Digital Design Logic
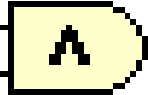
OU Robotics Club
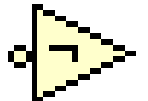11 Feb 2015

Boolean Algebra

- Main operators: AND, OR, NOT

- AND: ∧   Denoted with ∧ or ●

- OR: ∨   Denoted with ∨ or +

- NOT: ¬   Denoted with ¬ or −

Boolean Algebra

- Some operators (such as NOR) are functionally complete
  - Any other function can be created using only that one function.
- Other useful operations:
  - NOR
  - XOR
  - Implies

K-mapping

- Visual method for simplifying logic
- Minimize gates used by grouping outputs into rectangles
- Ex: $A(WXYZ) = \sum(2,3,4,5,6,7,9,11,13,15)$

	YZ=00	01	11	10
WX=00	0	0	1	1
01	1	1	1	1
11	0	1	1	0
10	0	1	1	0

Datasheets

- What are they useful for?
  - Pin-out information
  - Maximum ratings
  - Electrical characteristics
  - Recommended operating conditions
  - Application notes
  - Physical dimensions
- Examples
  - 74AC08 – Digital AND gate
  - 74AC32 – Digital OR gate

State Machines (Latches & Flip Flops)

- Used to hold state or memory
- Flip Flops are timed
- Latches include a "gate," often connected to a clock signal
- State can be used as an input for control or logic
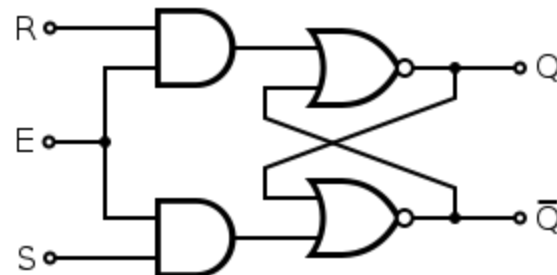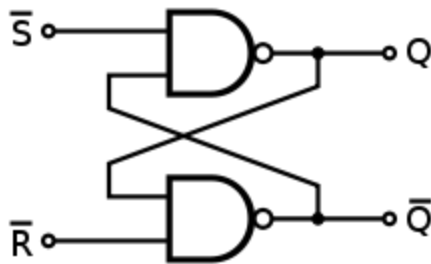
Activities

- Create a circuit that lights an LED accordingly:
  - $(A \bullet B) + C$
  - $(A + B) \bullet C$
- Create a 3-input majority gate or 1-bit adder.
- Create a functional SR latch.
- Make a circuit that will light three LEDs in sequence given a timing signal.