Implement the Given Function in the Eight Non-Degenerate Forms

$F(W,X,Y,Z)=\sum(0,1,2,3,4,8,9,12)$

F= ∑(0,1,2,3,4,8,9,12)

YZ
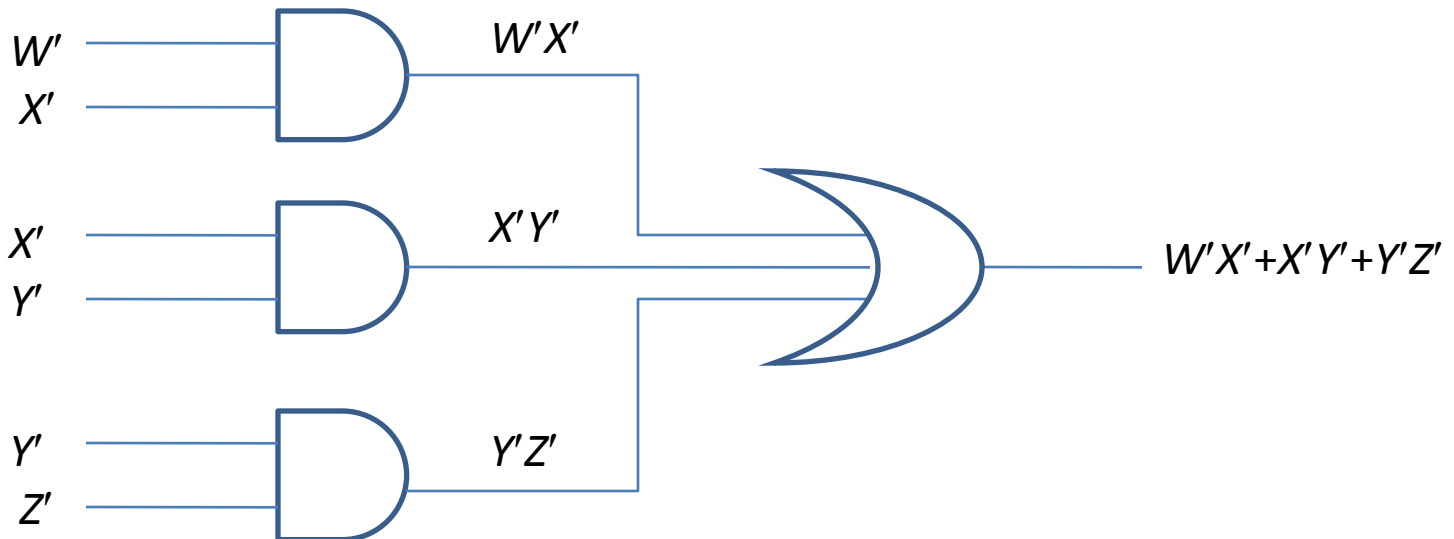
WX	00	01	11	10
00	1	1	1	1
01	1	0	0	0
11	1	0	0	0
10	1	1	0	0

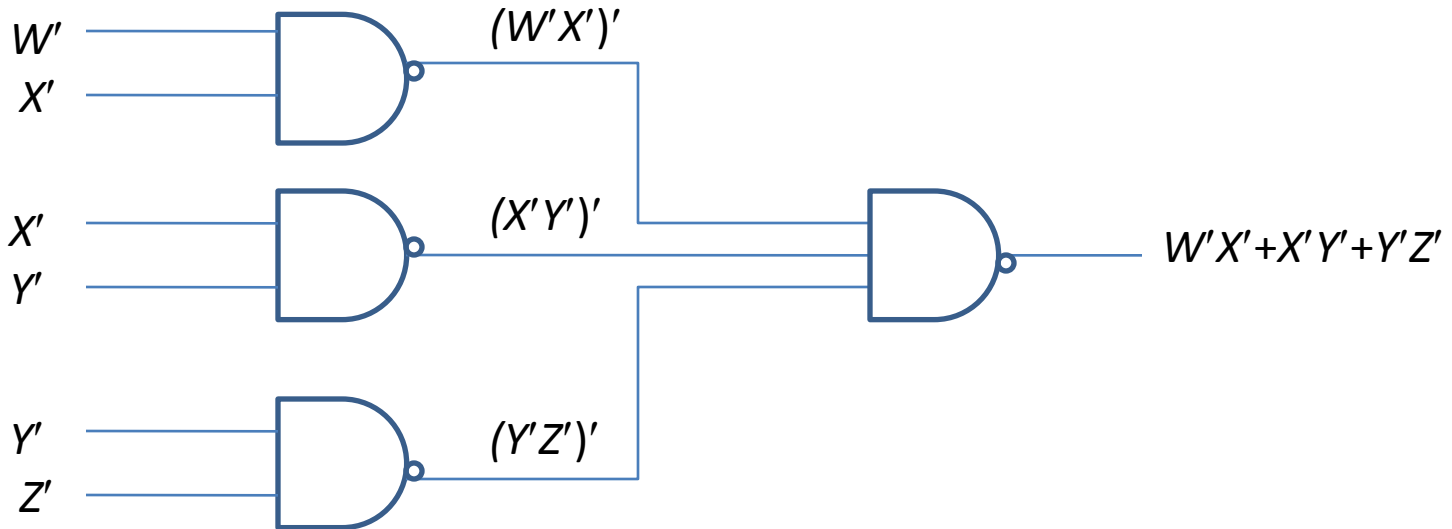SOP Form*: F=W'X'+X'Y'+Y'Z'*

1. AND-OR Implementation

$F = W'X' + X'Y' + Y'Z'$

2. NAND-NAND Implementation

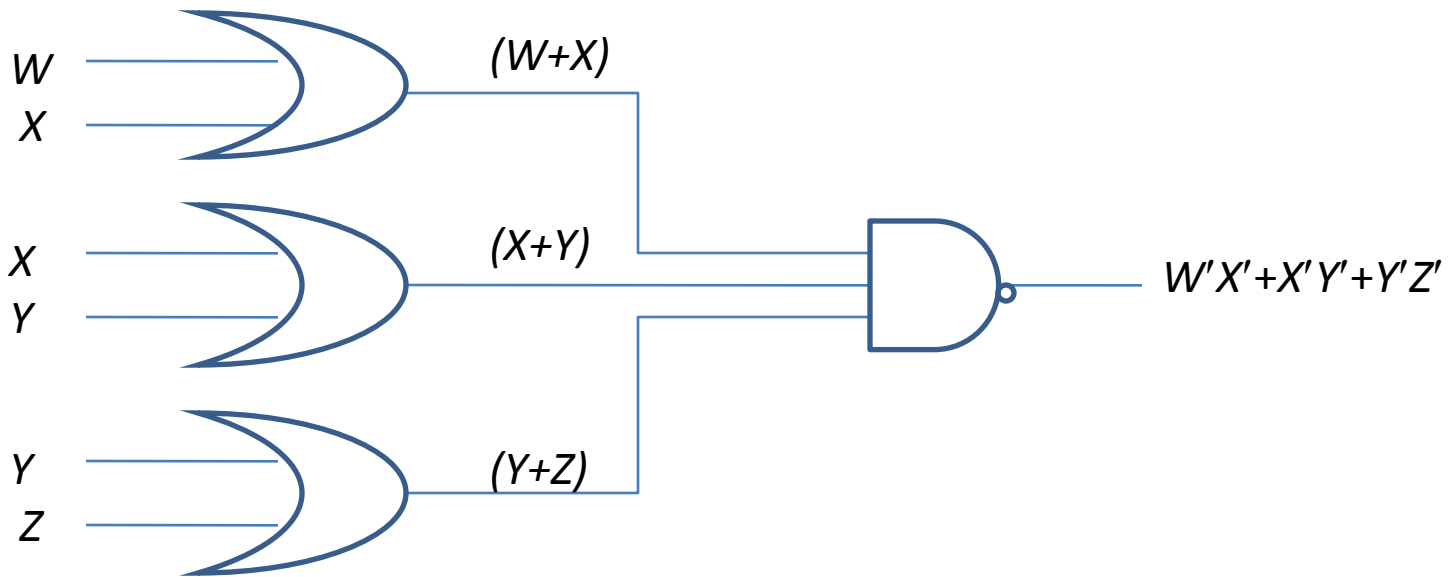$$F' = [W'X' + X'Y' + Y'Z']' = [(W'X')'\ (X'Y')'\ (Y'Z')']$$

$$F'' = F = [(W'X')'\ (X'Y')'\ (Y'Z')']'$$
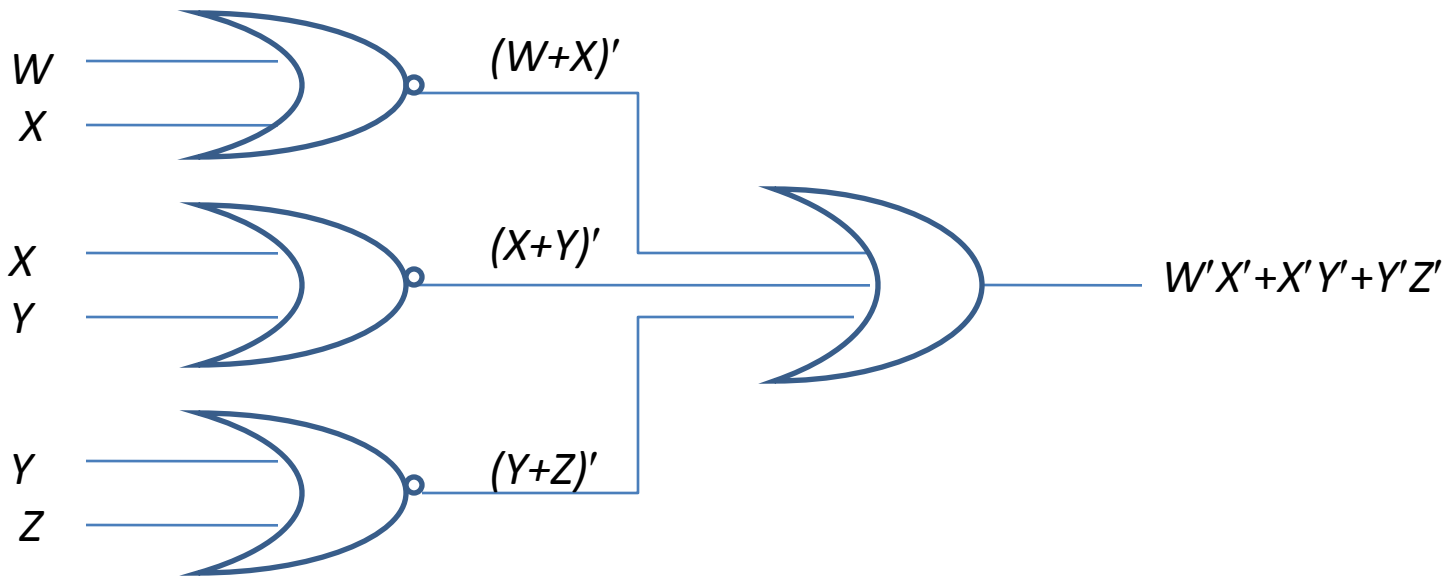
3. OR-NAND Implementation

$$F=W'X'+X'Y'+Y'Z'$$

$$F=(W+X)'+(X+Y)'+(Y+Z)'$$

$$F=[(W+X)(X+Y)(Y+Z)]'$$

4. NOR-OR Implementation

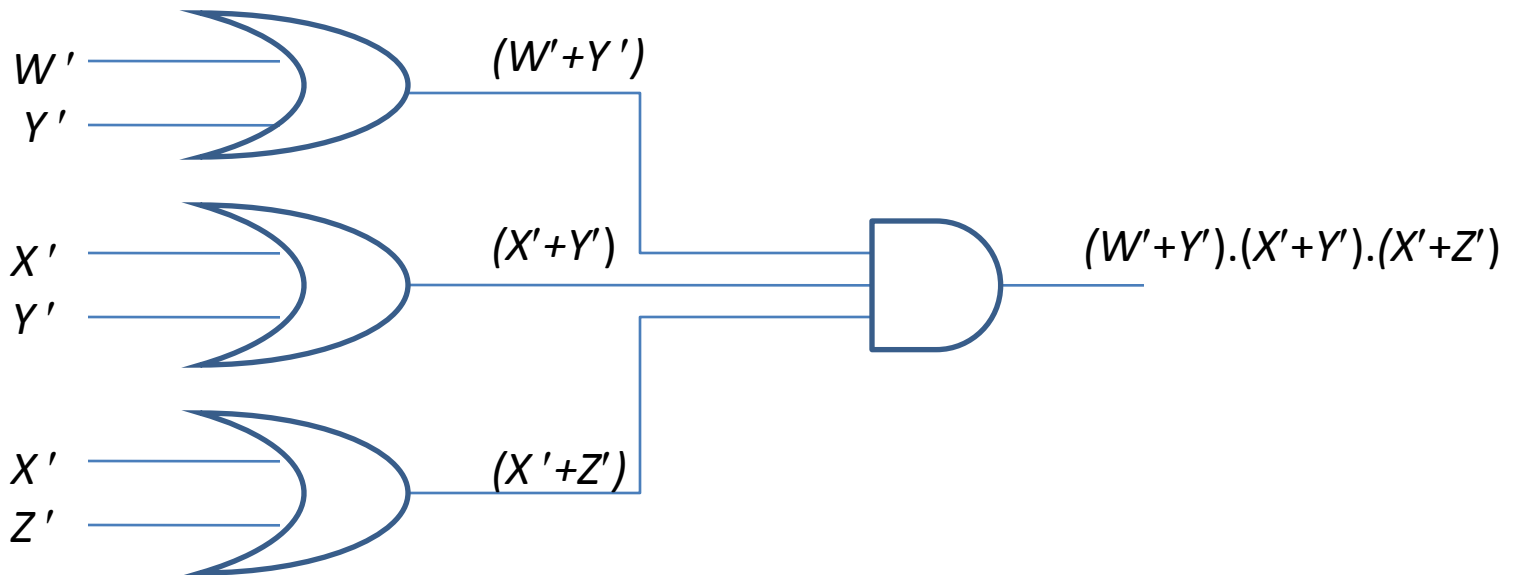$$F = W'X' + X'Y' + Y'Z' \qquad F = (W+X)' + (X+Y)' + (Y+Z)'$$

W
X — (W+X)'

X
Y — (X+Y)' — W'X'+X'Y'+Y'Z'

Y
Z — (Y+Z)'

F= ∑(0,1,2,3,4,8,9,12)

YZ

	00	01	11	10
WX				
00	1	1	1	1
01	1	0	0	0
11	1	0	0	0
10	1	1	0	0

POS Form: *F=(W'+Y').(X'+Y').(X'+Z')*

5. OR-AND Implementation

$F=(W'+Y').(X'+Y').(X'+Z')$

6.   NOR-NOR Implementation
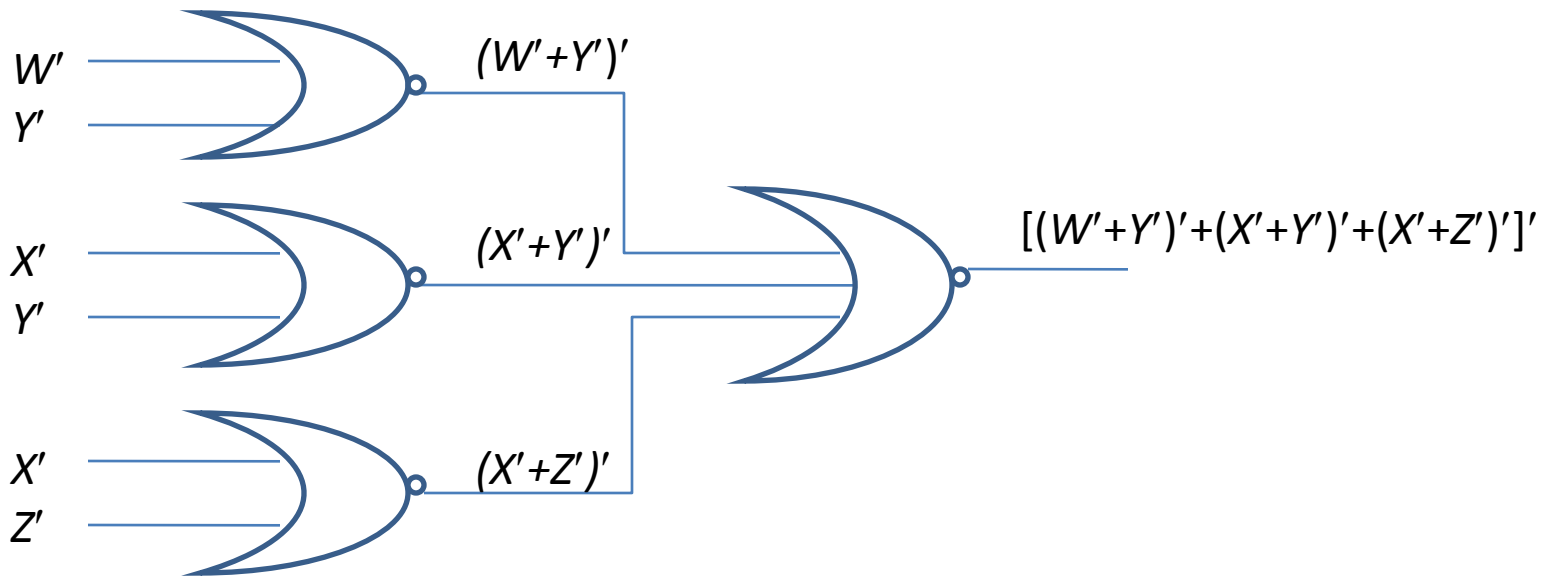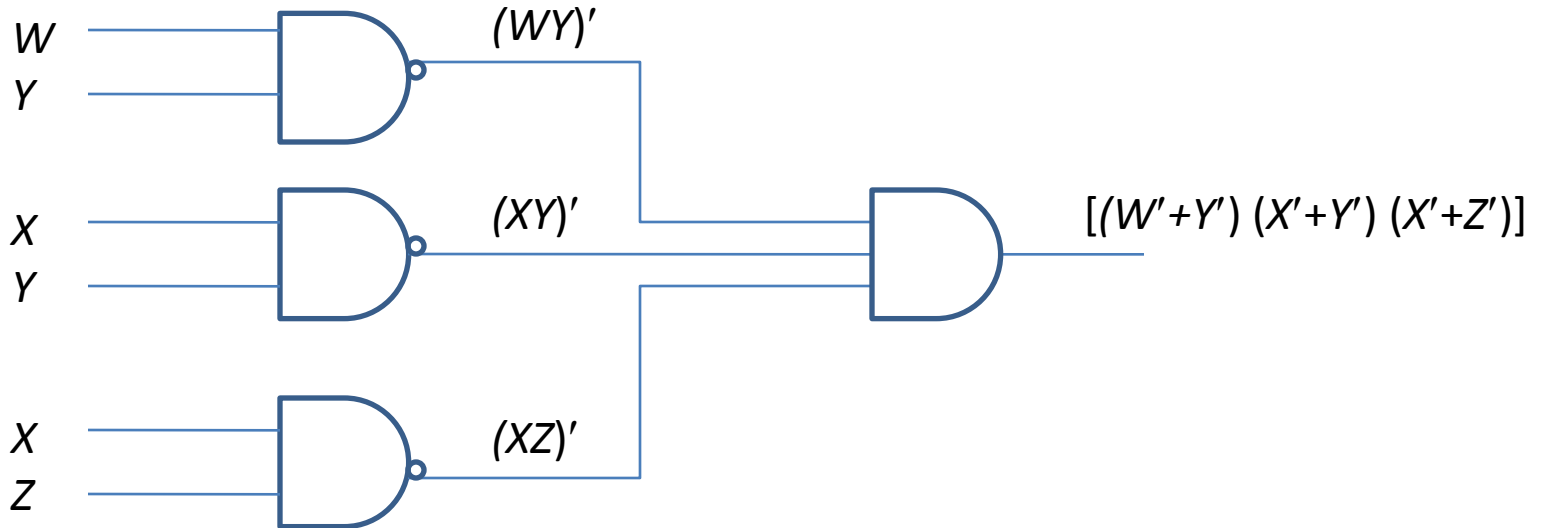
$$F=[(W'+Y')\ (X'+Y')\ (X'+Z')]$$

$$F=[(W'+Y')'+(X'+Y')'+(X'+Z')']'$$

7.   NAND-AND Implementation

$$F=[(W'+Y')\ (X'+Y')\ (X'+Z')] = [(WY)'\ (XY)'\ (XZ)']$$

F= ∑(0,1,2,3,4,8,9,12)

YZ

	00	01	11	10
WX				
00	1	1	1	1
01	1	0	0	0
11	1	0	0	0
10	1	1	0	0

SOP Form: *F'=WY+XY+XZ*

8.   AND-NOR Implementation

$F'=WY+XY+XZ$ $F=(WY+XY+XZ)'$