02/02/15 – W1

EHB 322E: Digital Electronic Circuits
SPRING 2015

Course title

Electronics vs **Electrical Engineering**

low current
low voltage
small circuits
+ chips
+ Laptops, phones
(billions of transistors)

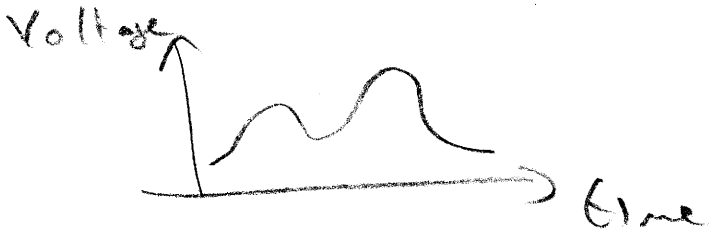
high voltage
high current
large circuits
+ converters (AC-DC)
+ Power lines
+ Adapters

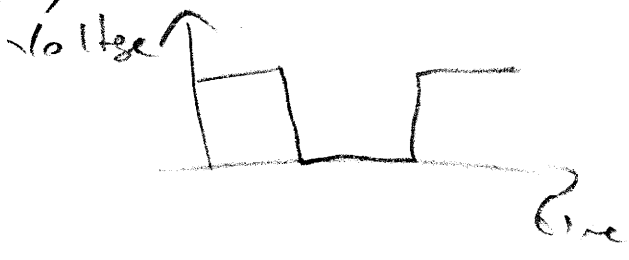
Electronics

Analog
+ old fashioned
your ear is analog

Digital
+ Modern

Rx
Scale
Watch
Computer
(95% digital)





– Faster
– Noise sensitive

Research!

– easy to design
– more accurate
– We create it to make life easier (interface)

Digital Electronics

Transistor level

Gate level - System level

Core: Digital Circuits

- Mosfet
  Metal-Oxide-Semiconductor
  Field-Effect-Transistor
- CMOS Complementary (both NMOS and PMOS)

+ Analysis and Synthesis of MOSFET Level digital circuits

+ Performance parameters
  - Power
  - Area
  - Delay (Speed)
  - Reliability (noise-energy)
    Sensitivity

Ex Design a CMOS circuit implementing $f = x_1\bar{x}_2 + \bar{x}_1 x_2$ (xor) with meeting the specifications

+ W.Post sim Dynamic Power Consumption $\leq$ 1mW
+ Area $\leq 10(\mu m)^2$
+ Wc Delay $\leq$ 10ns

Cont.

$$f = x_1\bar{x}_2 + \bar{x}_1 x_2$$

x_1	x_2	f
0	0	0
0	1	1
1	0	1
1	1	0

0 → 0 Volt

1 → 5 Volt

OR

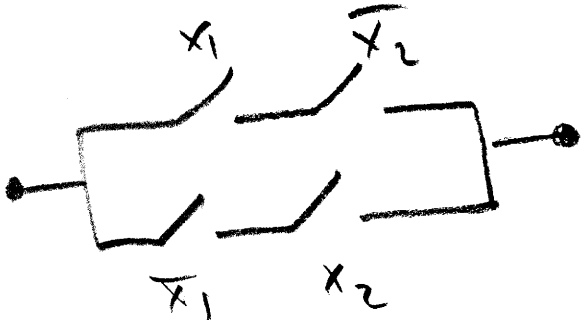
0 → −5V

1 → +5V

Switch

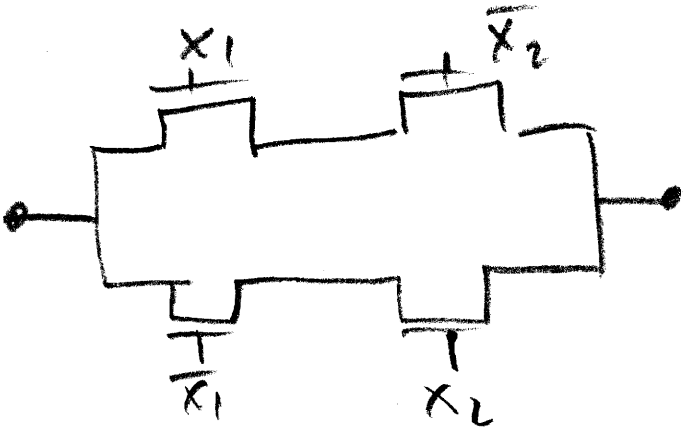
No current

conducting current

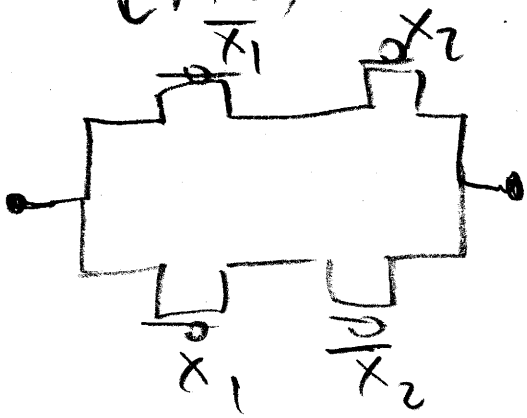


If there is a closed path between nodes then $f = 1$ otherwise $f = 0$

↓ NMOS



↓ PMOS



Course Website