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CS220 Computer Architecture

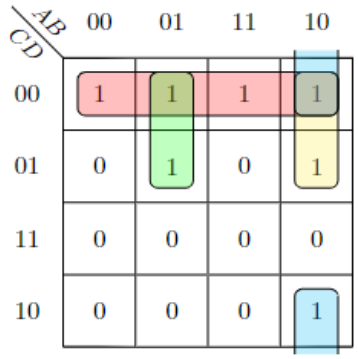
Practical 2 Report

Part A

a. *Design a circuit that bases on the function* $f(A,B,C,D) = \sum m(0,4,5,8,9,10,12)$.

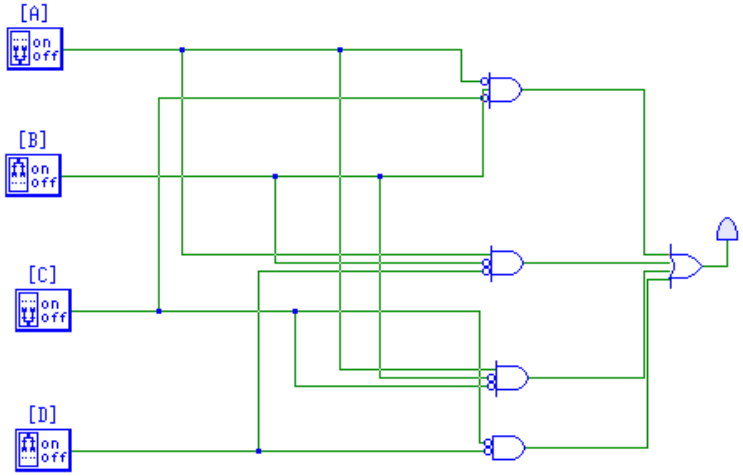
b. *The relevant truth table, k–map, and minimal Sum–of–Products expression*

A	B	C	D	f
0	0	0	0	1
0	0	0	1	0
0	0	1	1	0
0	0	1	0	0
0	1	0	0	1
0	1	0	1	1
0	1	1	1	0
0	1	1	0	0
1	0	0	0	1
1	0	0	1	1
1	0	1	1	1
1	0	1	0	0
1	1	0	0	1
1	1	0	1	0
1	1	1	1	0
1	1	1	0	0



$$f = \overline{C}\,\overline{D} + \overline{A}\,B\,\overline{C} + A\,\overline{B}\,\overline{D} + A\,\overline{B}\,\overline{C}$$

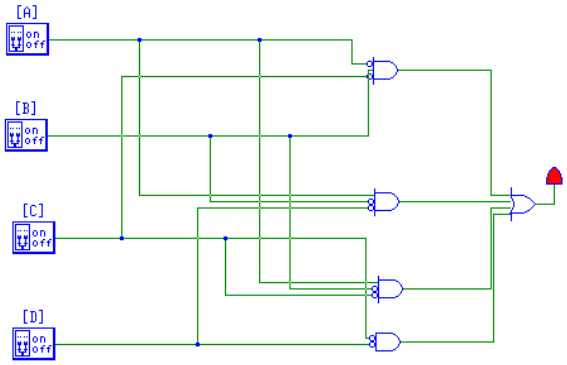
c. *Implement the function on the simulator*



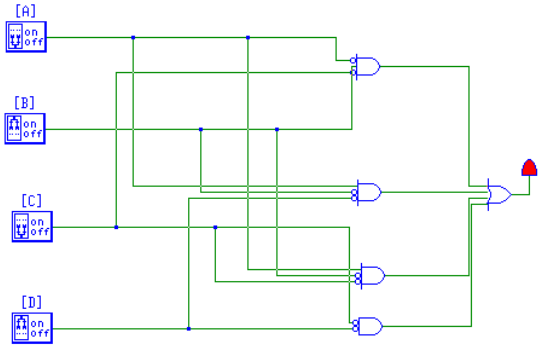
d. ***Verification of Experiment and Observations***

The circuit worked in accordance with the truth table for all input combinations.

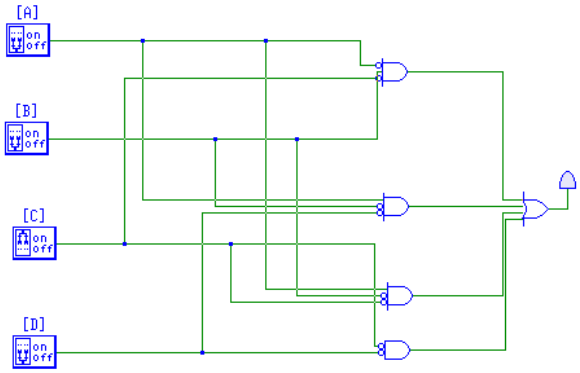
e.g.,1 $\boldsymbol{m_0}$: $\overline{A}\,\overline{B}\,\overline{C}\,\overline{D} = 1$



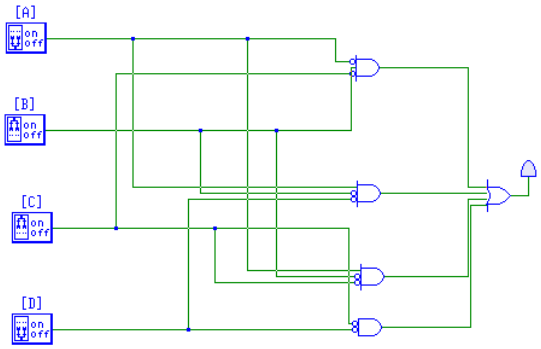
e.g.,2 $\boldsymbol{m_9}$: $\overline{A}B\overline{C}D = 1$



e.g.,3 $\boldsymbol{m_4}$: $\overline{A}\,\overline{B}C\overline{D} = 0$



e.g.,4 $\boldsymbol{m_7}$: $\overline{A}BC\overline{D} = 0$

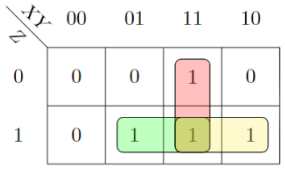


Part B

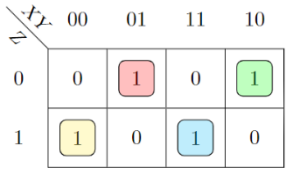
a. *Design a 1–bit full adder circuit using only five two–input logic gates.*

b. *The relevant truth table and k–maps.*

X	Y	Z	C	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

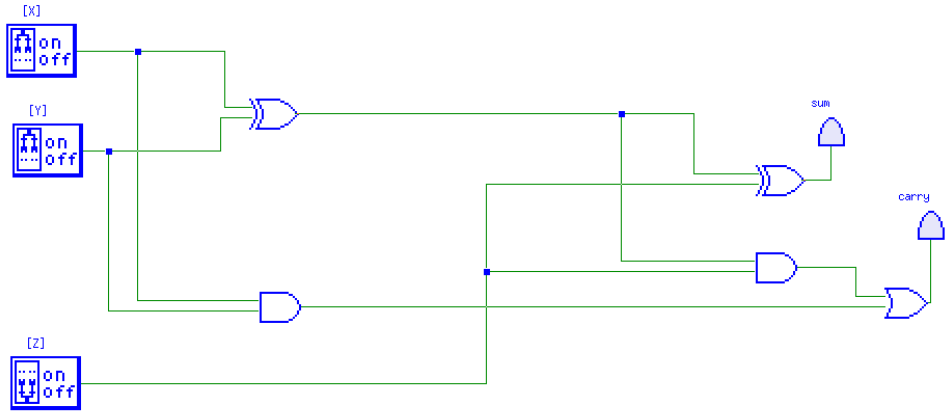


$C = XY + YZ + XZ$



$S = \overline{X}Y\overline{Z} + \overline{X}\,\overline{Y}Z + XYZ + X\overline{Y}\overline{Z} = X \oplus Y \oplus Z$

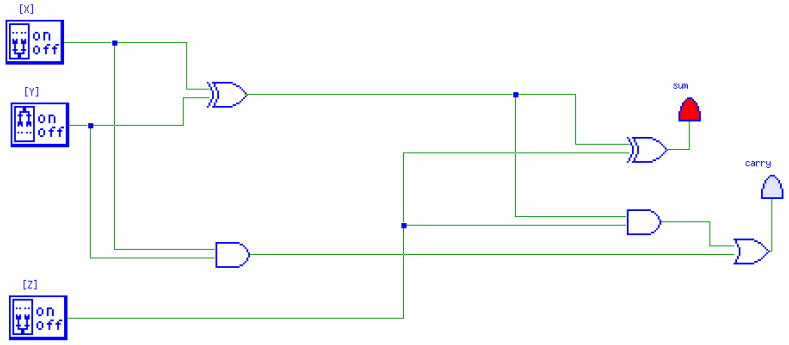
c. Implement the function on the simulator



d. Verification of Experiment and Observations

The circuit worked in accordance with the truth table for all input combinations.

e.g.,1 $X = 0, Y = 1, Z = 0, C = 0, S = 1$



e.g.,2 $X = 1, Y = 1, Z = 0, C = 1, S = 0$