \bar{A}BC\bar{D} + ABC\bar{D} + A\bar{B}C\bar{D}$

Actual

$A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C}\bar{D} + AB\bar{C}\bar{D} + \bar{A}\bar{B}CD + A\bar{B}CD + \bar{A}\bar{B}C\bar{D} + \bar{A}BC\bar{D} + AB\bar{C}\bar{D} + A\bar{B}C\bar{D}$



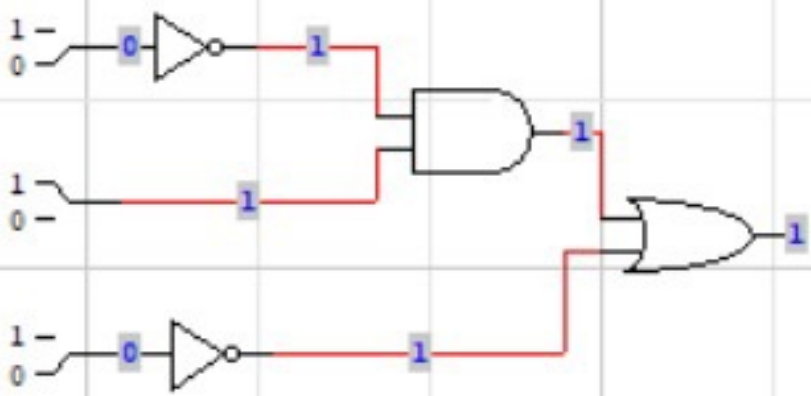
Simplified

$\bar{D} + \bar{B}C$ (SOP)

$(C + \bar{D})(\bar{B} + \bar{D})$ (POS)

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

SOP



POS