Group-2

Problem 1:

a) Design and implement the following ~~two~~ Boolean function using 4×1 MUXs and necessary gates:

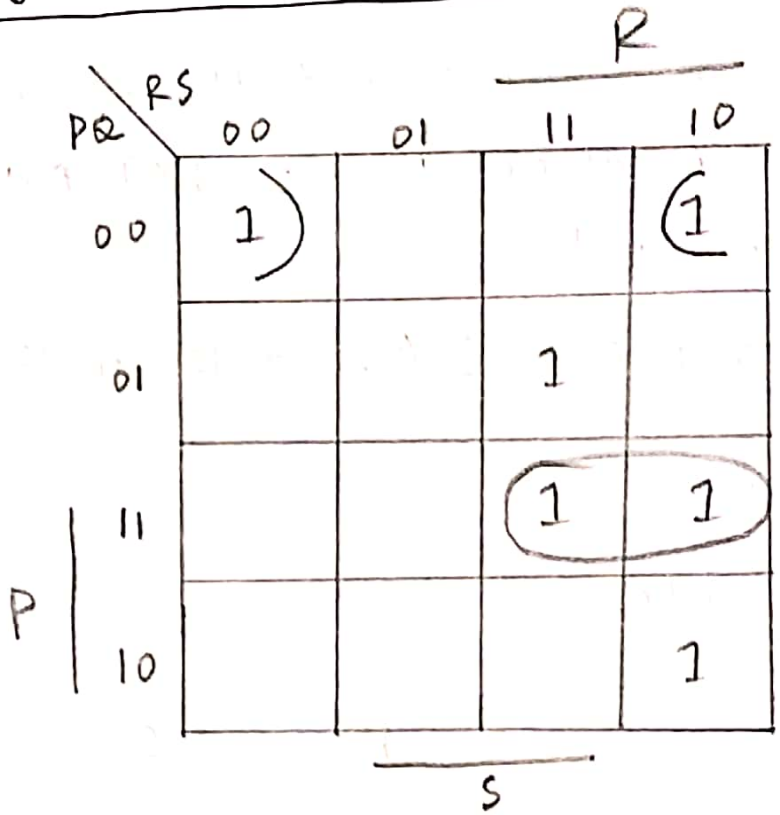
$$f(P,Q,R,S) = \Sigma(0,2,7,10,14,15)$$

Solution:

Truth table:

P	Q	R	S	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

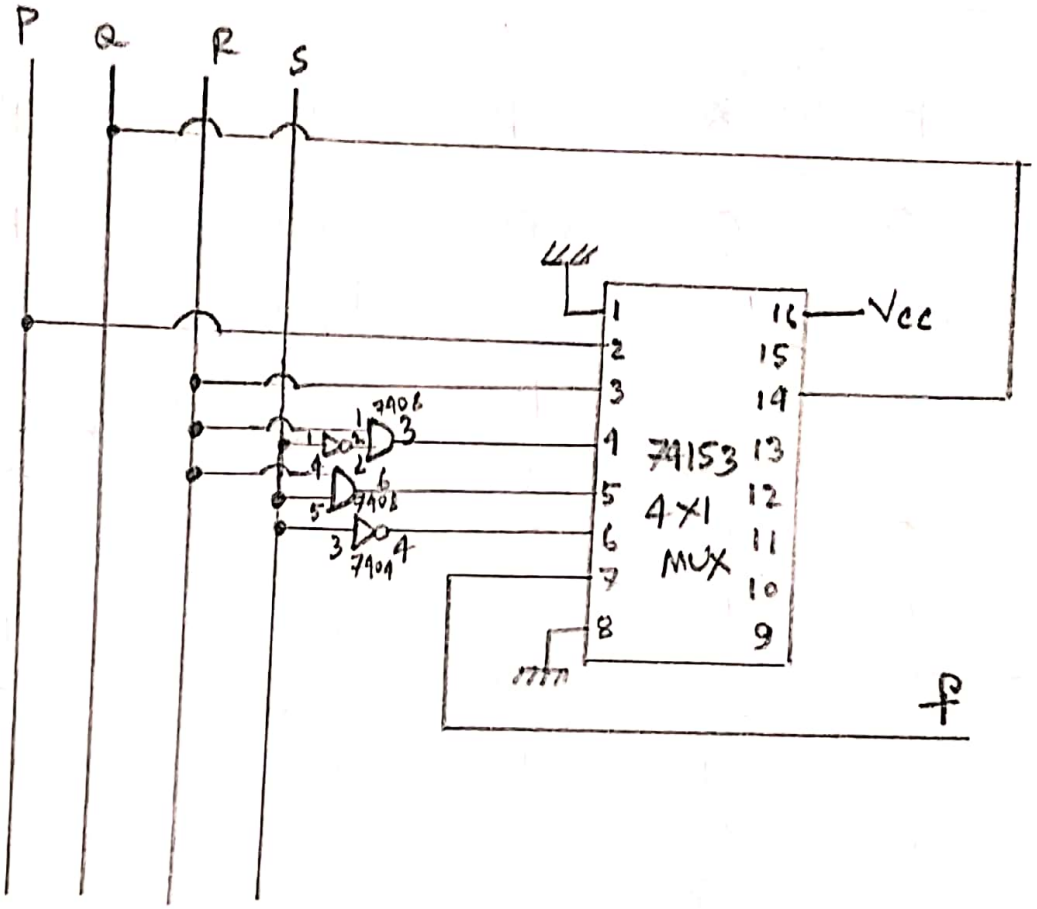
Design and minimization:



If we use P and Q as the selector bits for the 4×1 MUX, then the inputs are:

$I_0 = \bar{S}$, $I_1 = RS$, $I_2 = R\bar{S}$ and $I_3 = R$

Circuit Diagram:



1.b) Design and implement the following Boolean function using 4×1 MUXs and necessary gates:

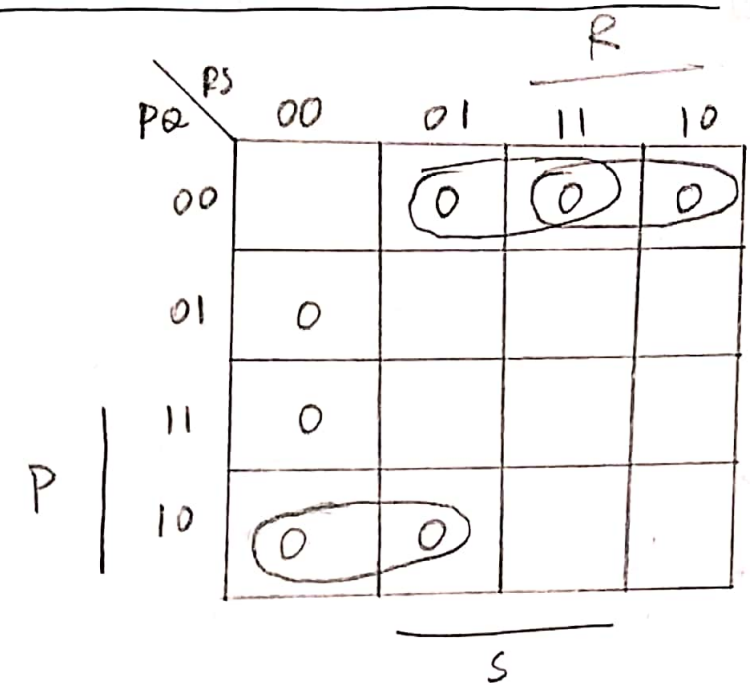
$$f(P,Q,R,S) = \prod(1,2,3,4,8,9,12)$$

Solution:

Truth table:

P	Q	R	S	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Design and minimization:



$I_0 = (S+R)'$

$I_1 = R+S$

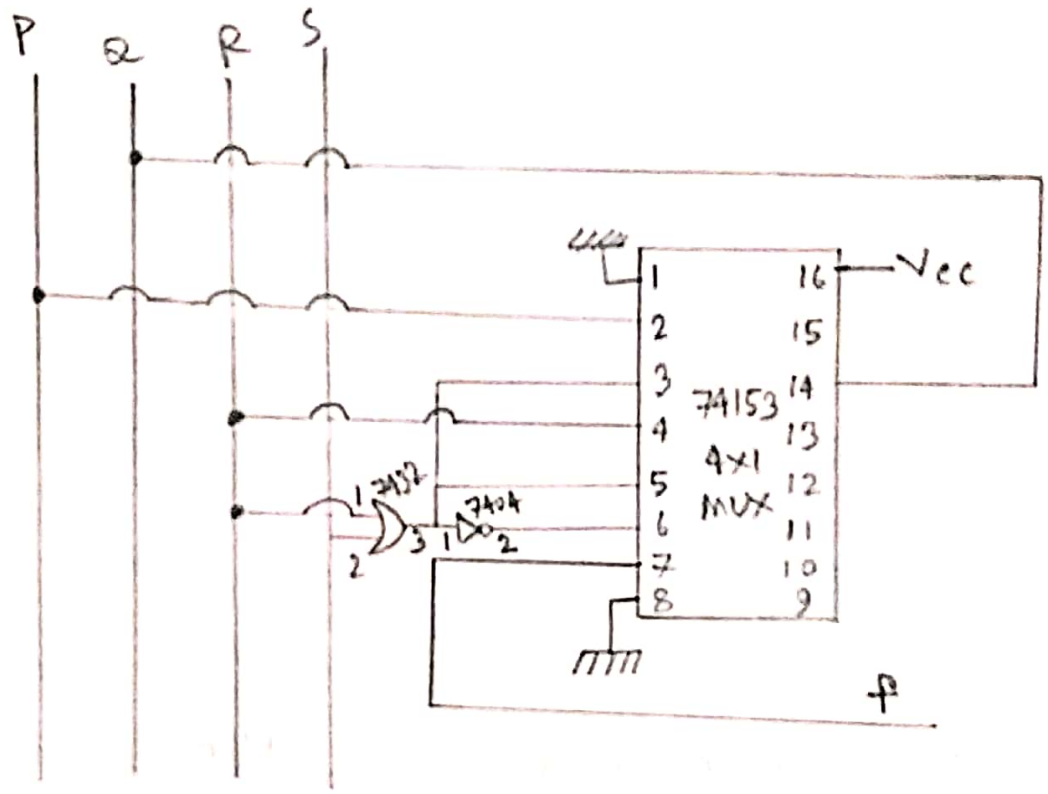
$I_3 = R+S$

$I_2 = R$

If we use P and Q as the selector bits for the 4×1 MUX, then the inputs are:

$I_0 = (R+S)'$, $I_1 = R+S$, $I_2 = R$ and $I_3 = R+S$

Circuit Diagram:



Problem 2

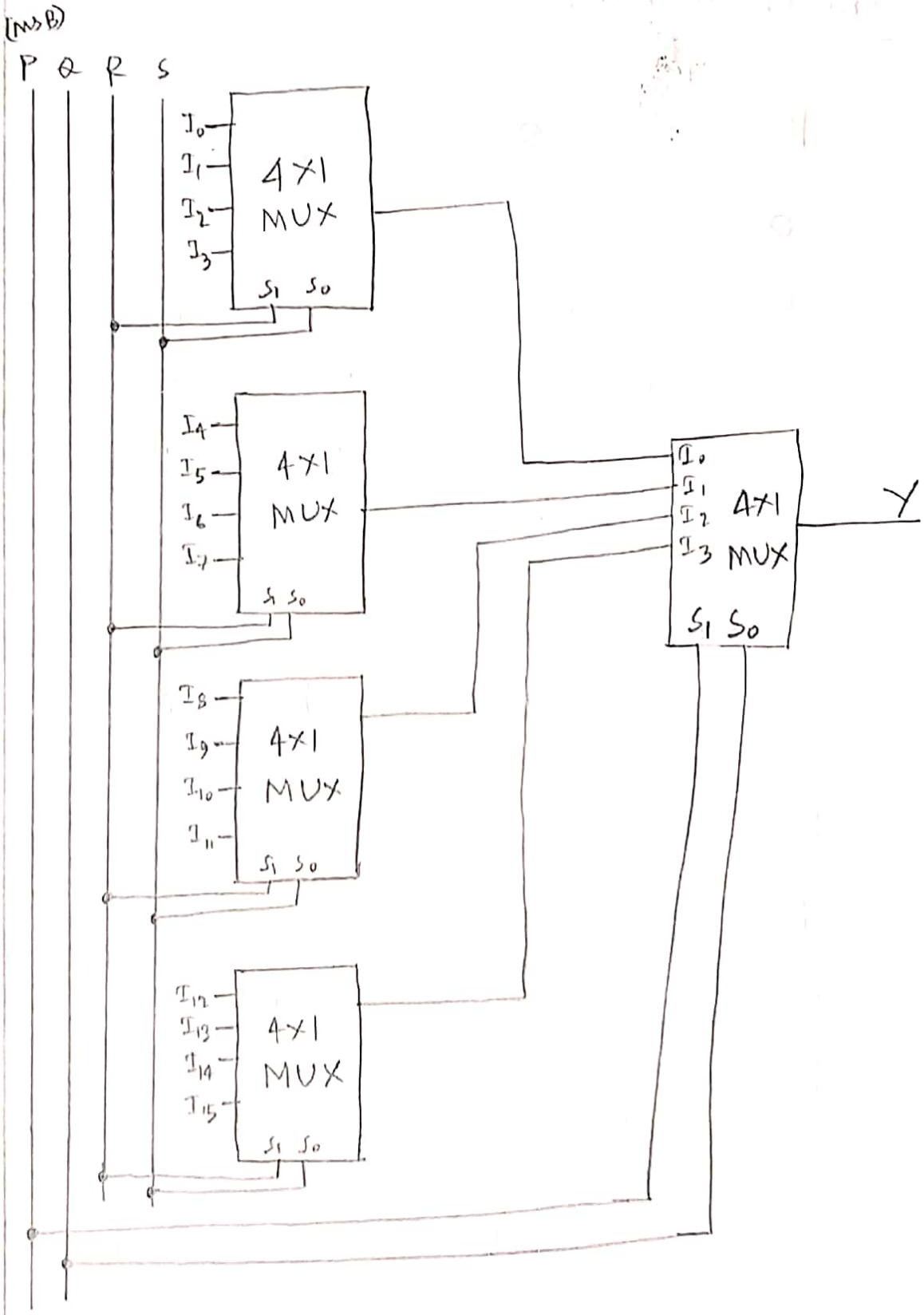
Design a 16×1 MUX using 4×1 MUXs only. Using this 16×1 MUX implement the Boolean function $f(P, Q, R, S) = \Sigma(0, 2, 7, 10, 14, 15)$

Solution:

Truth table:

P	Q	R	S	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Design of 16×1 MUX using 4×1 MUX:



Circuit diagram: