Name: Key Id#

COE 360, Principles of VLSI Design, Term 032
Quiz#2

Date: Sunday, March 14, 2004

Q1. Implement the following functions using **CMOS** with the smallest number of transistors possible. Indicate the number of transistors needed for your implementation:

(1) F= ABC + ADC' + ABD

$F = ABC + AD\bar{C}$

$= A[BC + D\bar{C}]$

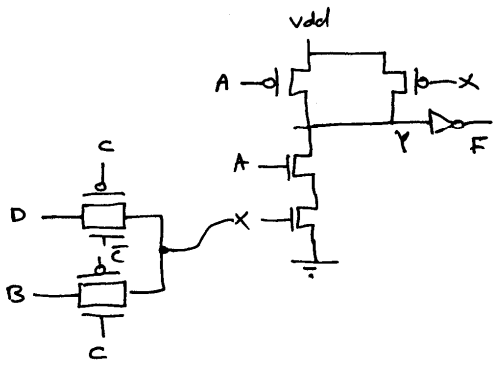
Let $X = BC + D\bar{C}$

$\Rightarrow F = AX$

$= \overline{[\overline{AX}]}$

Let $Y = \overline{[\overline{AX}]}$

$\Rightarrow F = \bar{Y}$

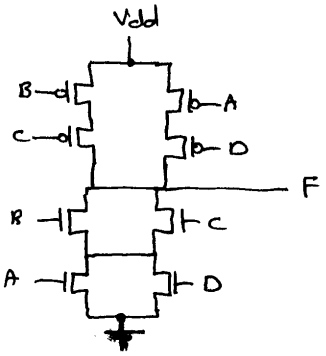


transistors = 6 + 4 + 2 = 12

(2) F = [AB + AC + DB + DC]'

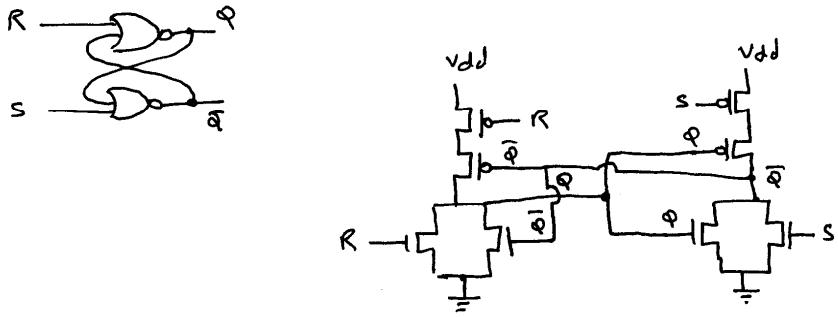
$F = [A[B+C] + D[B+C]]'$

$= [[B+C][A+D]]' = (\bar{B}\cdot\bar{C}) + (\bar{A}\cdot\bar{D})$



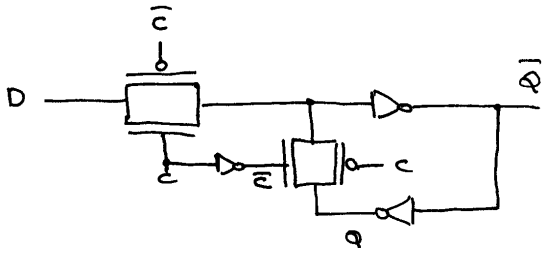
transistors = 8

(3) An SR Latch. (Note that the SR latch does not have a clock input)



transistors = 4 + 4 = 8

(4) A D-Latch.



transistors = 10