Assignment 1 | FPGA Lab

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1 Question

Derive a canonical POS expression for a boolean function F, represented by the following truth table :

P	Q	R	F(P,Q,R)
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

2 Solution

2.1 POS from table

from the truth table we can write

$$F(P,Q,R) = \prod(0,3,4,5)$$

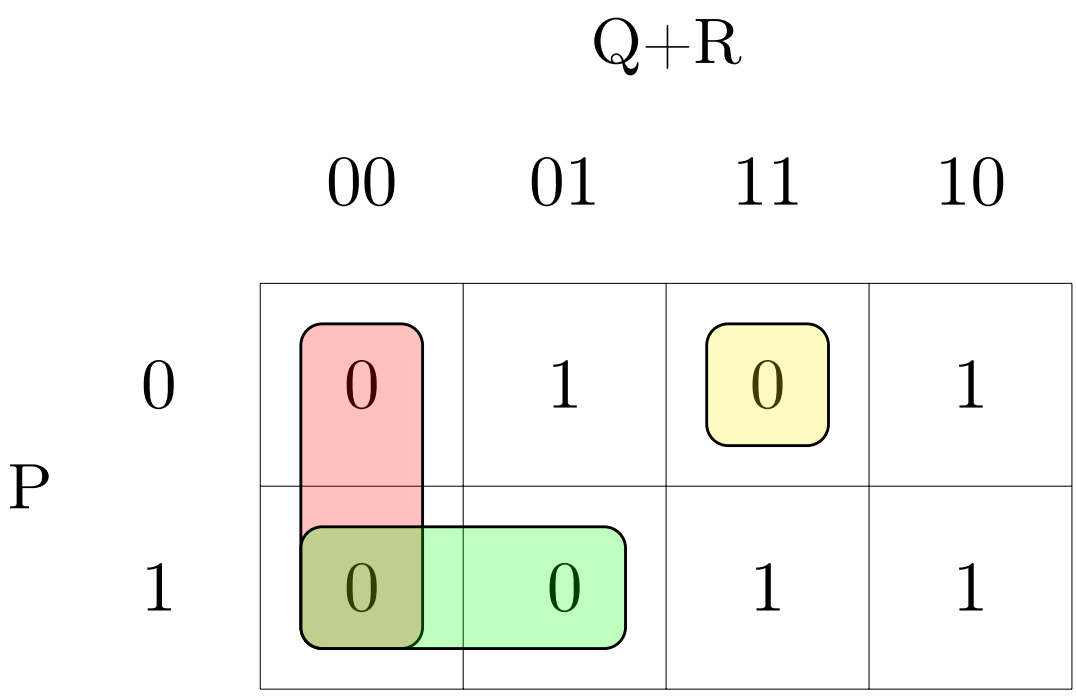
2.2 Canonical POS Expression

canonical POS can be written as

$$F(P,Q,R) = (P+Q+R).(P+\overline{Q}+\overline{R}).(\overline{P}+Q+R).(\overline{P}+Q+\overline{R})$$

2.3 Minimization using KMAPs

Obtained POS expression can be minimized using a KMap.



2.4 Minimized POS Expression

$F = (Q + R).(\overline{P} + Q).(P + \overline{Q} + \overline{R})$

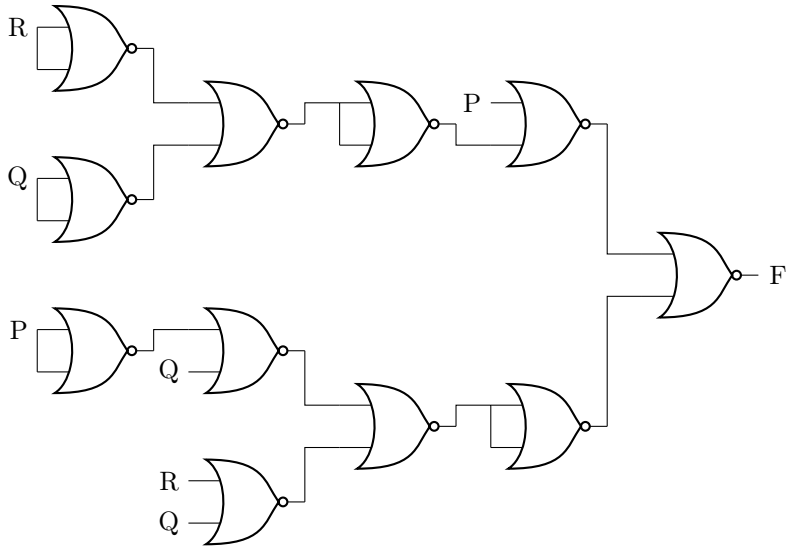
2.5 NOR Logic Implementation

Implementing it using NOR Logic :

$$F = \overline{\overline{(Q + R).(\overline{P} + Q).(P + \overline{Q} + \overline{R})}}$$

$$F = \overline{\overline{(Q + R)} + \overline{(\overline{P} + Q)} + \overline{(P + \overline{Q} + \overline{R})}}$$

The expression can be implemented using all two input NOR Gates.


R
Q
P
F
P
Q
R
Q