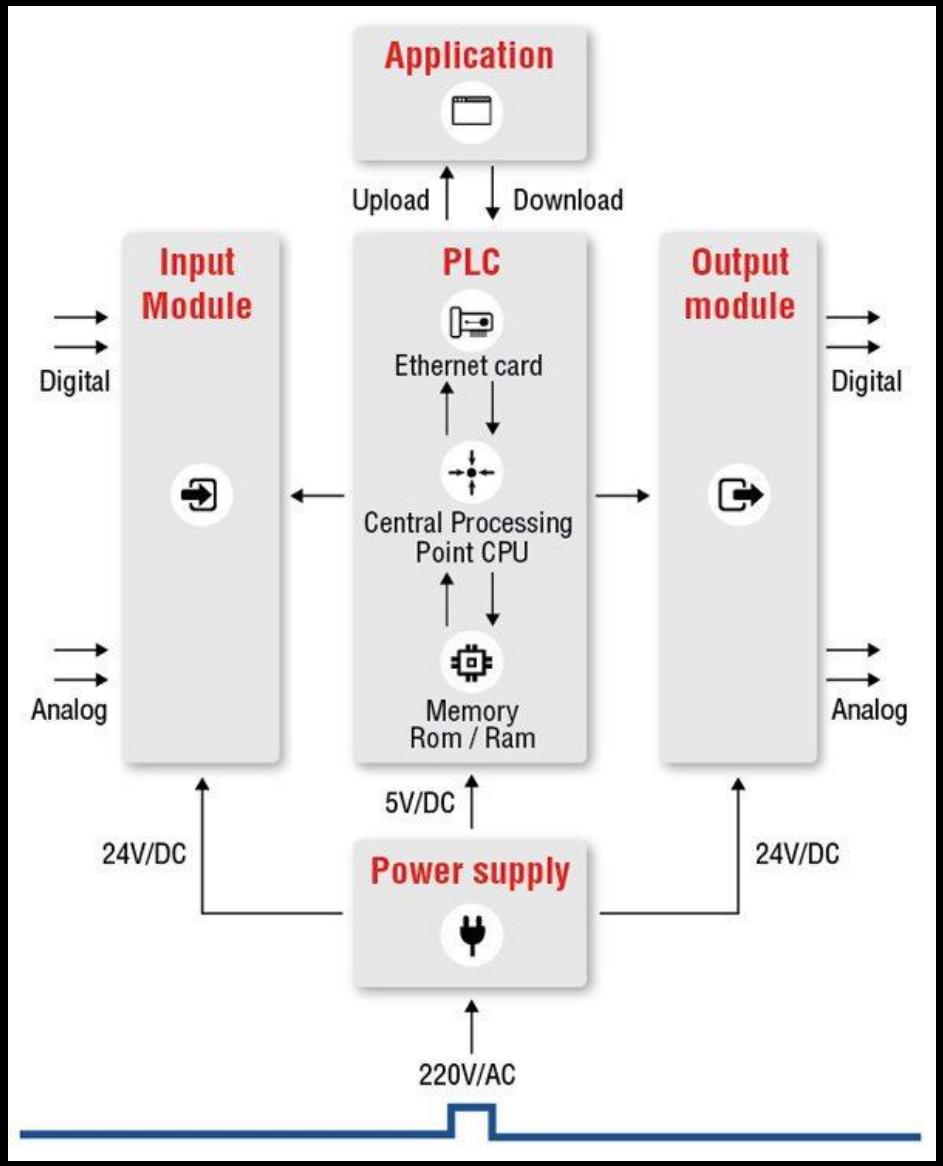
Digital Electronics and Computer Organization

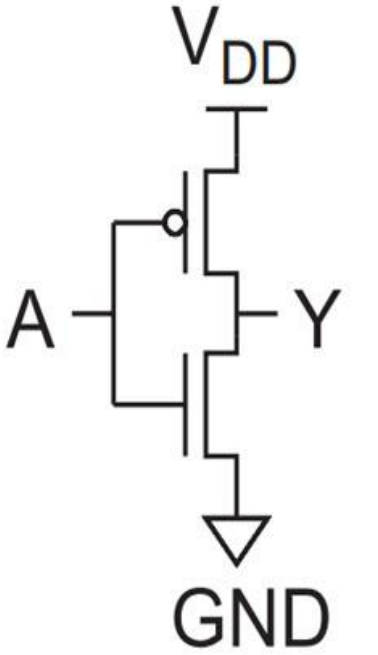
Digital Design

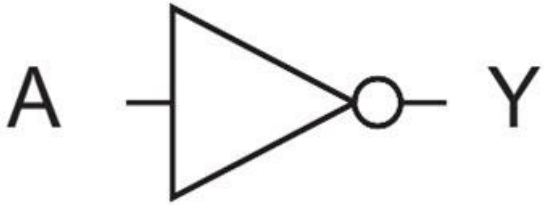
Lecture 27: Programable Logic Controllers

Programmable Logic Controller



CMOS Inverter



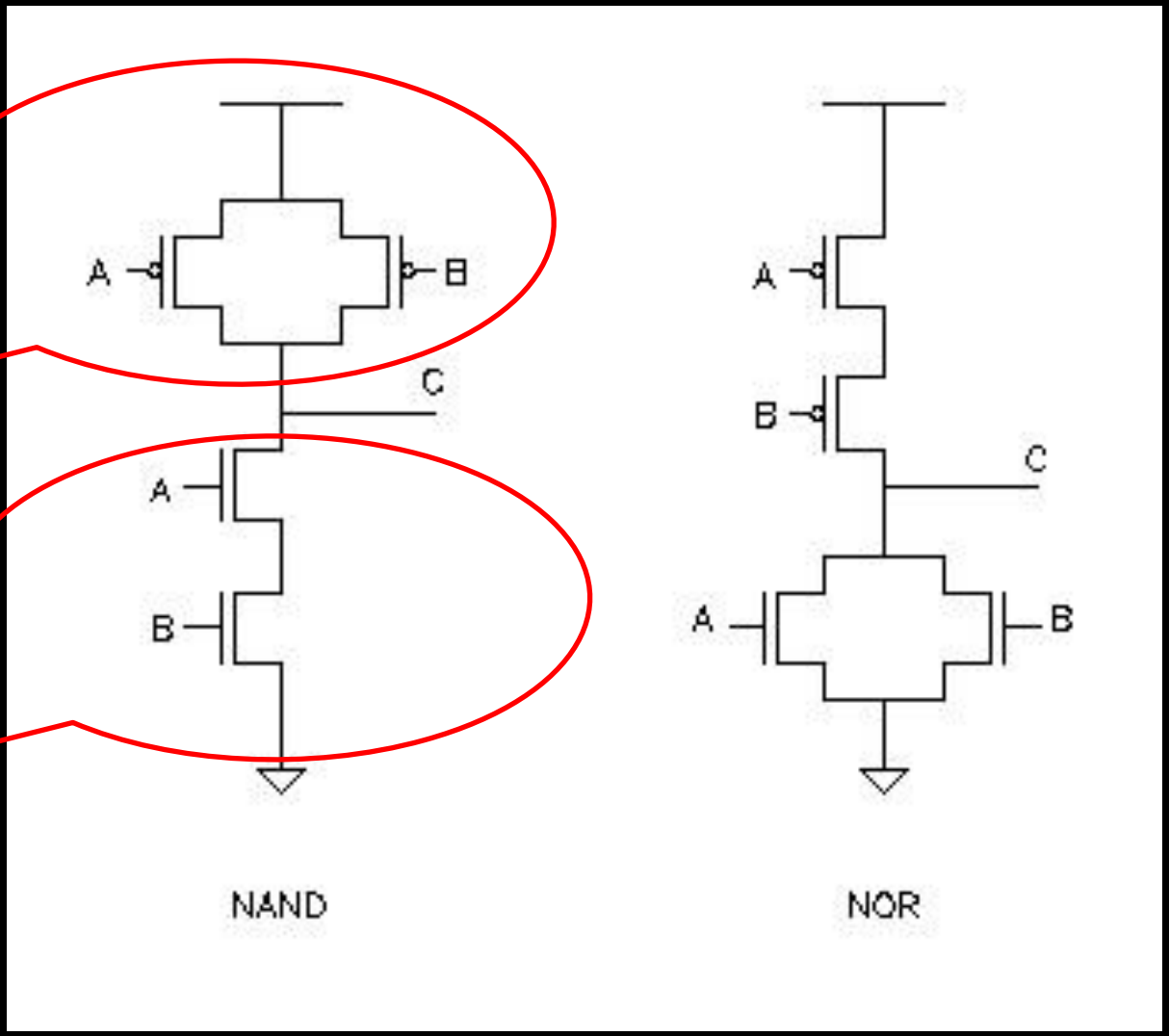


A	Y
0	1
1	0

CMOS NAND & NOR

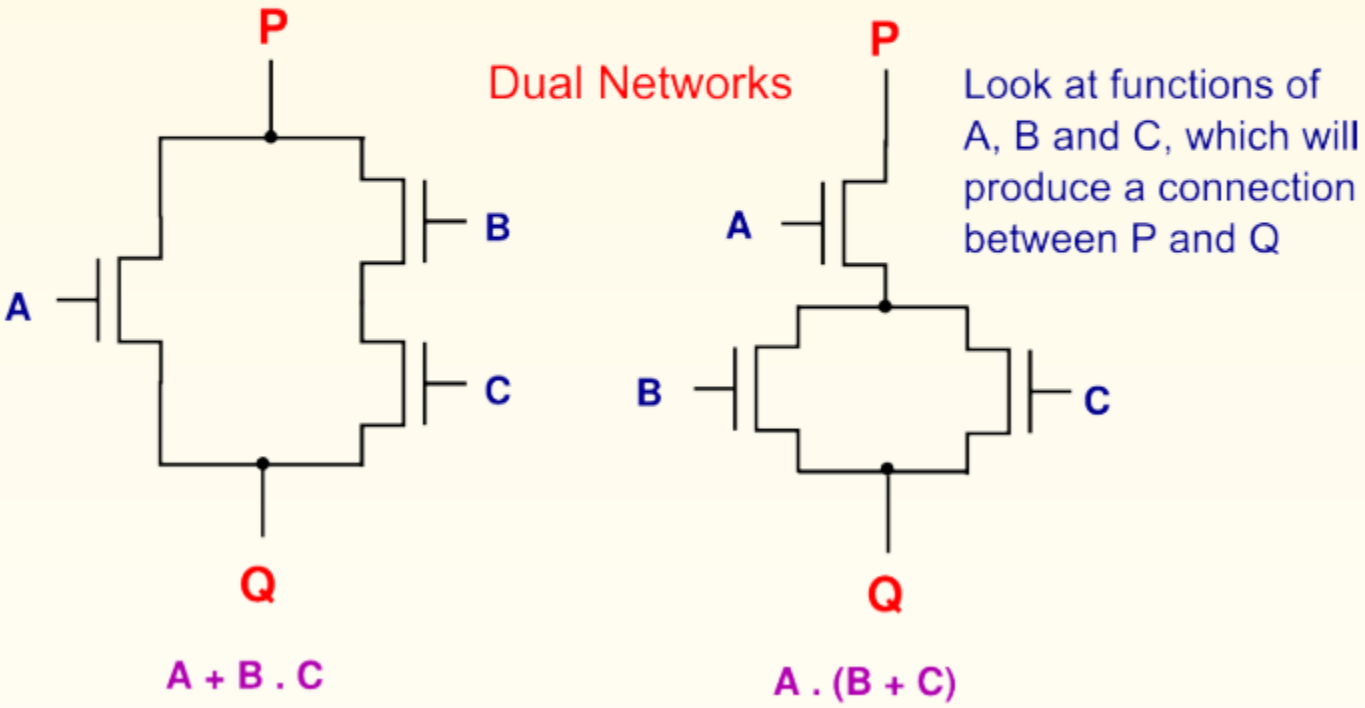
PUN

PDN



Complex Functions in CMOS

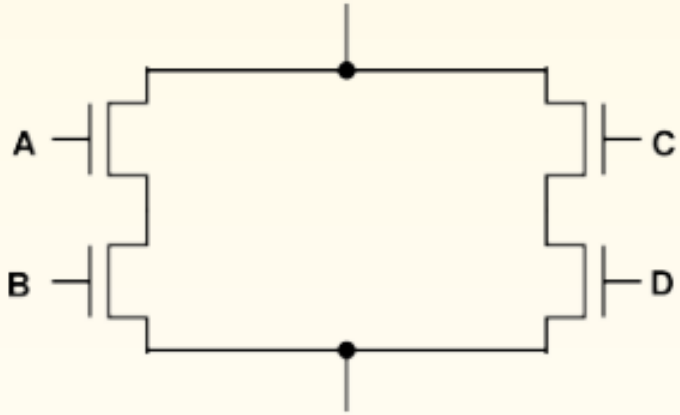
- N- and P- networks must implement **complementary** functions
- Duality **sufficient** for correct operation (but not necessary)



CMOS Complex Functions

Example: $F = \overline{(A \cdot B) + (C \cdot D)}$

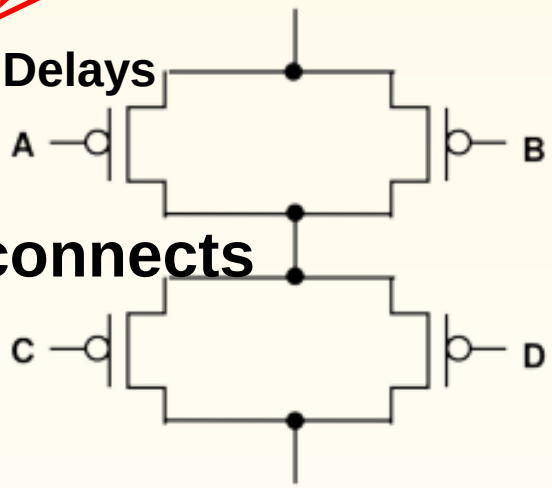
1. Take uninverted function $F = (A \cdot B) + (C \cdot D)$ and derive N-network
2. Identify AND, OR components: F is OR of AB, CD
3. Make connections of transistors



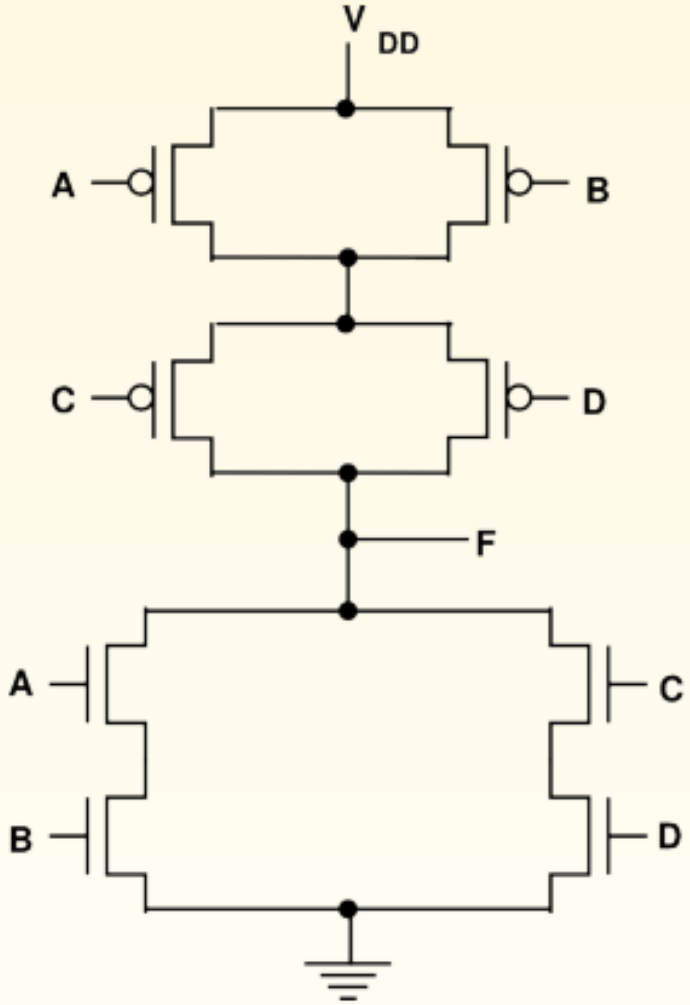
CMOS Complex Functions

4. Construct P-network by taking complement of N-expression $(AB + CD)$, which gives the expression, $(\overline{A} + \overline{B}) \cdot (\overline{C} + \overline{D})$
5. Combine P and N circuits

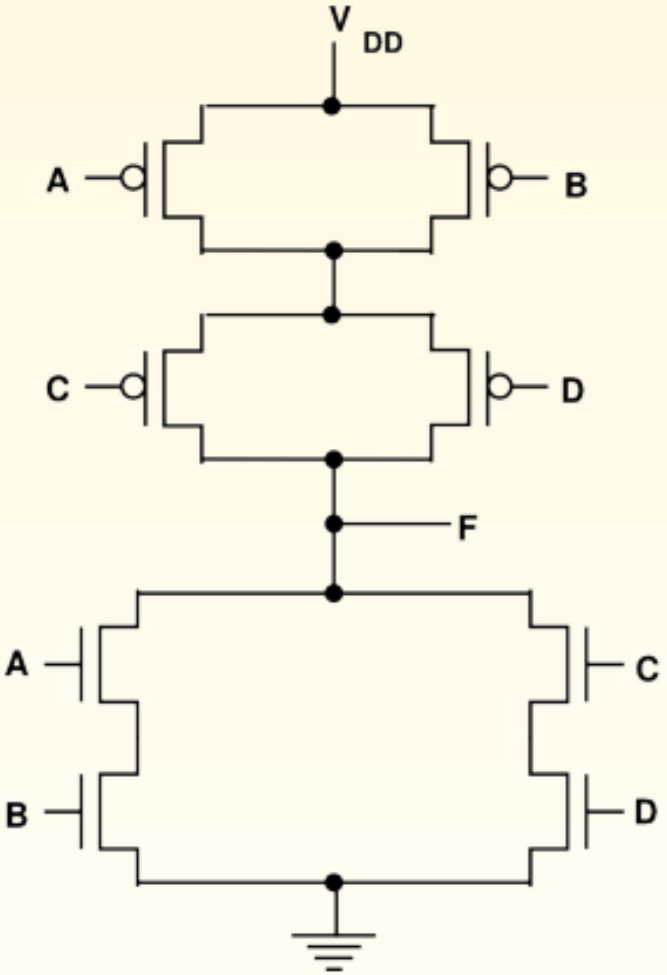
12 T
2 Gate Delays



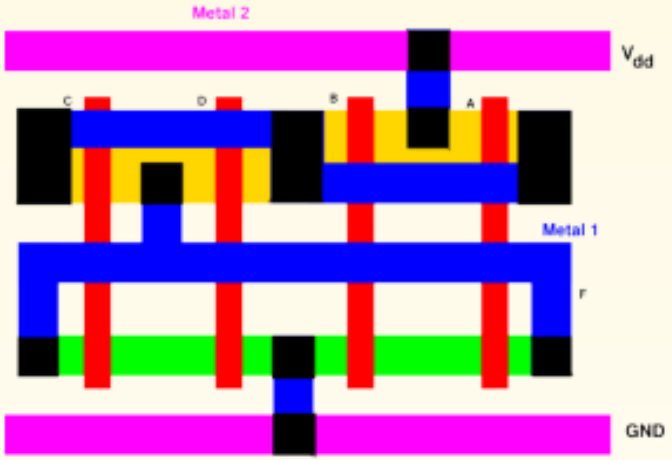
Interconnects



And Or Invert (AOI)



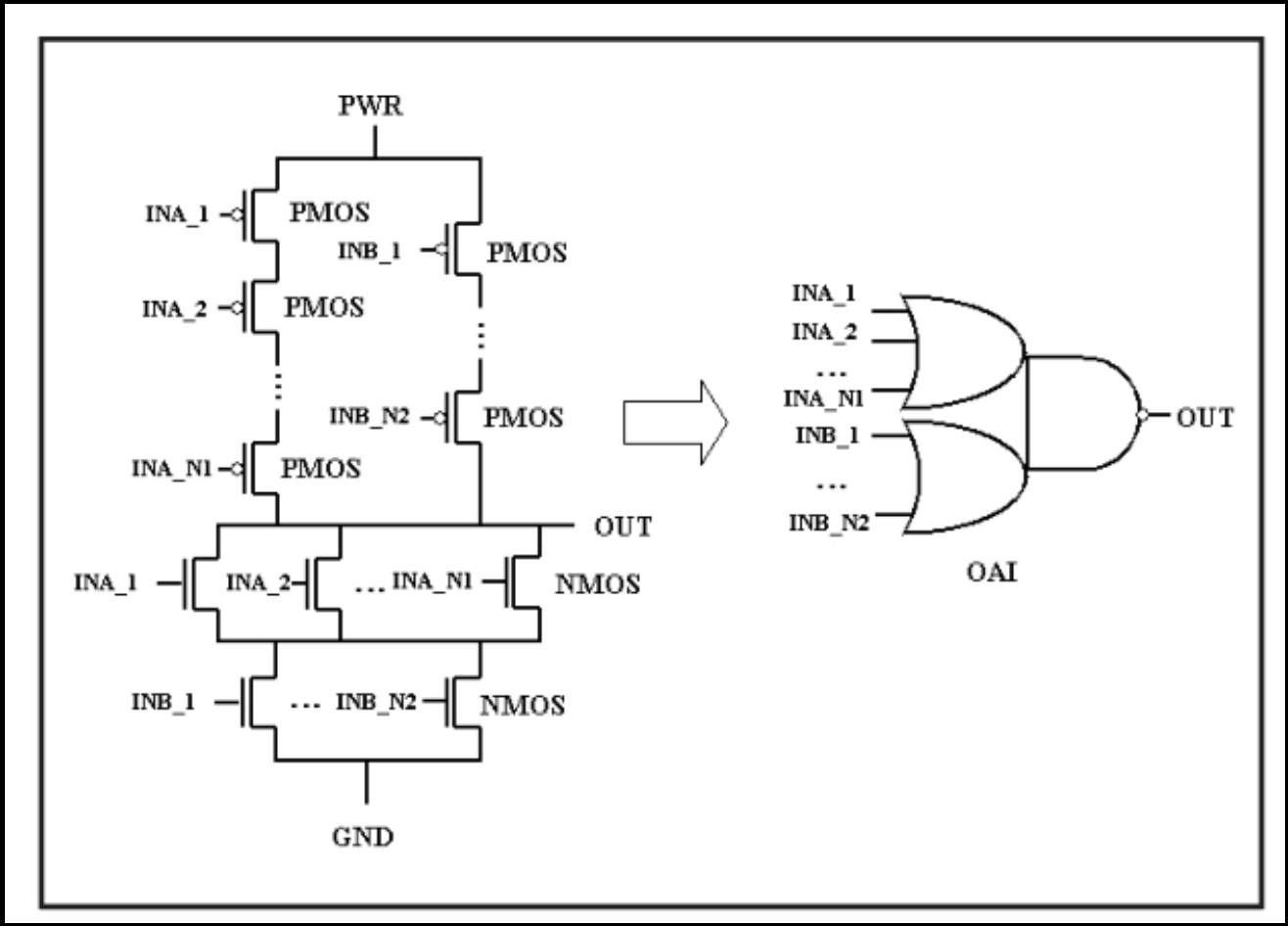
AND-OR-INVERT (AOI) gate



Note: Arbitrary shapes are not allowed in some nanoscale design rules

211 AOI

Or And Invert (OAI)



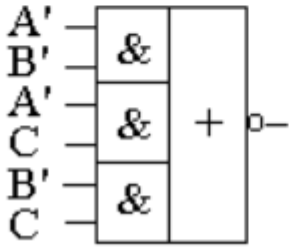
PLC

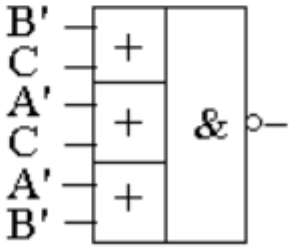
C \ A	0	1	1	1
0	0	0	1	0

B

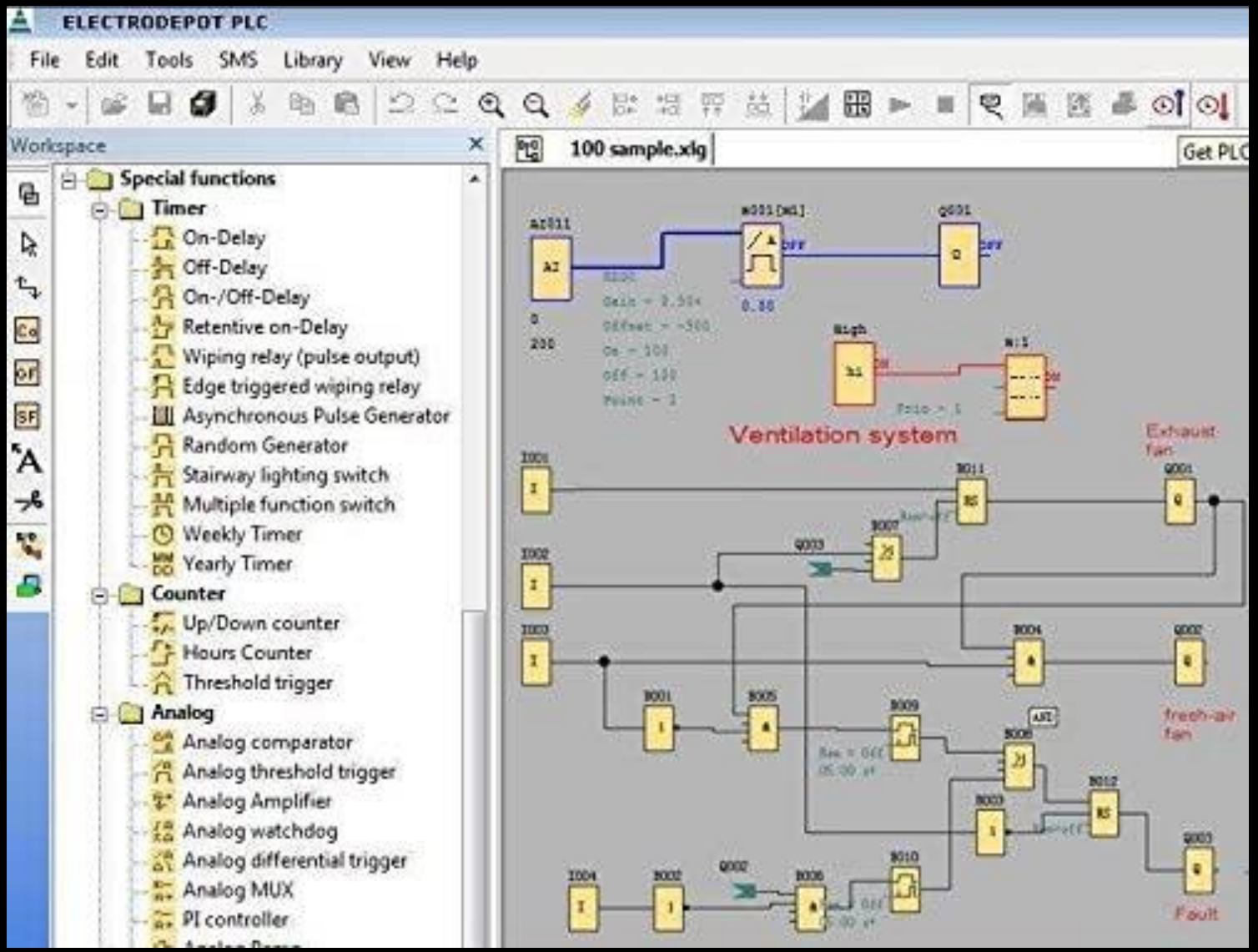
- $F' = A'B' + A'C + B'C$
- $F = (A'B' + A'C + B'C)'$
- Use a 2-input 3-stack AOI gate

- $F' = (B' + C)(A' + C)(A' + B')$
- $F = [(B' + C)(A' + C)(A' + B')]'$
- Use a 2-input 3-stack OAI gate





PLC


ELECTRODEPOT PLC
File
Edit
Tools
SMS
Library
View
Help
Workspace
Special functions
Timer
On-Delay
Off-Delay
On-/Off-Delay
Retentive on-Delay
Wiping relay (pulse output)
Edge triggered wiping relay
Asynchronous Pulse Generator
Random Generator
Stairway lighting switch
Multiple function switch
Weekly Timer
Yearly Timer
Counter
Up/Down counter
Hours Counter
Threshold trigger
Analog
Analog comparator
Analog threshold trigger
Analog Amplifier
Analog watchdog
Analog differential trigger
Analog MUX
PI controller
100 sample.xlg
Get PLC
Ventilation system
Exhaust fan
fresh-air fan
Fault

Thank You