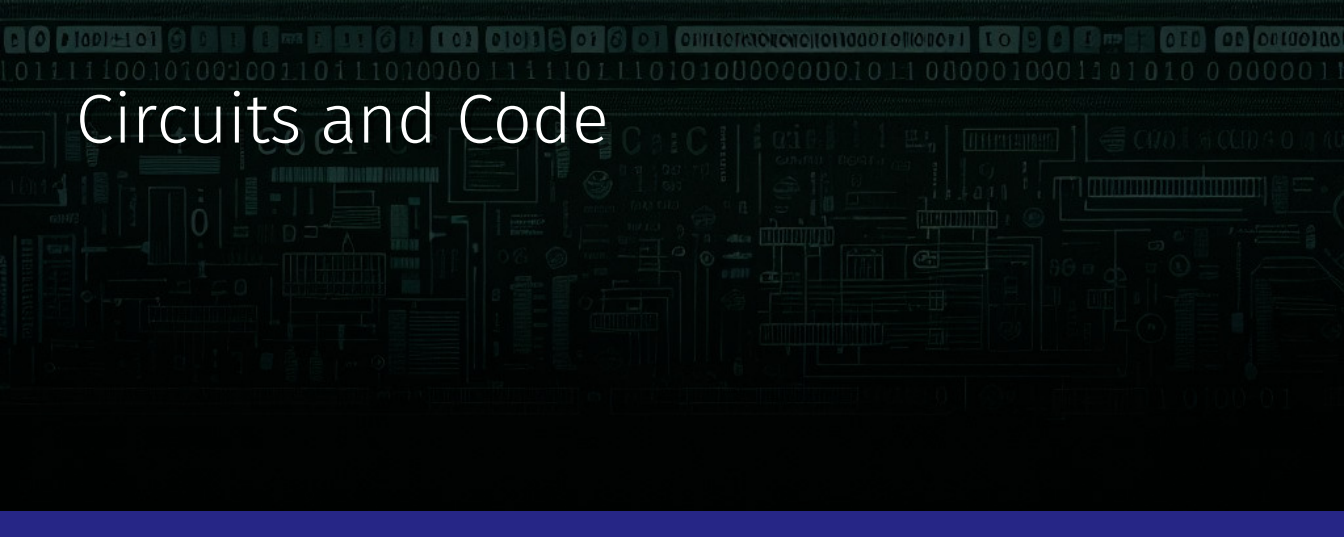


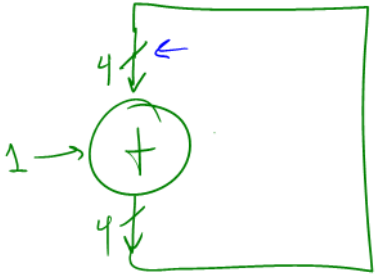
Circuits and Code

CS 2130: Computer Systems and Organization 1
February 2, 2026

Announcements

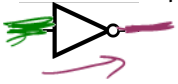
- Homework 1 due tonight
- Homework 2 available today, due next Monday

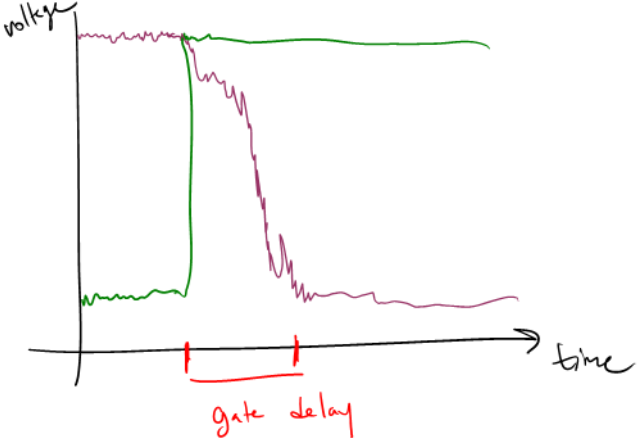
Building a Counter



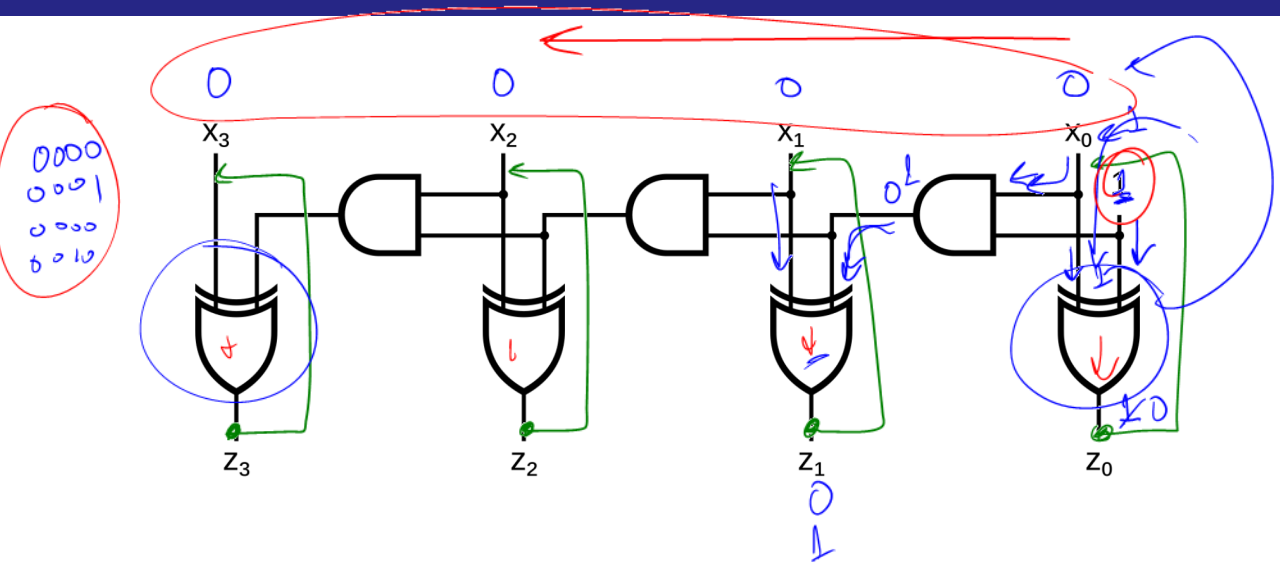
Gate Delay

What happens when I change my input?

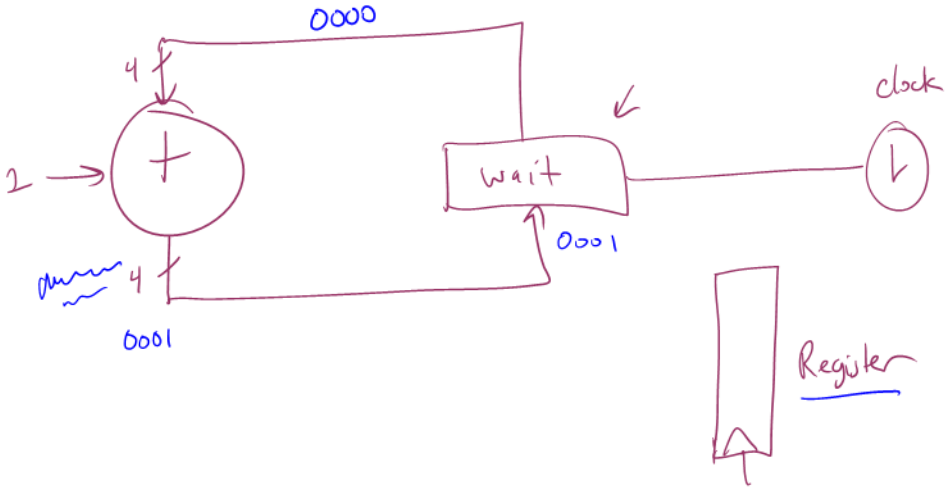




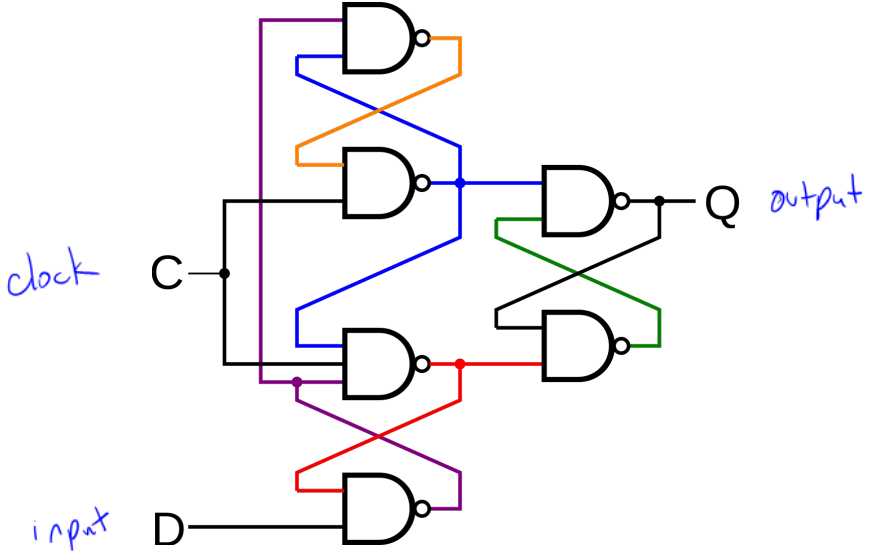
Building a Counter



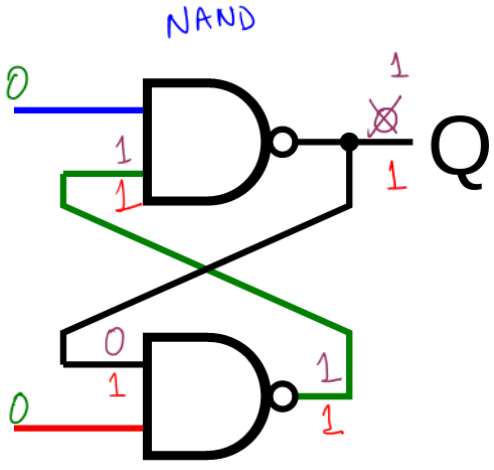
Building a Counter - Waiting



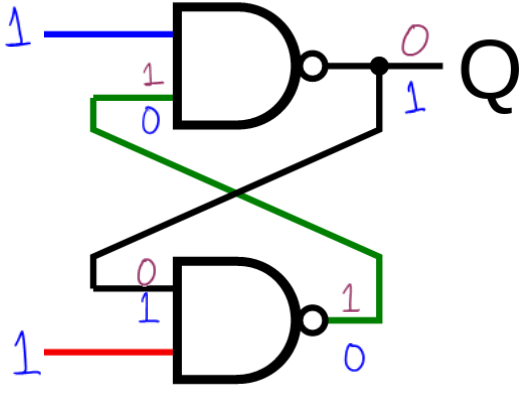
1-bit Register Circuit



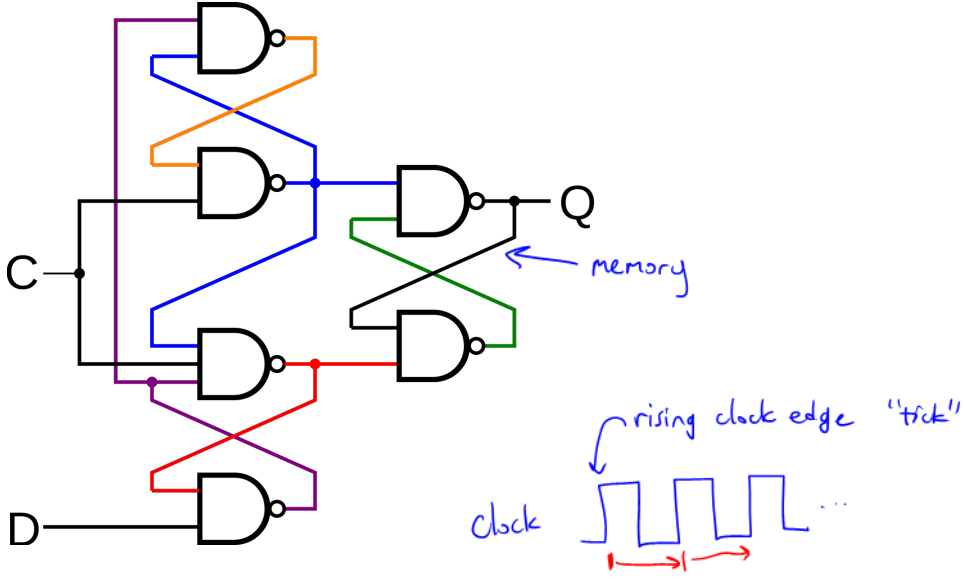
1-bit Register Circuit



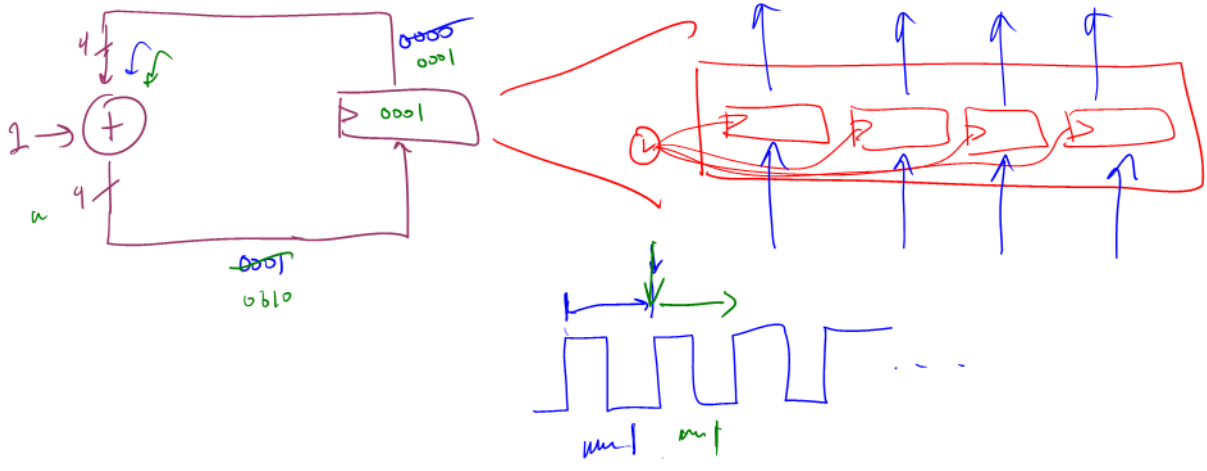
1-bit Register Circuit

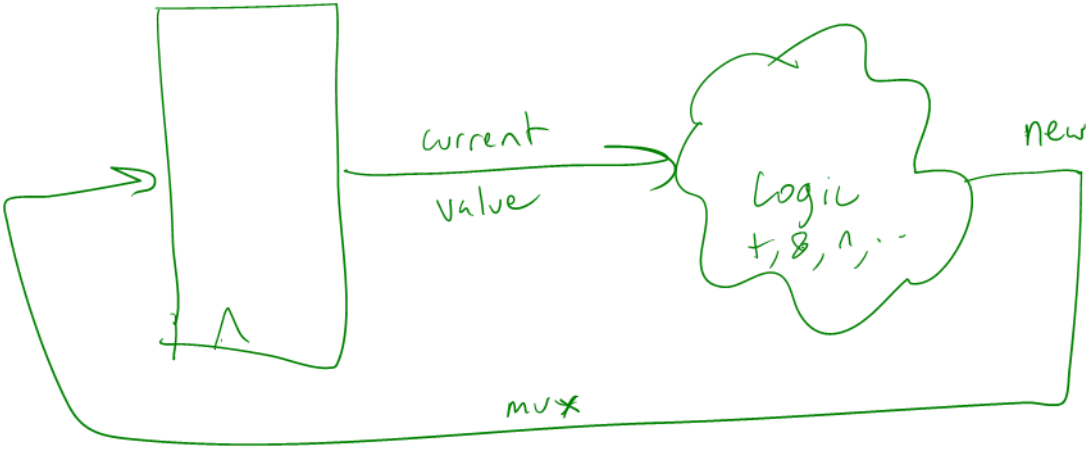


1-bit Register Circuit

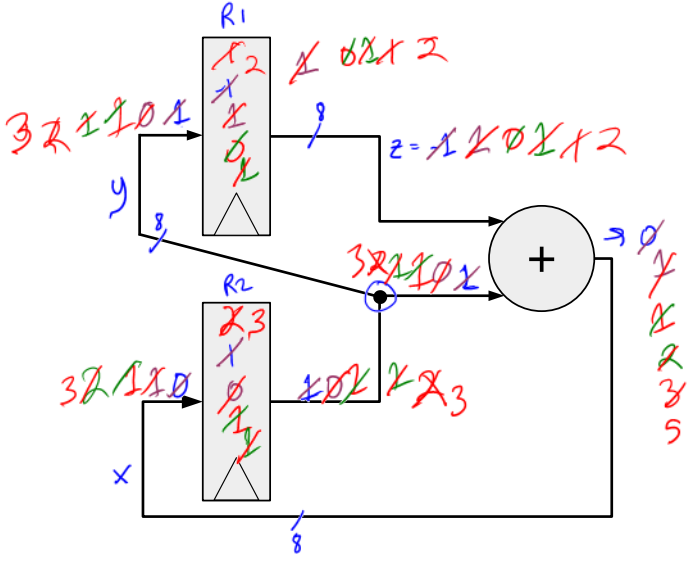


Building a Counter



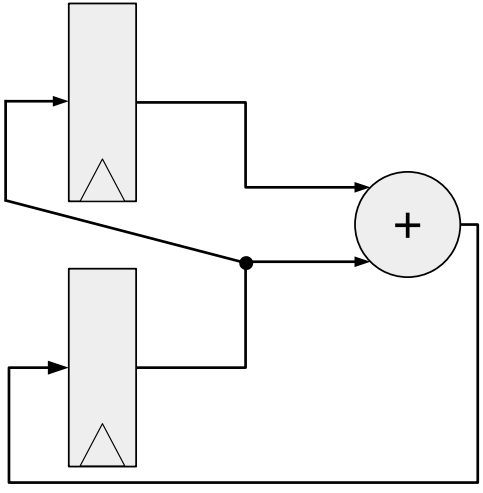

current
value
Logic
+, &, ^, ..
new
mux

Another Circuit



tick	x	y	R_1	R_2
0	0	1	-1	1
1	1	0	1	0
2	2	1	0	1
3	2	1	1	1
4	3	2	1	2
5	5	3	2	3

Another Circuit

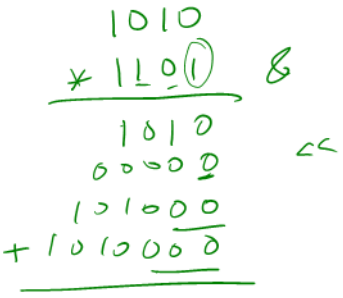


Common Model in Computers

Code to Build Circuits from Gates

Write code to build circuits from gates

- Gates we *already* know: `&`, `|`, `^`, `~`
- Operations we can build from gates: `+`, `-`
- Others we can build: `*`



Code to Build Circuits from Gates

Write code to build circuits from gates

- Gates we *already* know: `&`, `|`, `^`, `~`
- Operations we can build from gates: `+`, `-`
- Others we can build:
- Ternary operator: `?` `:`

```
z = (a==b) ? x : y
```

Equals

Equals: `=`

- Attach with a wire (i.e., connect things)
- Ex: `z = x * y`

Equals

Equals: `=`

- Attach with a wire (i.e., connect things)
- Ex: `z = x * y`
- What about the following?

```
x = 1
x = 0
```

Equals

Equals: `=`

- Attach with a wire (i.e., connect things)
- Ex: `z = x * y`
- What about the following?

```
x = 1
x = 0
```

- **Single assignment**: each variable can only be assigned a value once