Logic Families Static-1 (H.1)

20151215

References

Some Figures from the following sites

[1] http://pages.hmc.edu/harris/cmosvlsi/4e/index.html
Weste & Harris Book Site

[2] en.wikipedia.org

[3] Digital Integrated Circuits : A Design Perspective,
Jan M. Rabaey,
(http://bwrcs.eecs.berkeley.edu/Classes/IcBook/)

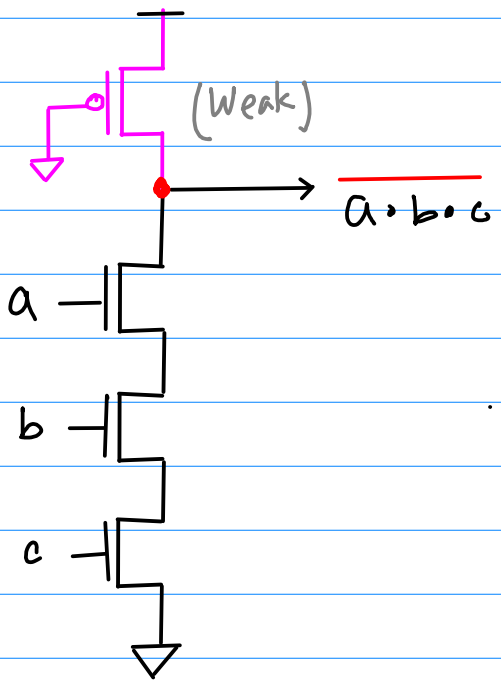
[4] Digital Electronics and Design with VHDL
Pedroni

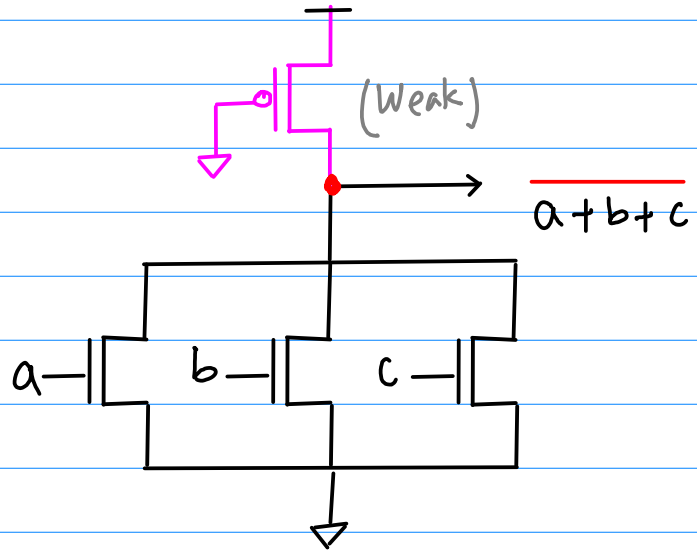
Other MOS Archtectures

Static MOS
- Pseudo-nMOS Logic
- Transmission-gate Logic
- BiCMOS Logic

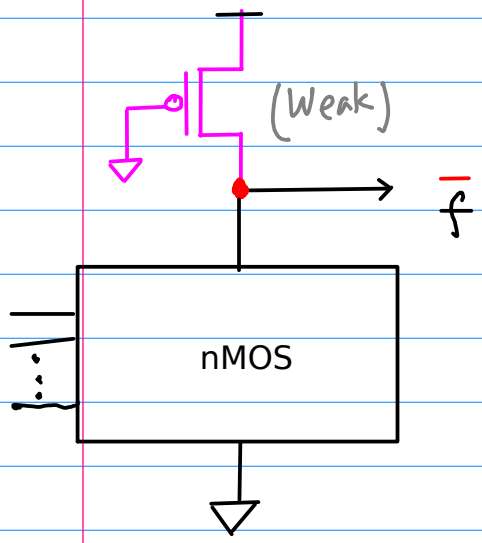
Dynamic MOS
- Dynamic Logic
- Domino Logic
- C2MOS Logic

Pseudo-nMOS Logic





simply replace all pMOS with
just one pMOS that is always ON

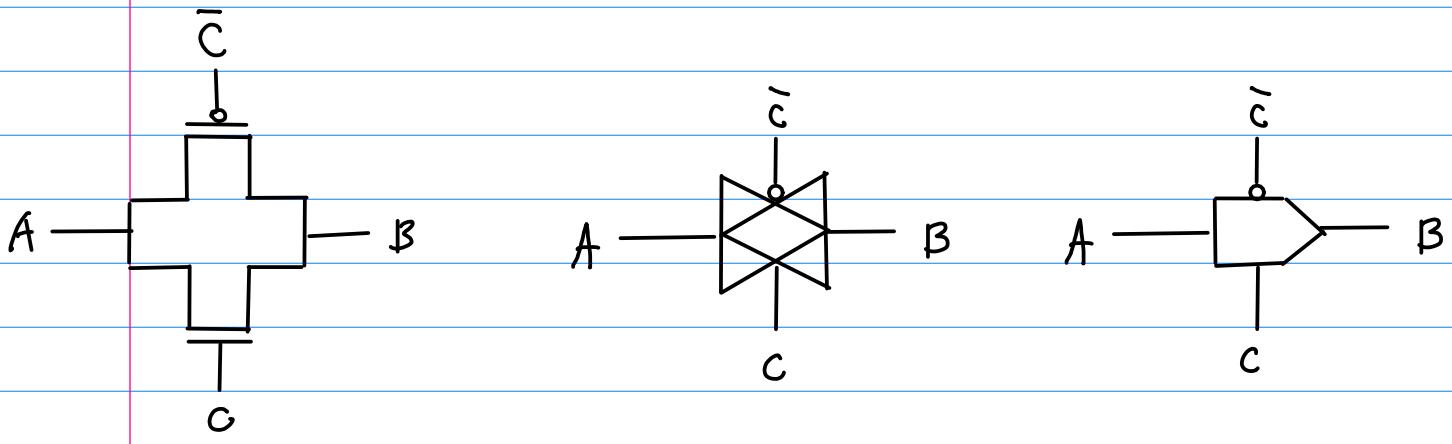


Pull-Up transistor
weak (small W/L, large R)
always nMOS wins (Off-On)

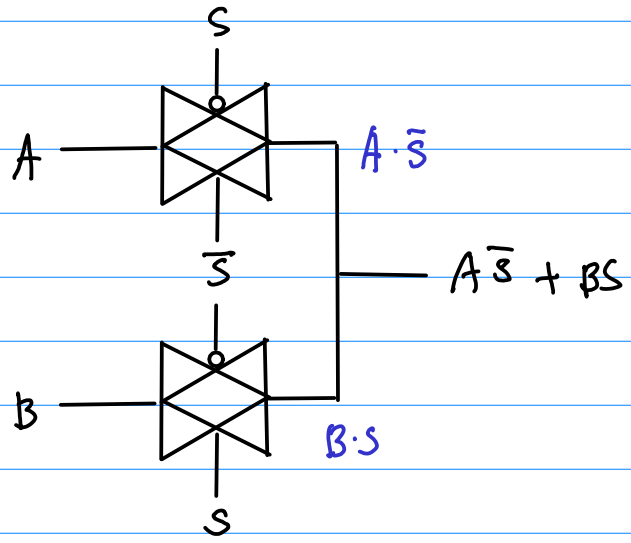
Reduced circuit size
Large fan-in possible
(no pilled transistor)

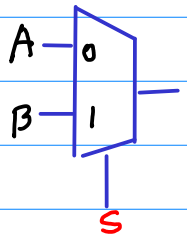
static power consumption
Slow rising time (large R)
Slow falling time (competing nMOS & pMOS)
Weak 0

Transmission Gate Logic

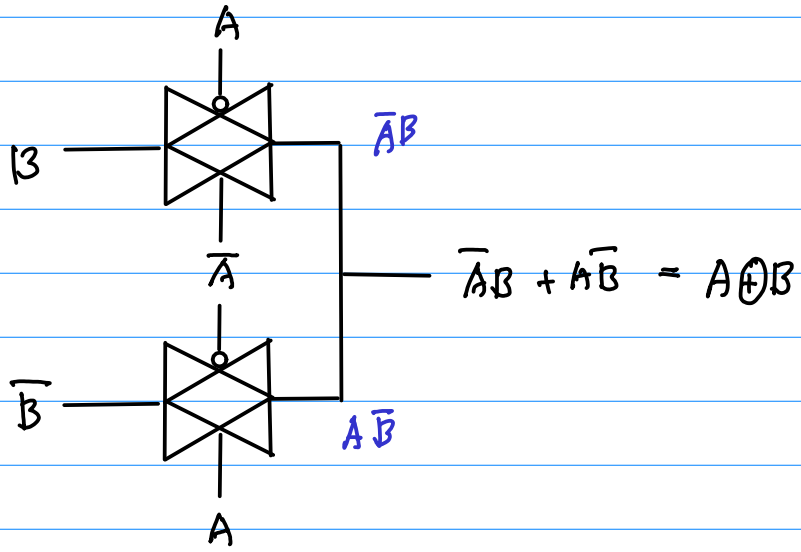


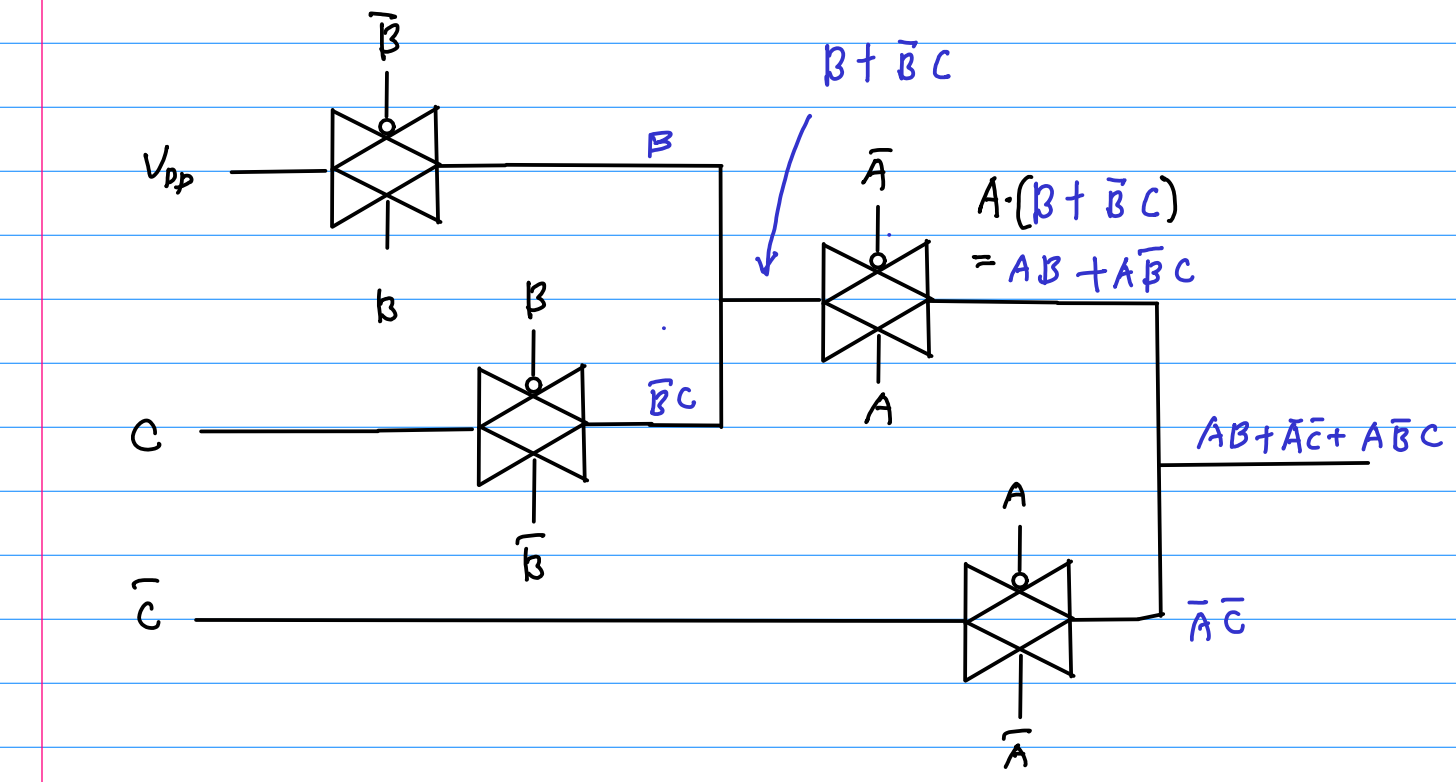
Mux

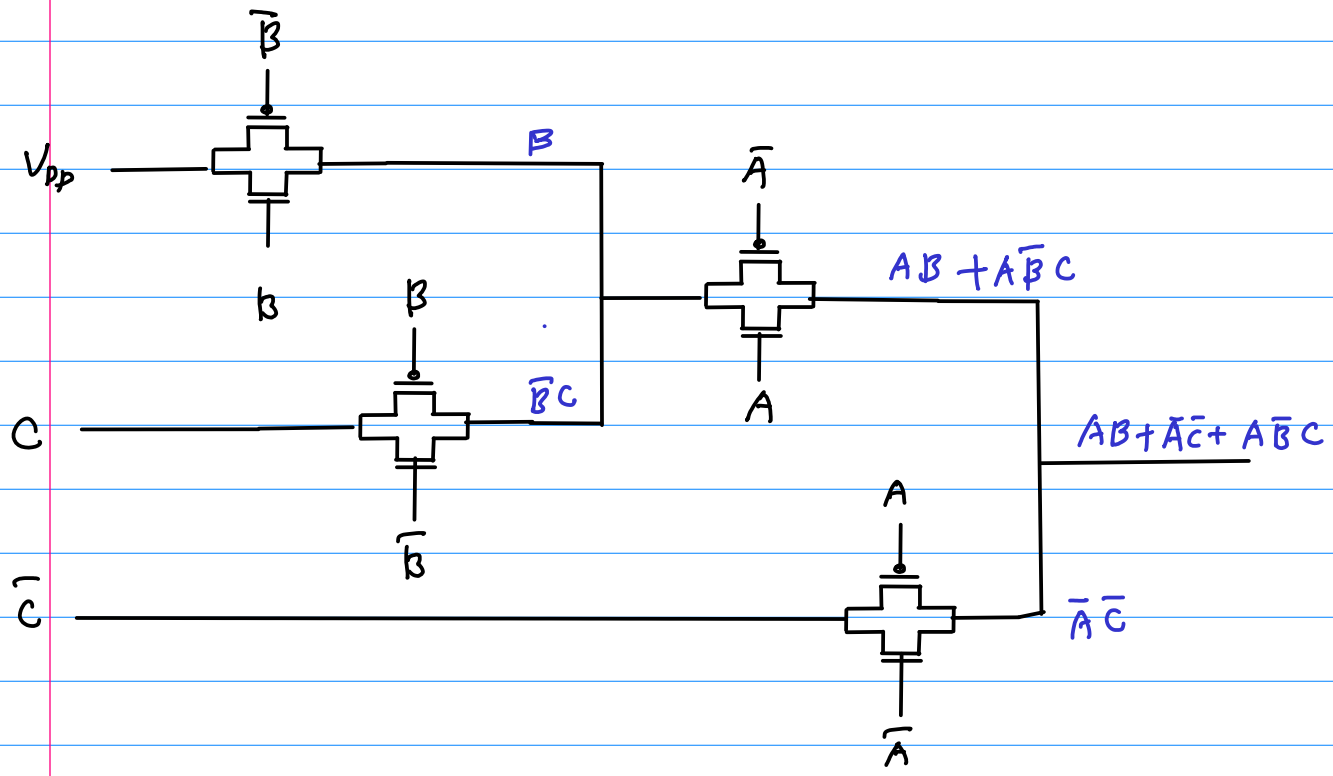

S
A
$A \cdot \bar{S}$
$\bar{S}$
$A\bar{S} + BS$
B
$B \cdot S$
S

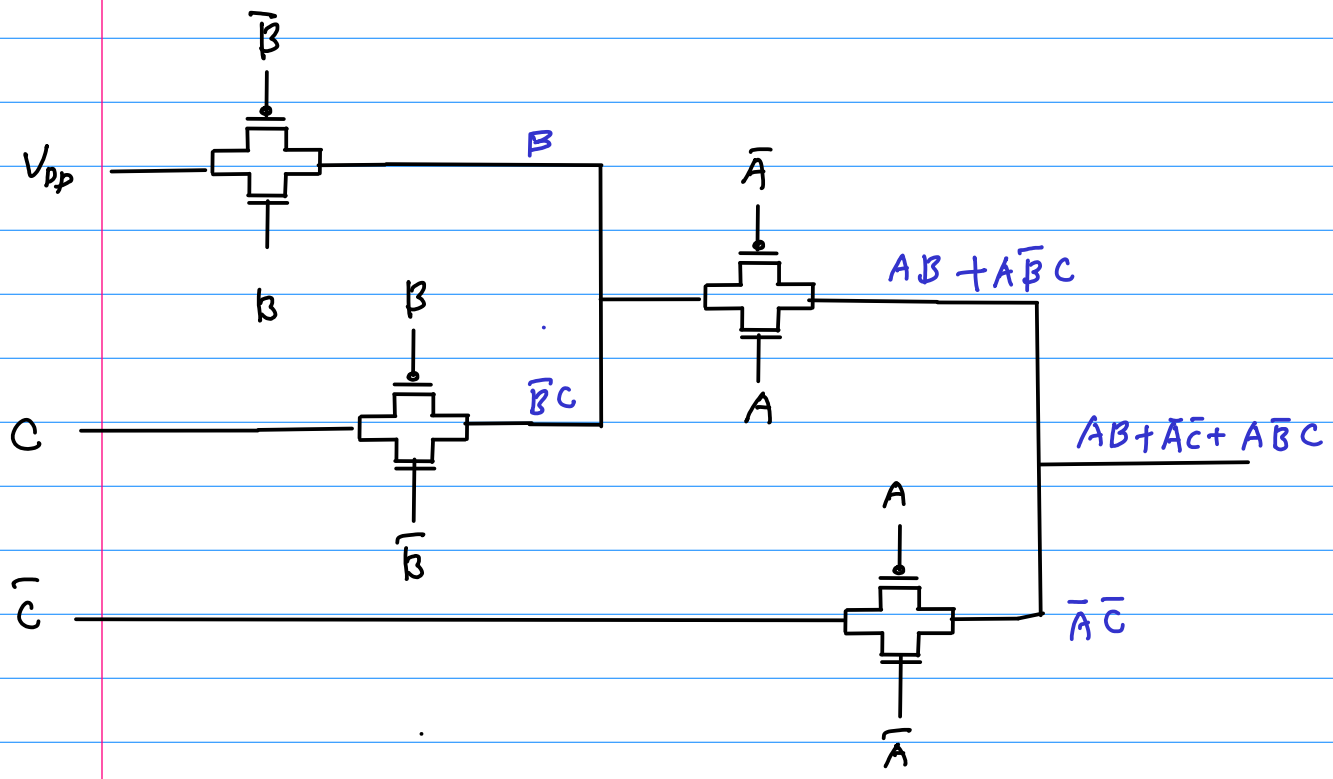

A
0
B
1
S

XOR

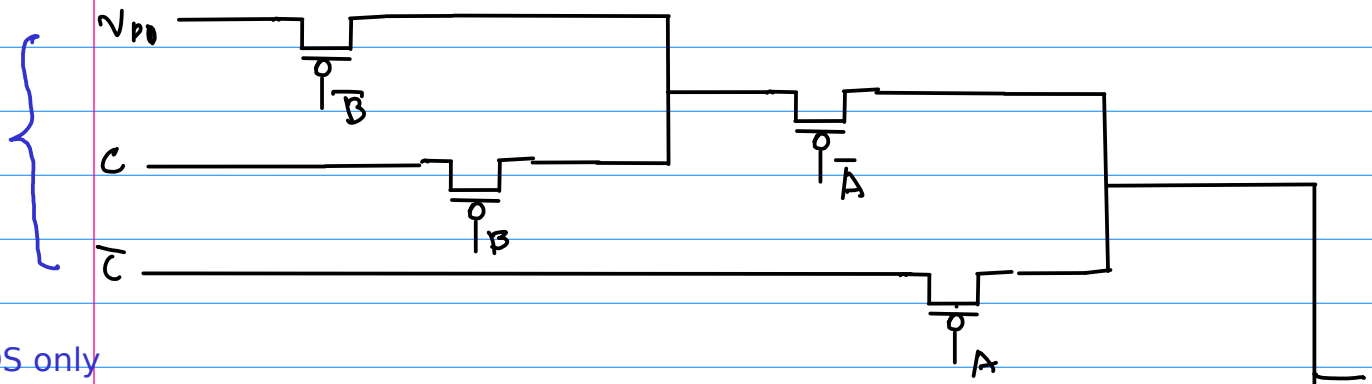

A
B
$\bar{A}B$
$\bar{A}$
$\bar{A}B + A\bar{B} = A \oplus B$
$\bar{B}$
$A\bar{B}$
A


$\bar{B}$
V_{DD}
B
b
$\bar{B}$
C
$\bar{B}C$
$\bar{b}$
$\bar{C}$
$B + \bar{B}C$
$\bar{A}$
$A\cdot(B + \bar{B}C)$
$= AB + A\bar{B}C$
A
$AB + A\bar{C} + A\bar{B}C$
A
$\bar{A}\bar{C}$
$\bar{A}$

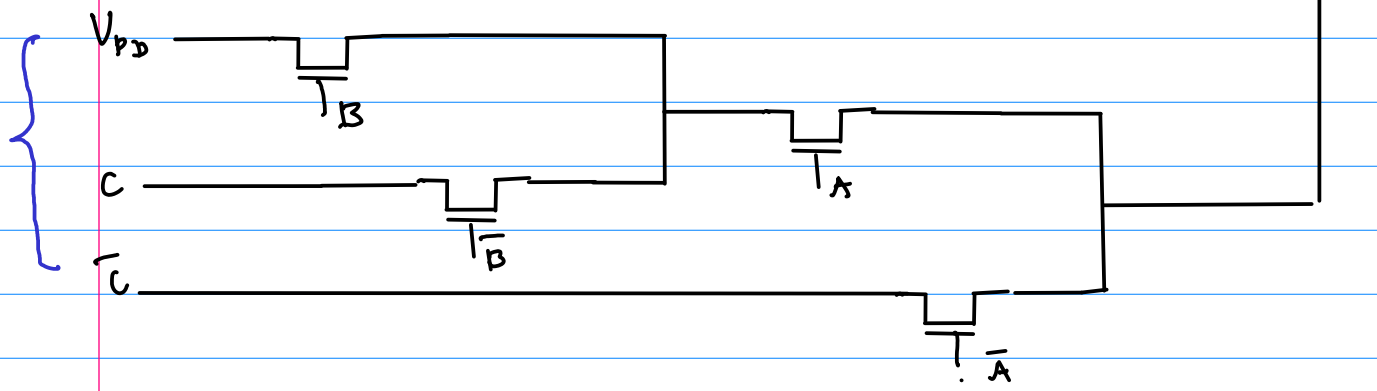

$\bar{B}$
V_{DD}
B
b
$\bar{B}$
C
$\bar{B}C$
$\bar{b}$
$\bar{C}$
$\bar{A}$
$AB + A\bar{B}C$
A
$AB + A\bar{C} + A\bar{B}C$
A
$\bar{A}\bar{C}$
$\bar{A}$



pMOS only

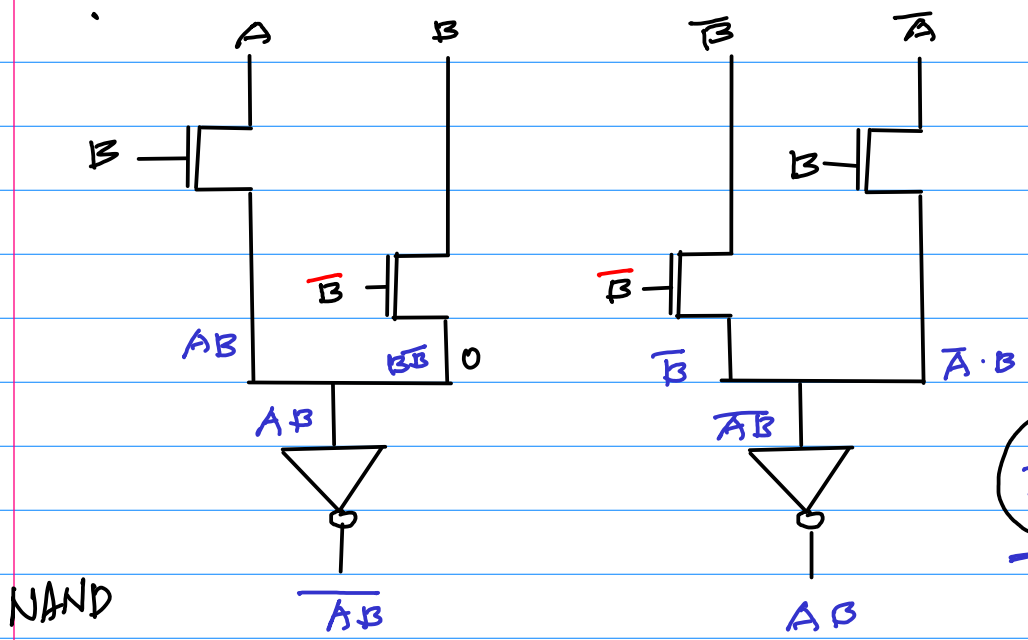


nMOS only



CPL

Complimentary Pass-Transistor Logic

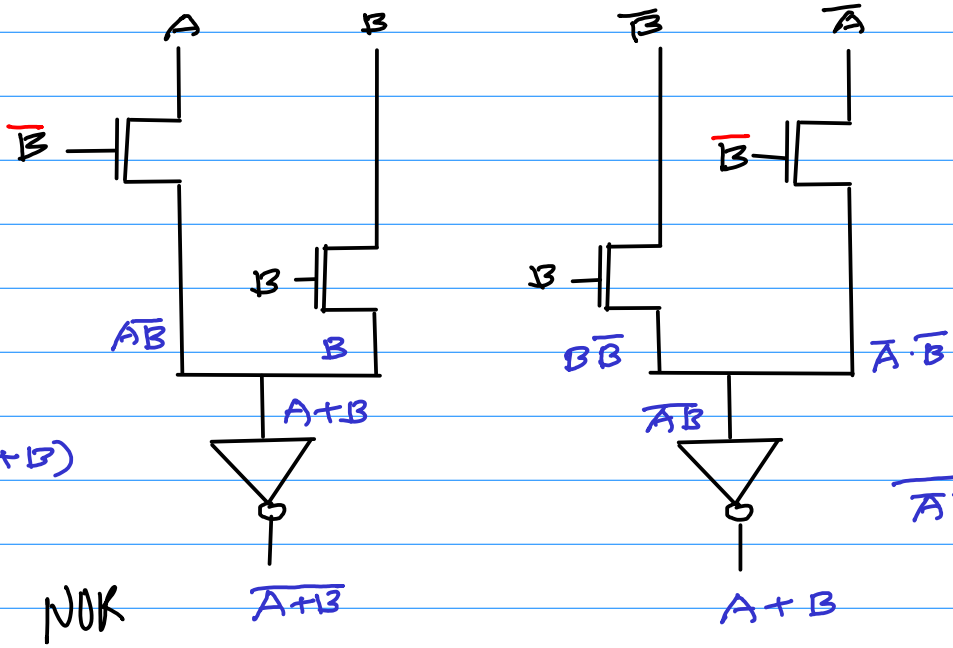


$\overline{B} + \overline{A} \cdot B$

$= (\overline{B} + \overline{A}) \cdot (\overline{B} + B)$

$= \overline{A} + \overline{B}$

$= \overline{AB}$



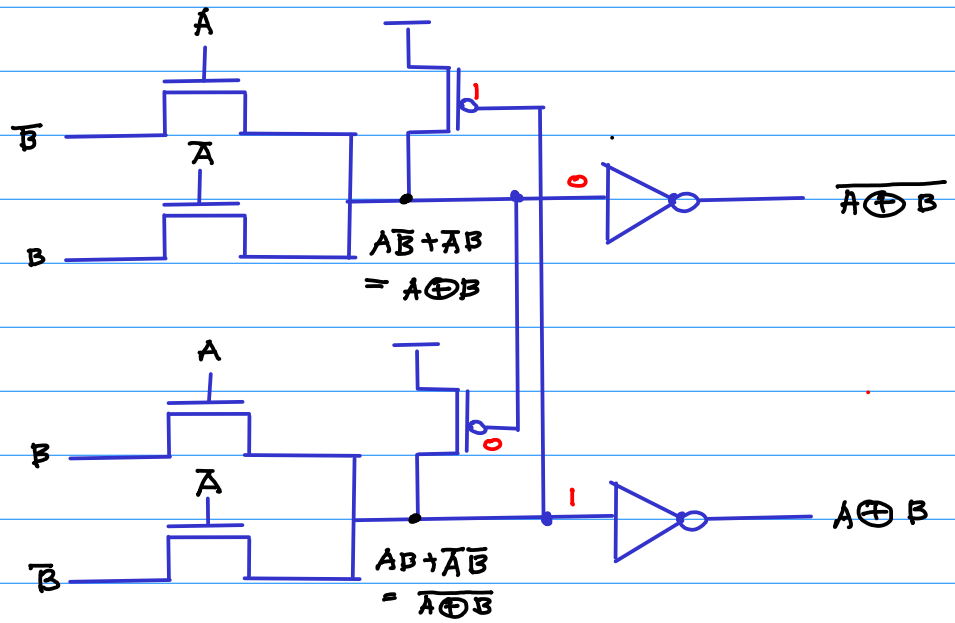
$A \cdot \overline{B} + B$

$= (A + B) \cdot (\overline{B} + B)$

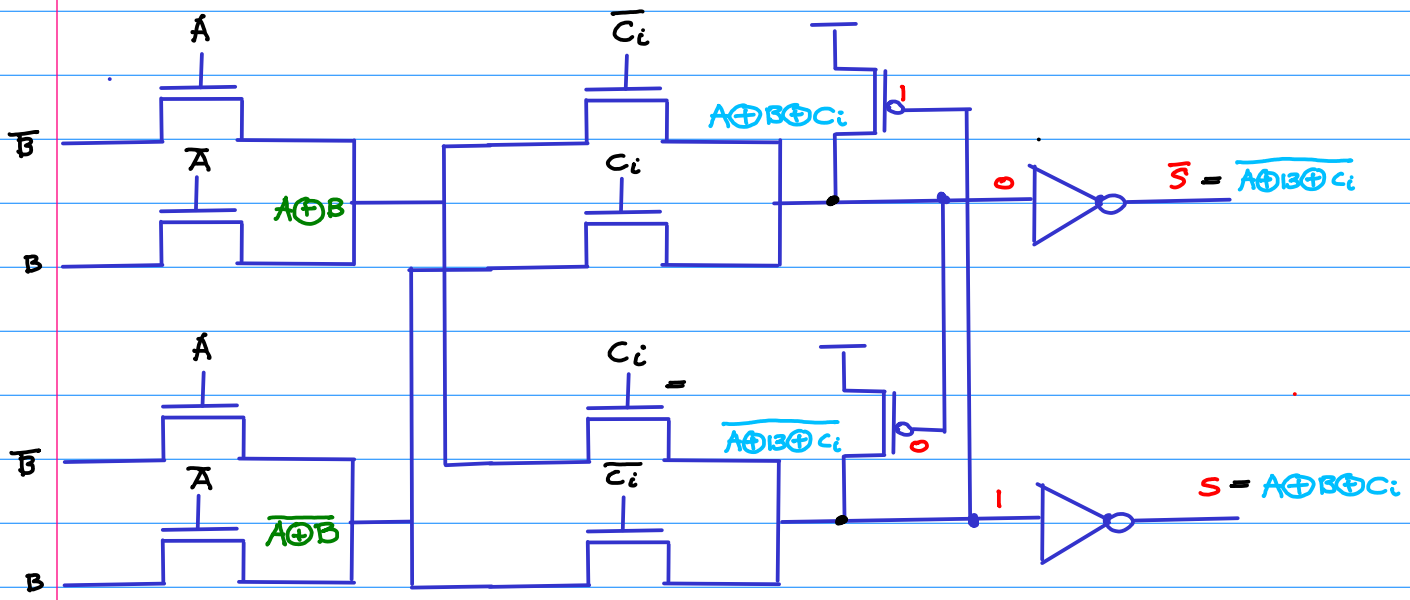
$= (A + B)$

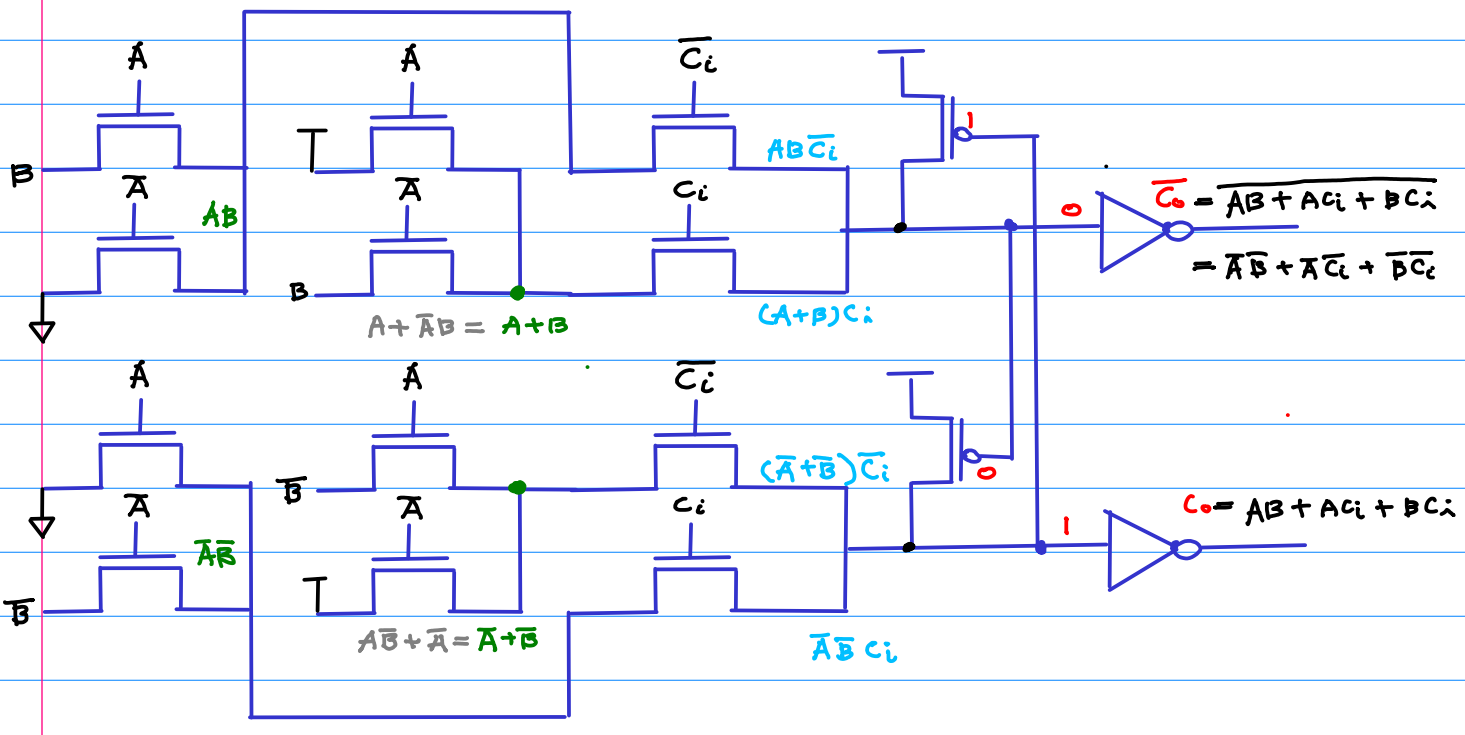
$\overline{AB} = A + B$

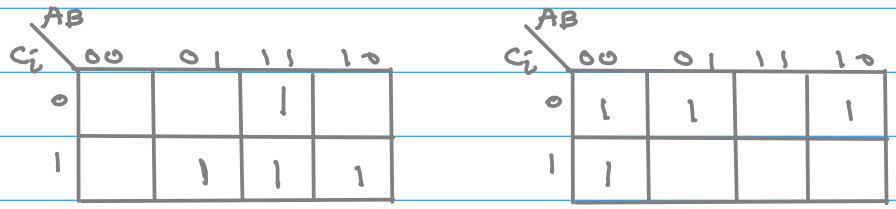
CPL XOR



CPL (FA)


A
B
Ci
A⊕B
A⊕B⊕Ci
S = A⊕B⊕Ci
A⊕B⊕Ci
S = A⊕B⊕Ci


A
B
Ci
AB
ABCi
A+AB = A+B
(A+B)Ci
Co = AB + ACi + BCi
= AB + ACi + BCi
(A+B)Ci
ABCi
Co = AB + ACi + BCi


AB
Ci
00
01
11
10
0
1