Welcome everyone!

The last class was quite full, please don't leave any seats between students

(it will allow us all to have desks to write on)

thanks!

3:25-5:05

CS1800 (Discrete Structures)

Day 1

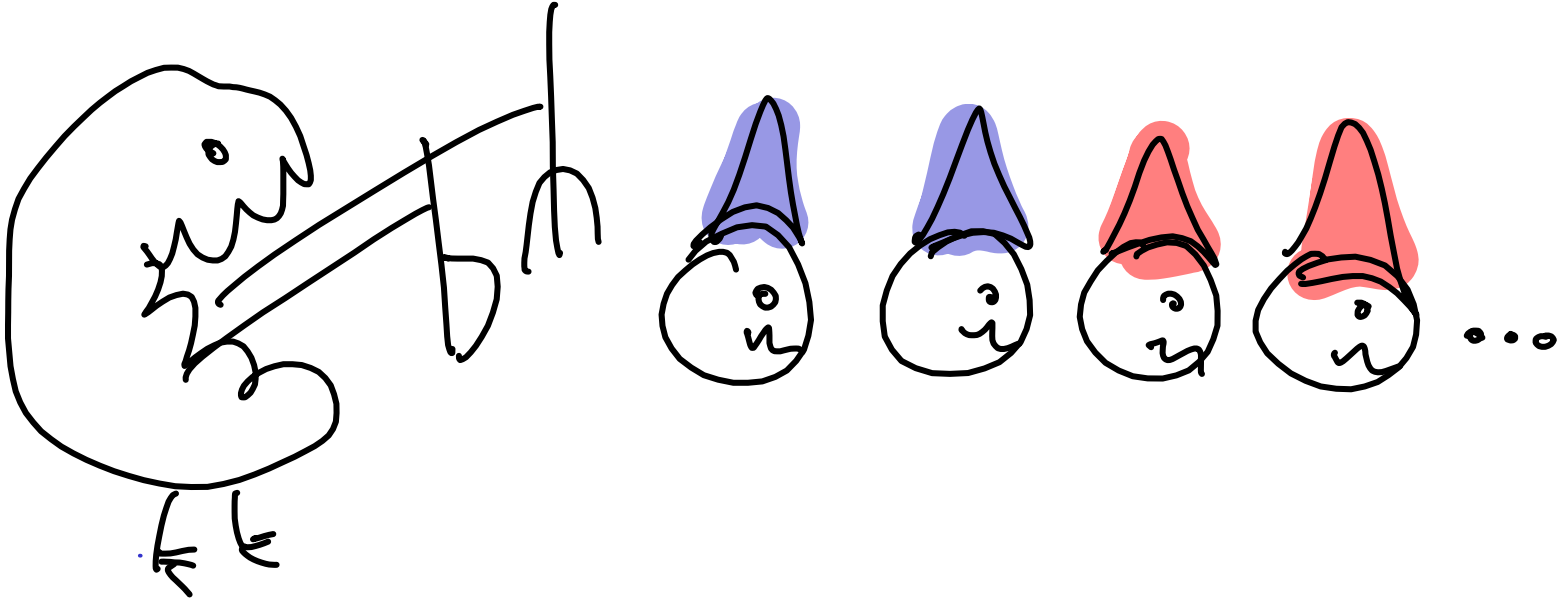
Welcome to CS1800 :)

Agenda:
- Make some friends
- What does it take to be effective at math?
- how to be successful in CS1800
- Admin stuff:
    - syllabus review
    - please use piazza!
- Numbers in different bases

Make some friends :)

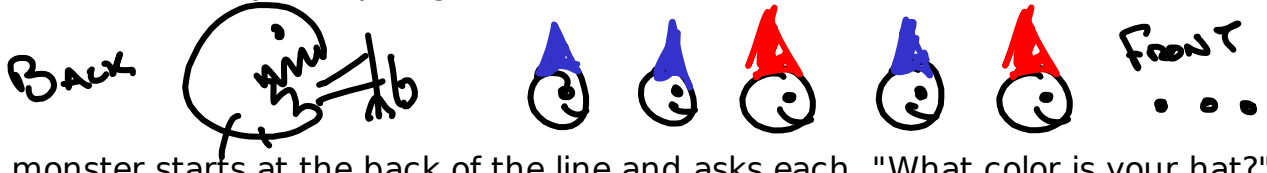
(I have some instructions)

My garden gnome friend is having a problem, can you help him out?



Garden Gnome Problem (please avoid working on this before day1, thank you!)

Given an arbitrary lineup of gnomes with red or blue hats:



A monster starts at the back of the line and asks each, "What color is your hat?":
correct response ----> gnome lives
incorrect response ----->gnome is eaten!

Where all the gnomes can:
- see all the gnomes in front of them
- hear the response (red / blue) and outcome (eaten / not eaten) of each response behind them

How can the gnomes use *only the responses to signal each other to maximize gnome survival?

Remember:

Be mindful of how you feel during this math problem please :)

In Class Activity 1 (no submissions for any in class activity)

Take 5 to 7 minutes and work on the gnome problem in a small group (no more than 5 please) of your new friends.

Be mindful of how you feel* during the course of the problem. I'll ask a few folks to share this (individually and collectively) just afterwards.

*yes I mean the touchy-feely stuff: e.g. confident, uncomfortable, embaressed, frustrated, excited, angry, fatigued, proud

How did we feel doing math?

Being an effective math student:

- Being confused is part of doing a math problem, you're welcome to be confused!

- Hard feelings (frustration, self-doubt, fatigue) will tax our motivation / sharpness:
    - work with a good friend (and be a good math friend)
        - be generous and patient helping each other
    - take care of your circumstances:
        - eat / sleep well
        - start work early to allow more time if needed

- Don't ignore hard thoughts (e.g. "that HW grade is much lower than I would've liked"), take productive steps for yourself (visit me in office hours!)

- Have fun! (really, no joke: math can be fun). Fun will sustain you while you're working

Succeeding in CS1800:

1. Attend all classes in person
2. Work hard and be super friendly / cooperative in recitation
3. Start your HW early
   (read it on the day assigned)
4. Make use of office hours
   (tip: further from due date its super quick to get an appointment)

If you're doing all of this and you'd still like more support, know that we'll be starting a small group TA-led weekly HW tutor session. (details to come)

<website / syllabus policy review & q/a>

(there's some fun math coming just after, I promise!)

no coincidence: "digits" are anatomical and numerical

ANATOMY

NUMBERS

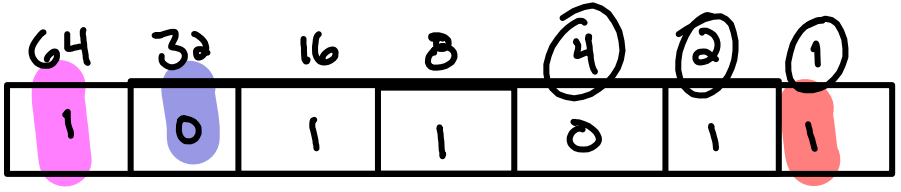
0, 1, 2, 3, ..., 9

ARE OUR 10 DIGITS

HOW DO FROGS (8 FINGERS) OR COMPUTERS (2 FINGERS) REPRESENT VALUES?

BASE 2 - BINARY: INTUITION

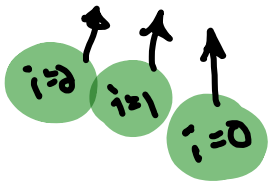
WHAT VALUE DOES $(1011011)_2$ REPRESENT?



$64 + 0 + 16 + 8 + 0 + 2 + 1$

BINARY SEEMS ODD,
WHERE DOES THAT REPRESENTATION
SYSTEM COME FROM?

BASE-10 (DECIMAL): REPRESENTING VALUES W/ 10 DIGITS



$$= 100 \cdot 1 + 10 \cdot 9 + 1 \cdot 2$$

$$= 10^2 \cdot 1 + 10^1 \cdot 9 + 10^0 \cdot 2$$

EACH PLACE VALUE REPRESENTS A VALUE OF 10^i

BASE-2 (BINARY): REPRESENTING VALUES W/ 2 DIGITS

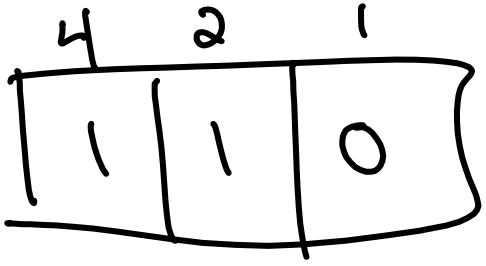
$$(110)_2 = 4 \cdot 1 + 2 \cdot 1 + 1 \cdot 0 = 6$$

$$= 2^2 \cdot 1 + 2^1 \cdot 1 + 2^0 \cdot 0$$

4 2 1

NOTICE:

- WE USE **PARENTHESES W/ SUBSCRIPT** TO INDICATE BINARY (ASSUME BASE-10 OTHERWISE)
- BINARY HAS ONLY 2 DIGITS: 0, 1



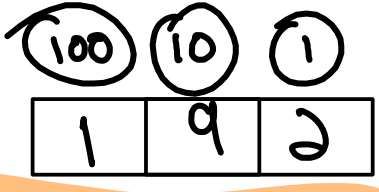
$4 + 2 + 0 = 6$

Decimal and Binary: Comparison

$(192)_{10}$

Decimal

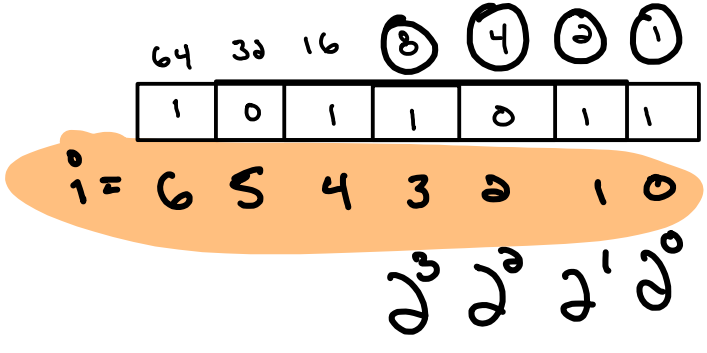
B = 10



$(1011011)_2$

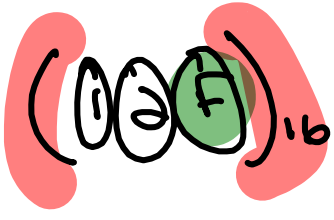
Binary

B = 2



→ The i-th place represents B^i

Base 16 (Hexadecimal) Representing values w/ 16 Digits



$$(12F)_{16} = 1 \cdot 16^2 + 2 \cdot 16^1 + 15 \cdot 16^0$$

Hex Has 16 Digits

0 1 2 3 4 5 6 7 8 9

10	11	12	13	14	15
A	B	C	D	E	F

$(BFF)_{16}$

$(01101)_2$

BIT = BINARY DIGIT

(EITHER 0 OR 1)

In Class Activity 2

- What is the smallest and largest value you can represent with 3 binary digits (bits)?

- What are all the values you can represent with 3 binary digits?

- If you wrote these all out in a big column, the smallest on top and largest on bottom, what patterns do you notice?

Stuck?

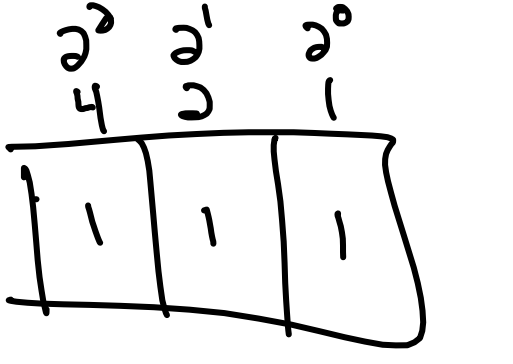
- Try solving a simpler problem by changing "binary" to "base-10" above.
- Ask for help (and check if your new friends need any), cooperation encouraged!

(++ if you still have time)

- What are all the values you can represent with N binary digits?
- What are all the values you can represent with N digits in base b?

$(000)_2$

$(111)_2$



$4+2+1=7$