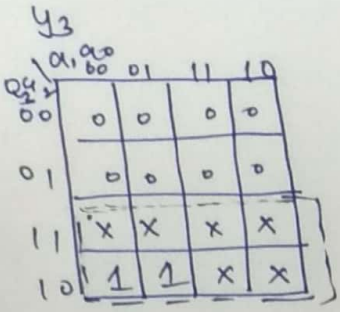
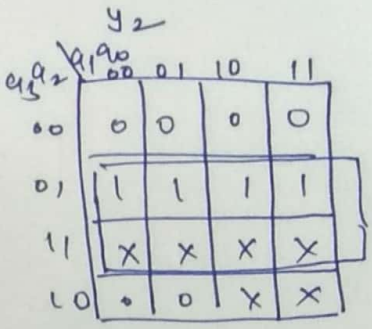
Binary BCD:

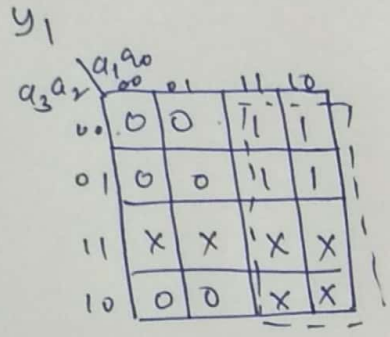
Binary $q_3 q_2 q_1 q_0$	BCD $y_2 y_2 y_1 y_0$
0000	0000
0001	0001
0010	0010
0011	0011
0100	0100
0101	0101
0110	0110
0111	0111
1000	1000
1001	1001
1010	xxxx
1011	xxxx
1100	xxxx
1101	xxxx
1110	xxxx
1111	xxxx



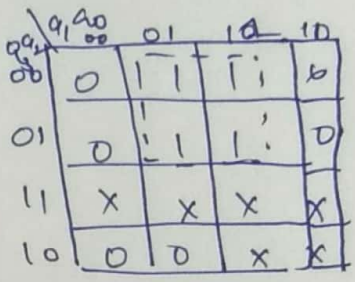
$y_3 = q_3$



$y_2 = q_2$



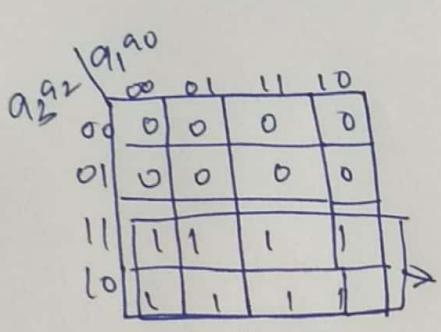
$y_1 = q_1$



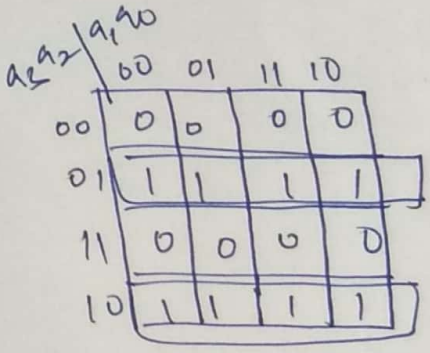
$y_0 = \bar{q}_3 q_0$

Binary to Gray:

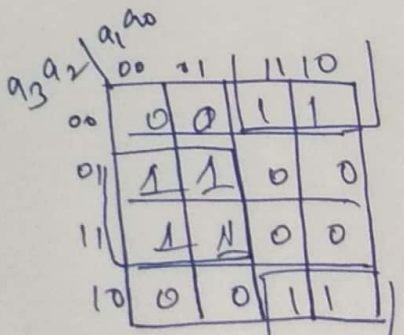
Binary $q_3 q_2 q_1 q_0$	Gray: $y_2 y_2 y_1 y_0$
0000	0000
0001	0001
0010	0011
0011	0010
0100	0110
0101	0111
0110	0101
0111	0100
1000	1100
1001	1101
1010	1111
1011	1110
1100	1010
1101	1011
1110	1001
1111	1000



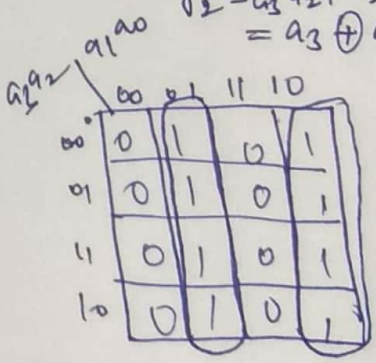
$y_3 = q_3$



$y_2 = q_3\bar{q}_2 + q_2\bar{q}_3$
$= q_3 \oplus q_2$



$y_1 = q_2\bar{q}_1 + q_1\bar{q}_2$
$= q_1 \oplus q_2$



$y_0 = \bar{q}_1 q_0 + q_1\bar{q}_0$
$= q_0 \oplus q_1$