EE16B Section 4B

Warmup: Convert between decimal, hexadecimal, and binary.

101010_2 in decimal: 42

11111_2 in decimal: 31

12_{10} in binary: 1100

73_{10} in binary: 1001011

100_{10} in binary: 1100100

10_{16} in decimal: 16

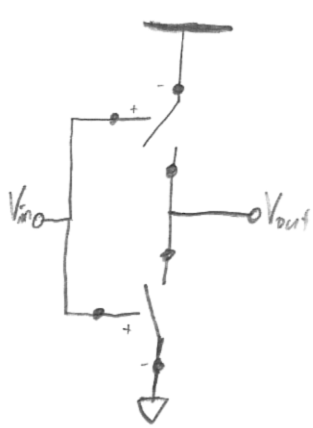
$2A_{16}$ in decimal: 42

$3F_{16}$ in decimal: 63

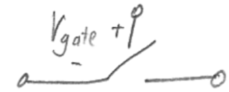
Question From Tuesday's Lecture

Switches as Transistors

Recall the inverter from lecture:



Made up of three-terminal switches:



- If $V_{gate} > V_t$, switch is ON; otherwise OFF
  - Or $V_{gate} < V_t$ for the second device.

So how does the inverter work?

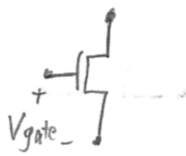
- If $V_{in} = V_{DD}$, the bottom switch is ON and the top switch is OFF. V_{out} is shorted to GND.
- If $V_{in} = 0$, the top switch is ON and the bottom switch is OFF. V_{out} is shorted to V_{DD}.

We can implement these switches with MOSFETs (transistors).

M(etal) O(xide) S(emiconductor) F(ield) E(ffect) T(ransistor)

However, we need two types:

nMOS



If $V_{gate} > V_t$, switch is ON; otherwise OFF.

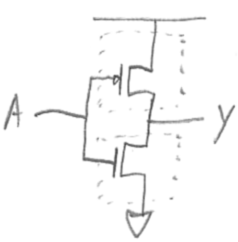
- "Good at" passing GND; "bad at" passing V_{DD}.
- Use in the pull-down network

pMOS

If $V_{gate} < V_t$, switch is ON; otherwise OFF.

- "Good at" passing VDD; "bad at" passing GND
- Use in the pull-up network

So, let's re-draw our inverter:



Pull-up network (pMOS)

Pull-down network (nMOS)

Together, "complementary" networks form CMOS!

- Are V_{DD} and GND ever shorted together?
- Is the input ever shorted to the output?