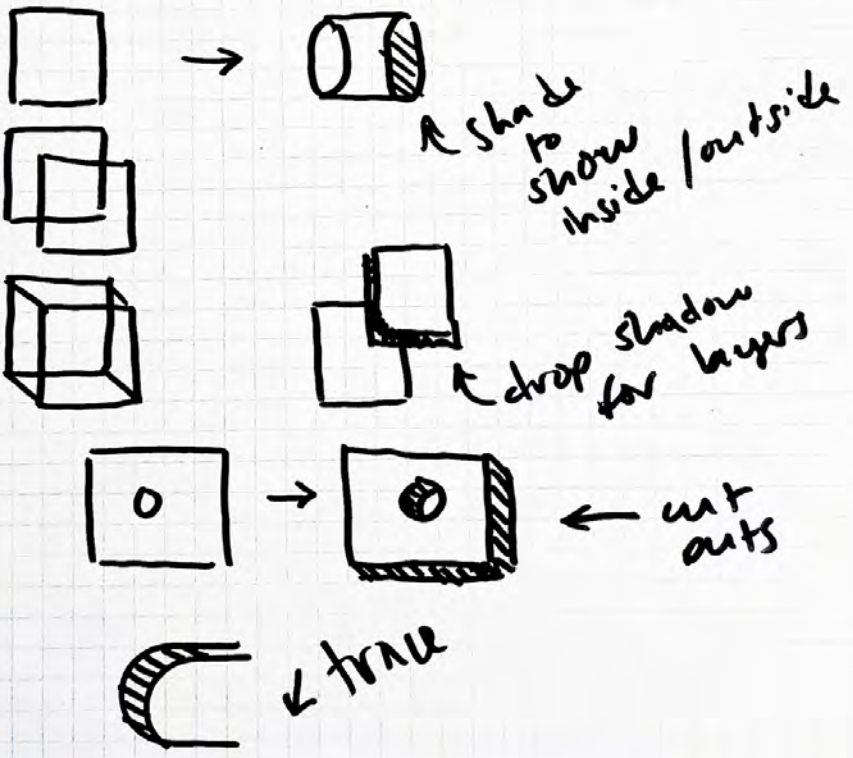
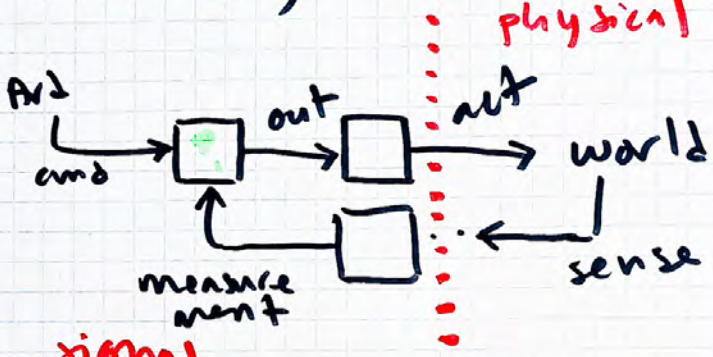
COGS 300 Control 01 Jan 27/26 ①

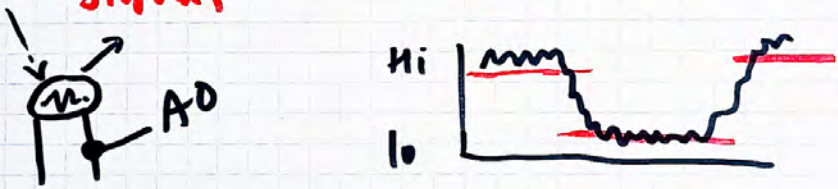
warm up: using compound shapes for depth



control

modulating action





1. Build the circuit
2. create conditions: dark vs. light
3. Take the average
4. Detect white vs. black on page

light vs. dark

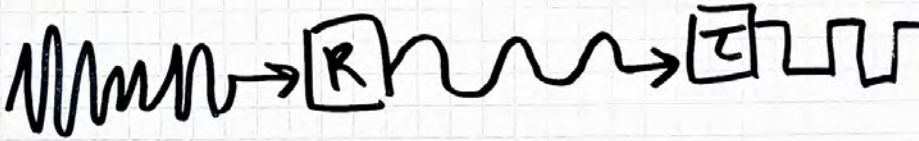
1. calibration
   - offline
   - online
2. Apply filters.


```
if(signal < τ) {
    output = 0;
} else {
    output = 1;
}
```

$$\frac{x_1 + x_2 + x_3 \cdots x_n}{n} = \text{average } (X)$$

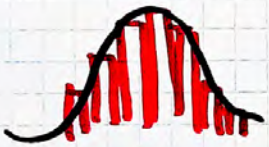
$$\frac{last + curr}{2}$$

running average



signal processing

$$\frac{last_1 + last_2 + last_3 + curr}{4}$$



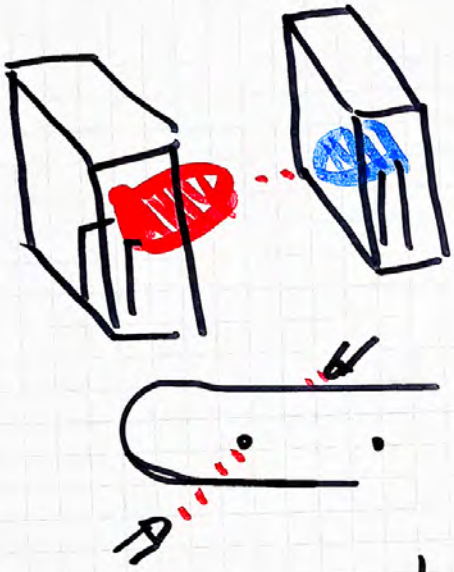
$$\frac{\sum_{i=n-1}^{i=0} last_i}{n}$$

longer history / bigger window / higher n

→ more smoothness

(5)

optical encoder



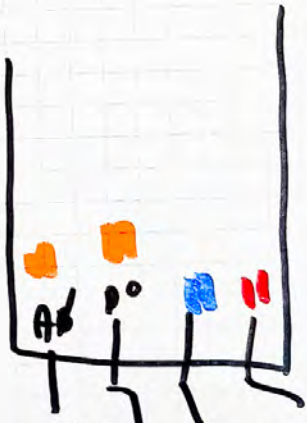
area

πr^2

$2\pi r / 24$

How many degrees is each hole?

$\frac{360^\circ}{10 \text{ holes}} = 36^\circ$



$360^\circ / 24 \text{ holes} = 15^\circ$

control 01

warm up: compound shapes + depth

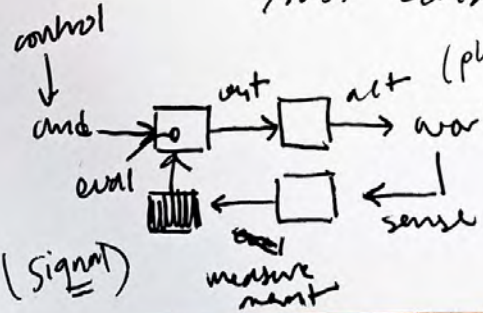
 draw a square

 draw another

 connect for depth.

same idea applies to compound shapes.

Last time: servo + your first control alg.



photocell as detector

* build circuit + processing sketch.

average in google sheets.

eg.

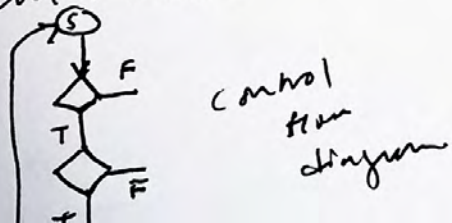
AVERAGE(A12 : A500)

↓

average photocell val under condition.

→ Test white vs. black.

→ make robust under conditions.



control flow diagram

white = 1002

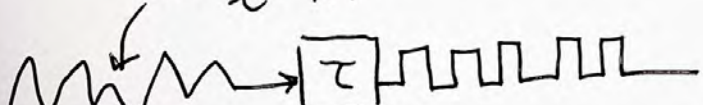
black = 203

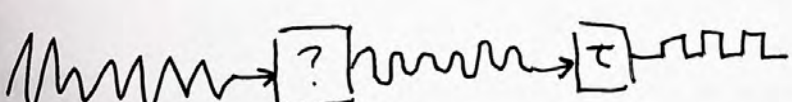
↑ min? max? avg?

Threshold filter : basic "detection"

```
if (val > t) {
    output = high; // 1
} else {
    output = lo; // ∅
}
```

level of t flips value.





chain filters.

☆ what is average?

$$\frac{x_1 + x_2 + x_3 \cdots x_n}{n} = \frac{\text{sum of vals}}{\text{\# of vals.}}$$

Running average

$$\frac{last + now}{2}$$

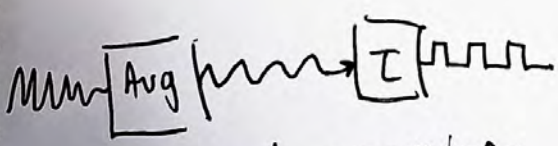
☆ bigger window?

$$\frac{last_1 + last_2 + now}{3}$$

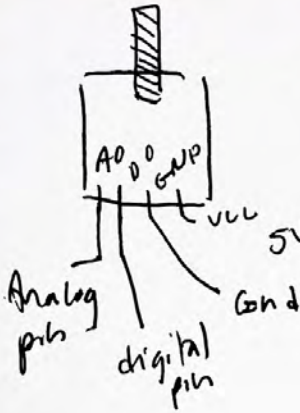
☆ Arbitrarily large?

$$\frac{\sum_{i=0}^{n-1} last_i}{n}$$ ← sum of array

longer history / bigger window
= more smooth
but ... slower response.



signal processing.



optical encoder

★ How many deg can it measure?

↙ resolution.

★ create a simulation of driving from white to white of popsicle sticks.

↳ measure distance from white to white.