

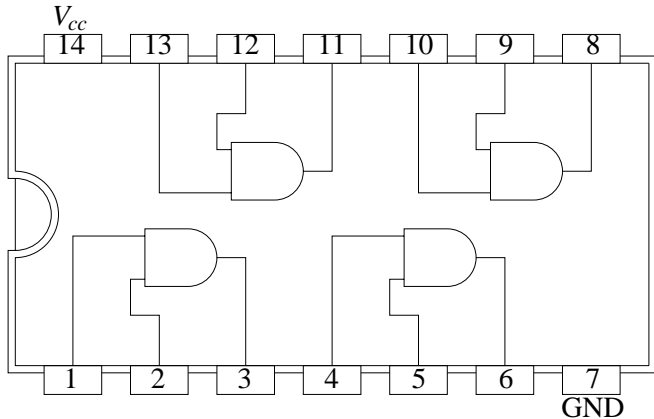
# CMSC 313 Lecture 23

- **Today: in-class lab II**
- **Next time: finite state machines**

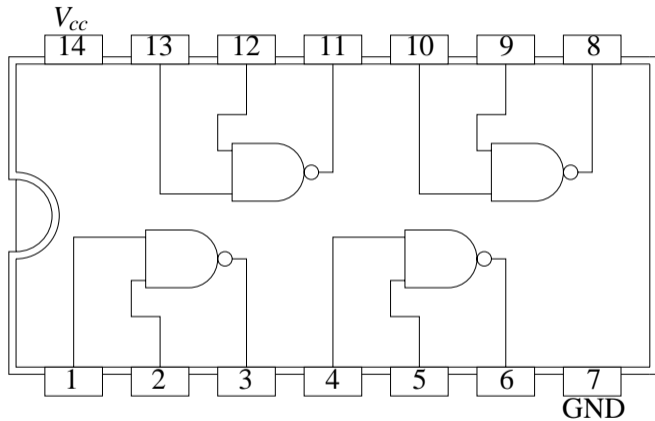
# #1. Set up the bread board

- Skip the literal generator.
- Use wires to connect to +5v or ground.
- Set up the power and ground to the + and - "rails".
- Use the diode to protect the chips.
- Set up two LEDs in series with 270 $\Omega$  resistors.
- Place a 74LS08 chip (AND gates)
- Place a 74LS00 chip (NAND gates)

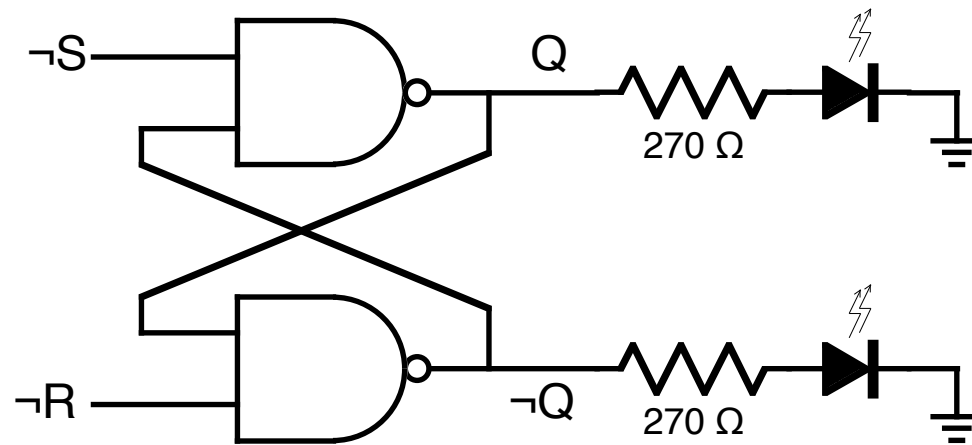
## 5 74LS08 Quadruple 2-Input AND Gates



## 2 74LS00 Quadruple 2-Input NAND Gates

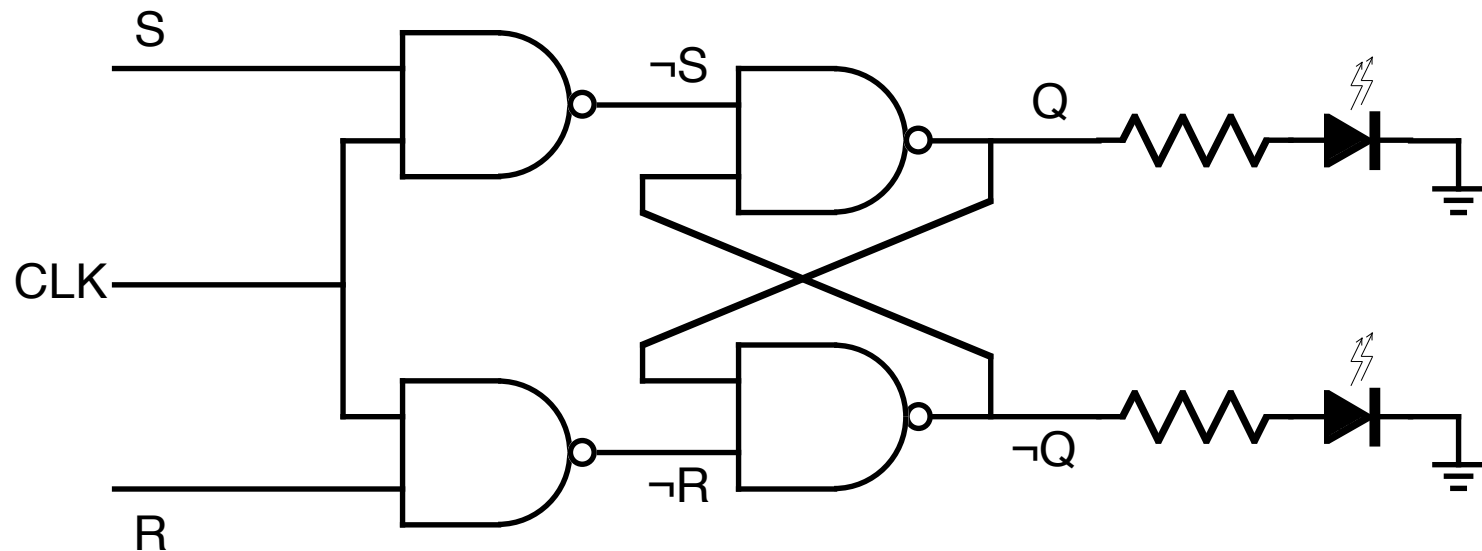


## #2 Make an S-R Latch



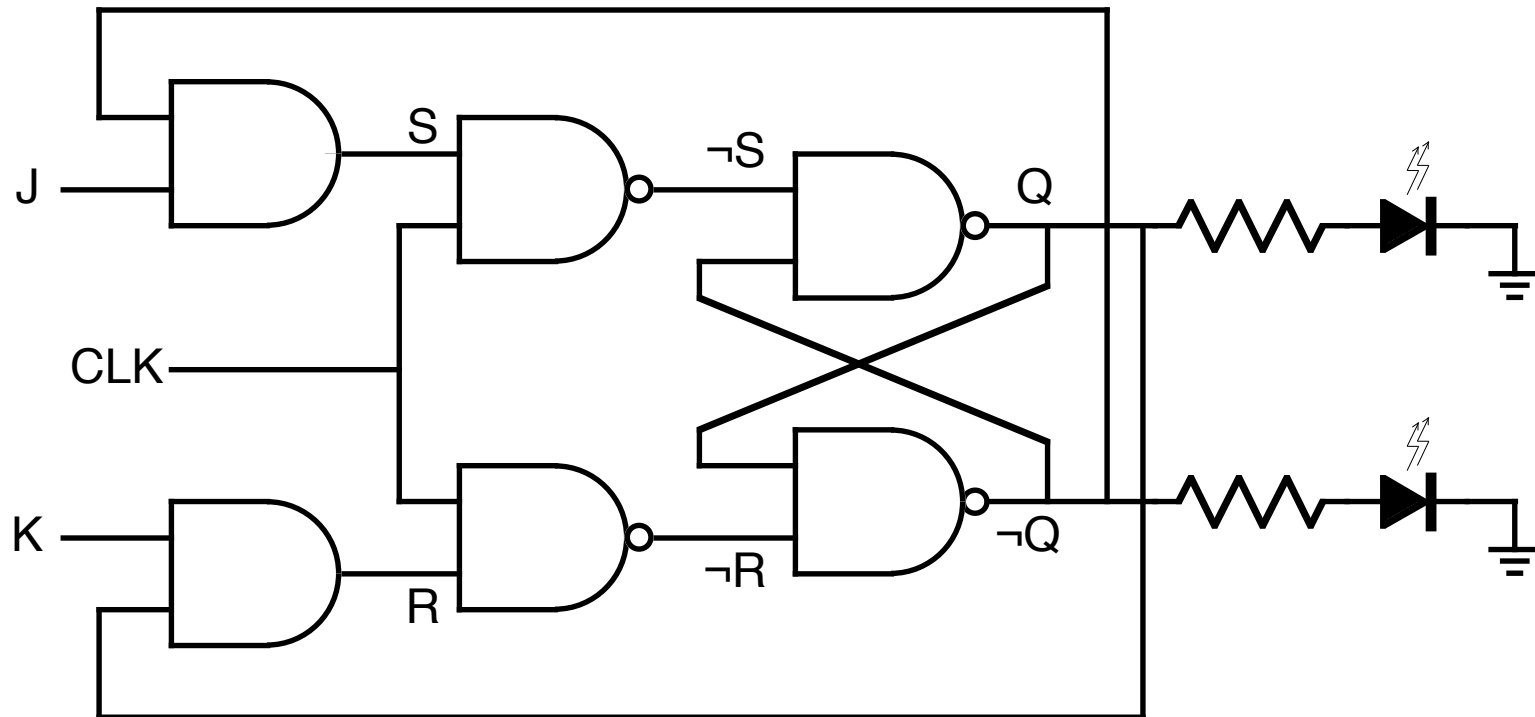
- Use the last 2 NAND gates to make an S-R latch
- Connect  $\neg S$  to ground to set the latch
- Connect  $\neg R$  to ground to reset the latch

# #3 Make a Clocked S-R Latch



- Use remaining NAND gates to connect the “clock”.
- Testing: connect CLK to ground, change S and R connections, disconnect CLK from ground.
- Connect S to +5v to set, connect R to +5v to reset.

## #4 Make a J-K Flip Flop



- Use two AND gates to connect J, K, Q and  $\bar{Q}$ .
- Testing: connect J to +5v to set, K to +5v to reset
- If both J & K are +5v, we get endless toggle. (When CLK is grounded, either LED might be on.)