Left neighbour	Your Name	Your Entry No.	Right neighbour

COL215 Digital Logic and System Design Quiz 1 (Set A) 11.08.2017

Q 1. (a) Write a Boolean expression in SoP form equivalent to P XOR Q. (b) From this, derive an equivalent PoS expression using Boolean algebraic transformations. (c) Give a NOR-NOR implementation of P XOR Q.

Solution:

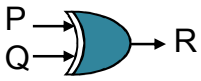
(a) SoP form: R = P●Q' + P'●Q [½+1+½ marks]

(b) Using distributive property, R = (P●Q' + P')●(P●Q' +Q)

Using distributive property again,

R = (P+P')●(Q'+P')●(P+Q)●(Q'+Q) = 1●(Q'+P')●(P+Q)●1

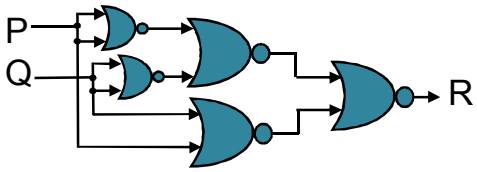
= (P'+Q')●(P+Q) => This is PoS form



R = P XOR Q

P	Q	R
0	0	0
0	1	1
1	0	1
1	1	0

(c) NOR-NOR implementation follows straight from the PoS form and is shown below.



Q 2. Design a synchronous counter that counts down from 13 to 0 in a cyclic fashion. Show the waveforms for all the bits.

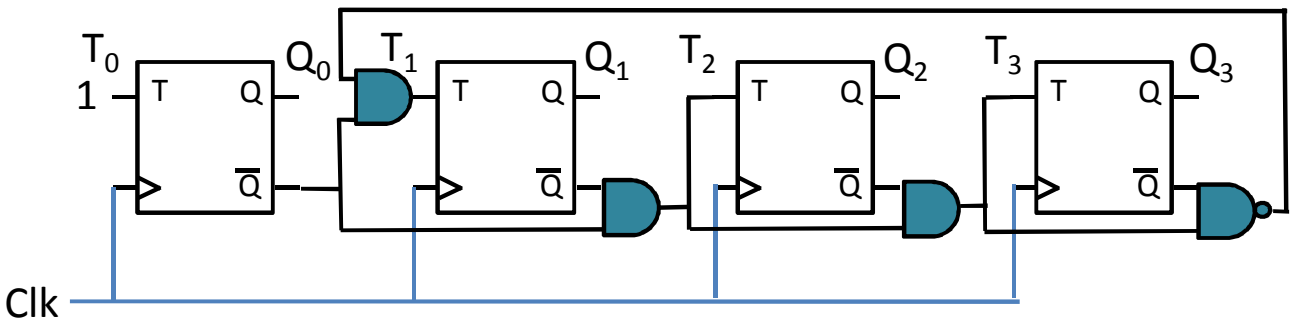
Solution:

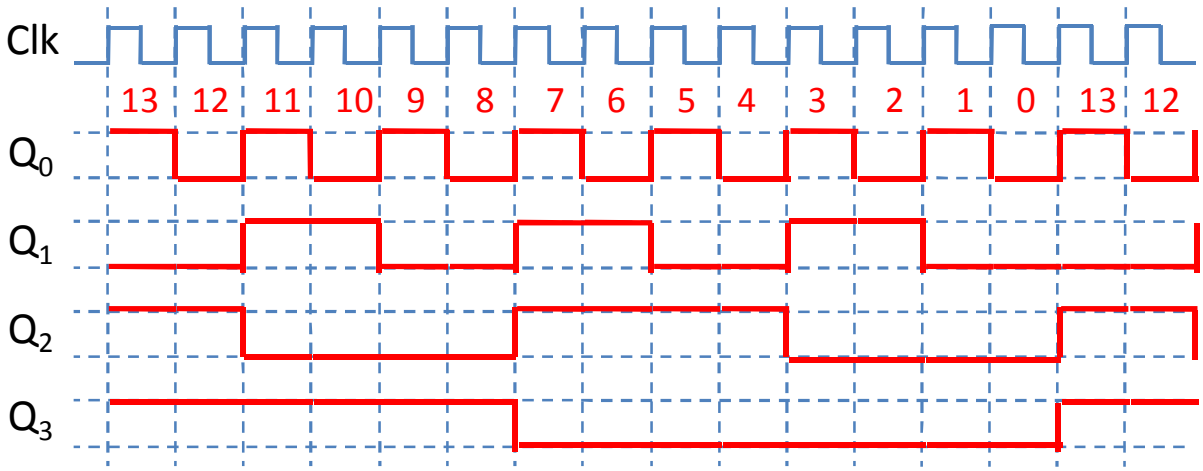
For a down counter, $T_0 = 1$; $T_1 = Q_0'$; $T_2 = Q_0'\bullet Q_1'$; $T_3 = Q_0'\bullet Q_1'\bullet Q_2'$

But when the count reaches 0, then Q_0, Q_2 and Q_3 should toggle, Q_1 should not.

=> $T_0 = 1$; $T_1 = Q_0'\bullet E'$; $T_2 = Q_0'\bullet Q_1' + E$; $T_3 = Q_0'\bullet Q_1'\bullet Q_2' + E$, where $E = Q_0'\bullet Q_1'\bullet Q_2'\bullet Q_3'$

This simplifies to $T_0 = 1$; $T_1 = Q_0'\bullet E'$; $T_2 = Q_0'\bullet Q_1'$; $T_3 = Q_0'\bullet Q_1'\bullet Q_2'$ [2+1 marks]





Left neighbour	Your Name	Your Entry No.	Right neighbour

COL215 Digital Logic and System Design Quiz 1 (Set B) 11.08.2017

Q 1. (a) Write a Boolean expression in SoP form equivalent to P XNOR Q. (b) From this, derive an equivalent PoS expression using Boolean algebraic transformations. (c) Give a NOR-NOR implementation of P XNOR Q. [Note: XNOR is complement of XOR]

Solution:

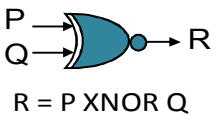
(a) SoP form: R = P'●Q' + P●Q [½+1+½ marks]

(b) Using distributive property, R = (P'●Q' + P)●(P'●Q' +Q)

Using distributive property again,

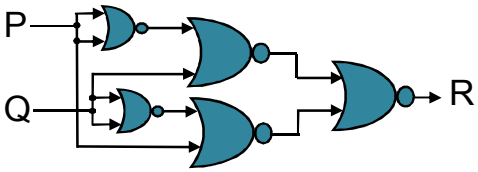
R = (P'+P)●(Q'+P)●(P'+Q)●(Q'+Q) = 1●(Q'+P)●(P'+Q)●1

= (P+Q')●(P'+Q) => This is PoS form



P	Q	R
0	0	1
0	1	0
1	0	0
1	1	1

(c) NOR-NOR implementation follows straight from the PoS form and is shown below.



Q 2. Design a synchronous counter that counts down from 11 to 0 in a cyclic fashion. Show the waveforms for all the bits.

Solution:

For a down counter, $T_0 = 1$; $T_1 = Q_0'$; $T_2 = Q_0'●Q_1'$; $T_3 = Q_0'●Q_1'●Q_2'$

But when the count reaches 0, then Q_0, Q_1 and Q_3 should toggle, Q_2 should not.

=> $T_0 = 1$; $T_1 = Q_0' + E$; $T_2 = Q_0'●Q_1'●E'$; $T_3 = Q_0'●Q_1'●Q_2' + E$, where $E = Q_0'●Q_1'●Q_2'●Q_3'$

This simplifies to $T_0 = 1$; $T_1 = Q_0'$; $T_2 = Q_0'●Q_1'●E'$; $T_3 = Q_0'●Q_1'●Q_2'$ [2+1 marks]