

Welcome!

# Clocks, Other Hardware

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CS 2130: Computer Systems and Organization 1

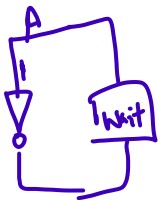
September 12, 2022

# Announcements

- Homework 1 due tonight!
- Homework 2 available tomorrow (and in class on Wednesday)

# Quiz Review

OxCA

$$\begin{array}{r} \begin{array}{ccccccc} & i & c & & & A & \\ 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ -7 = & 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \leftarrow \\ & & & & & 1 & 1 & 0 \leftarrow \\ & & & + & & & 1 \\ \hline & & & & & & 1 & 1 & 1 \end{array} \end{array}$$
~~$$\begin{array}{cccc} 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{array}$$~~

-1011000

$$-1.011 \times 2^7$$
$$[1110 \ 011]$$
$$\begin{array}{r} 011 \\ + 011 \\ \hline 110 \end{array}$$
$$00011001 = 25$$
$$\begin{array}{r} 11001000 \\ \wedge 11001010 \\ \hline 10 = 2 \end{array}$$
$$a + \overbrace{(na + 1)}^{-a} = 0$$

$$a - a$$

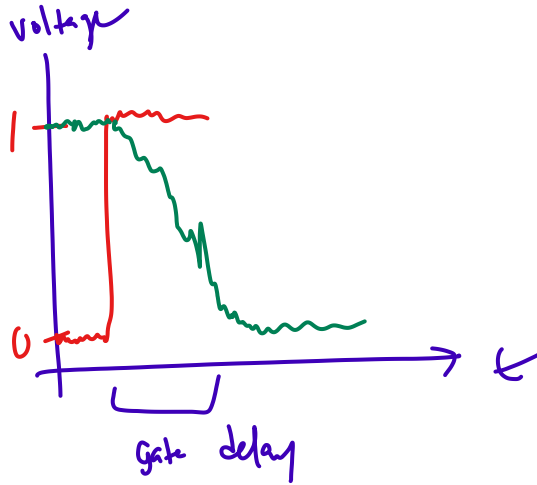
$q = 0 \times \underset{1}{b} \underset{1}{e} b e$

q8 0x0f0f = 0x0e0e

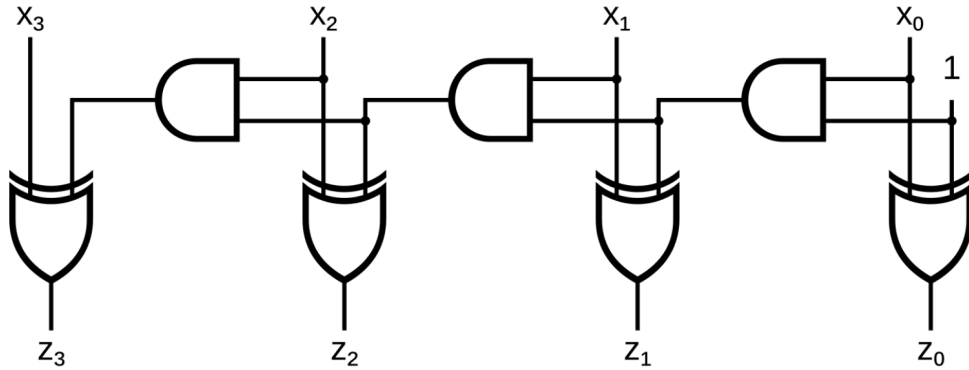
$(y_{ij})$  Bokefif = ox dlo

# Gate Delay

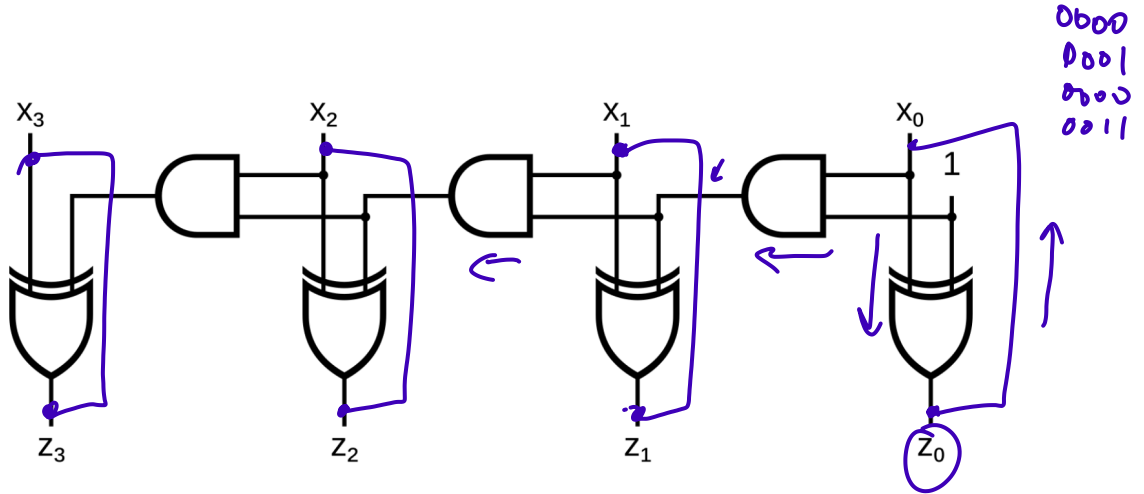
What happens when I change my input?



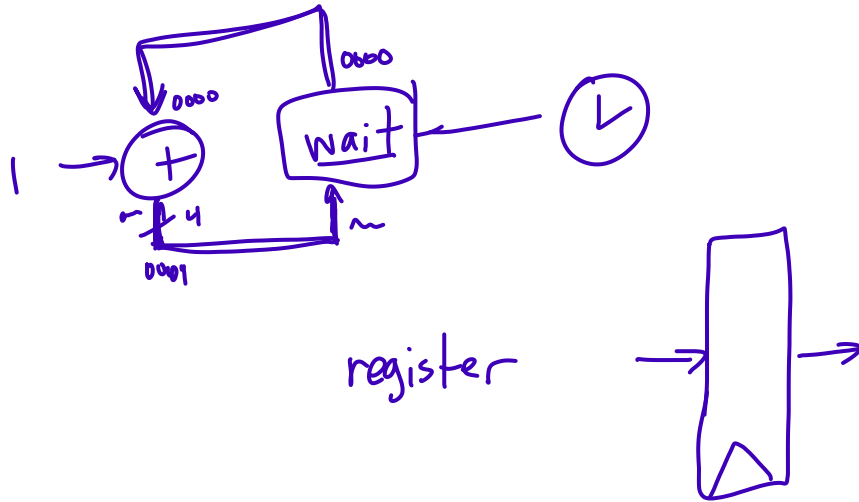
# Increment Circuit



# Building a Counter



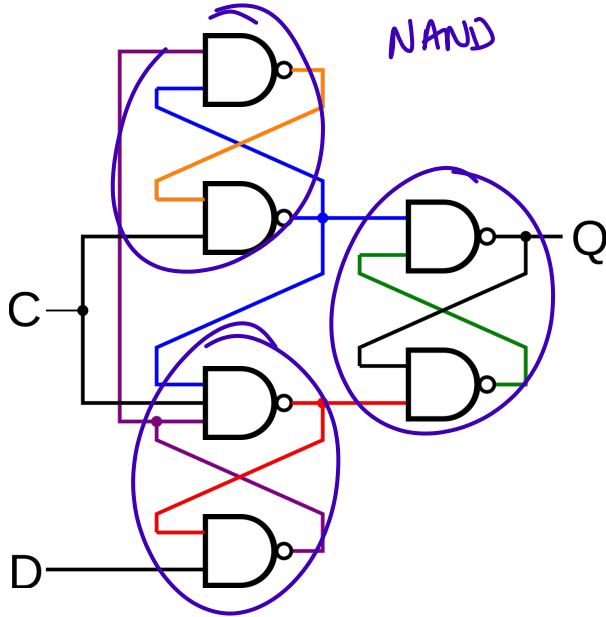
# Building a Counter



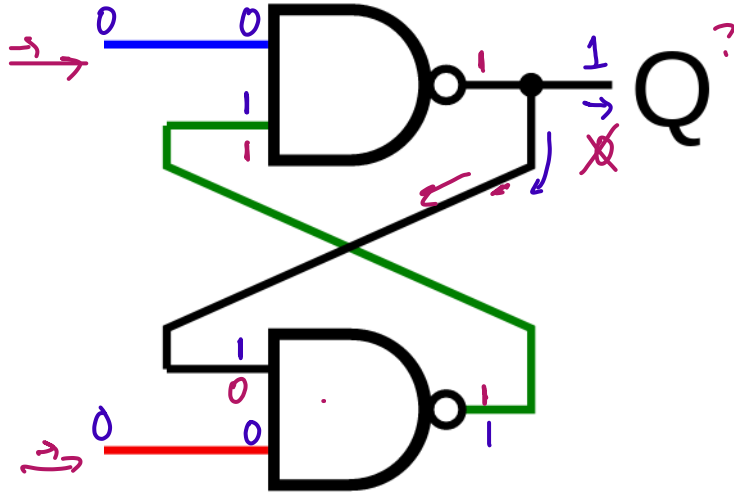
# Building a Counter - Waiting



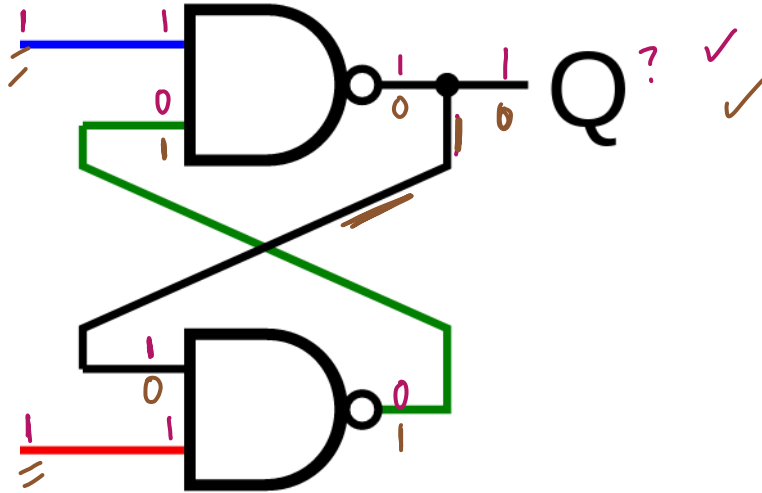
# 1-bit Register Circuit



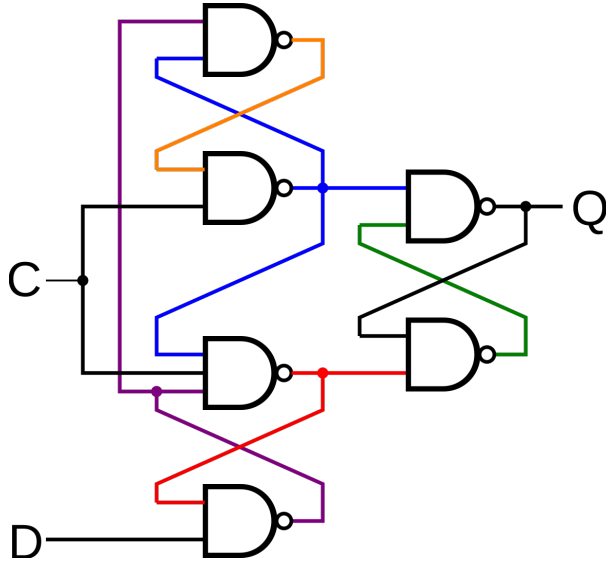
# 1-bit Register Circuit



# 1-bit Register Circuit



# 1-bit Register Circuit



# Building a Counter