Another Design Example 15-14-12-8-0

Design a digital circuit that counts

15 - 14 - 12 - 8 - 0 back to 15

1111 - 1110 - 1100 - 1000 - 0000 back to 1111

Soln 1: Minimal flip-flops

PS	NS	OUT
ABC	ABC	Y[3~0]
000	001	1111
001	010	1110
010	011	1100
011	100	1000
100	000	0000
101	xxx	xxxx
110	xxx	xxxx
111	xxx	xxxx

$DA = BC$ $DB = BC' + B'C = B \oplus C$

$DC = A'C'$

$Y3 = A'$ $Y2 = A'C' + A'B'$

$Y1 = A'B'$ $Y0 = A'B'C'$

-------------------- Solution 2 ---------------------------------

Design a digital circuit that counts 15 -> 14 -> 12 -> 8 -> 0 then back to 15.

Use D-ff.

Soln 2: Moore, use 4-flip-flops

PS	NS
ABCD	ABCD = {DA, DB, DC, DD}
0000	1111
1000	0000
1100	1000
1110	1100
1111	1110
else	xxxx

$DA = A' + B$

$DB = A' + C$

$DC = A' + D$

$DD = A'$

OUT = {QD,QC,QB,QA}