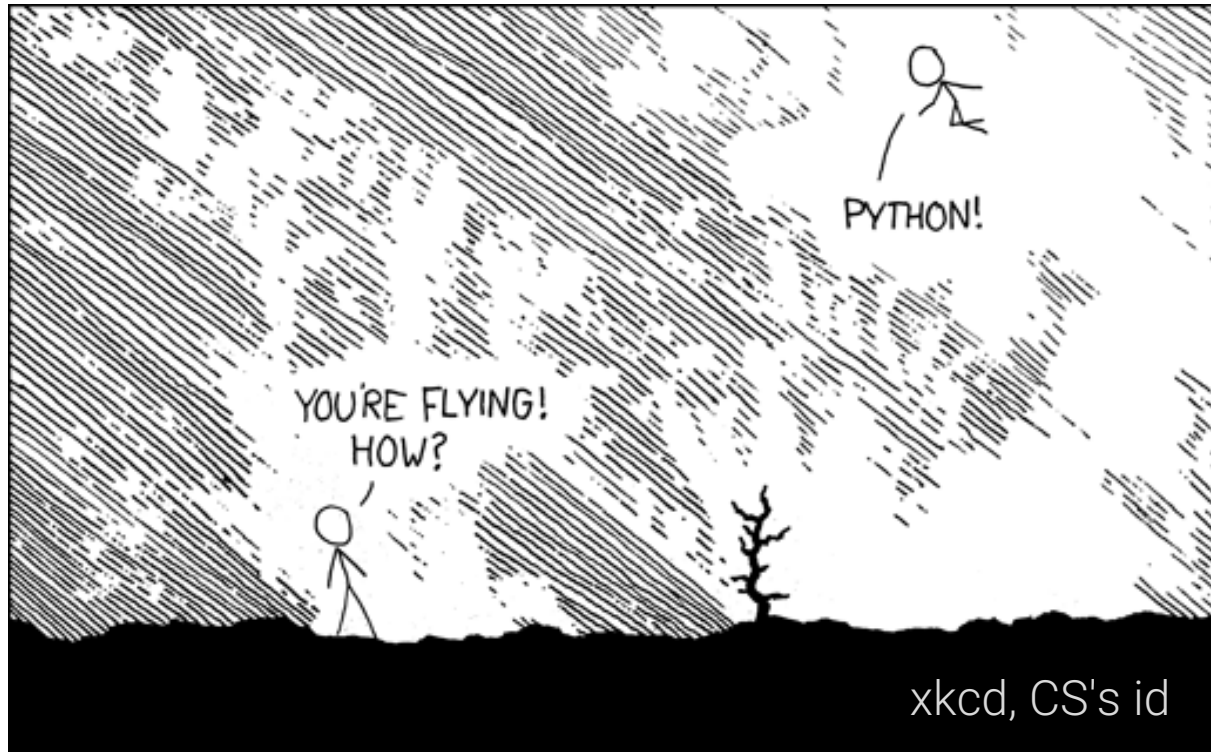
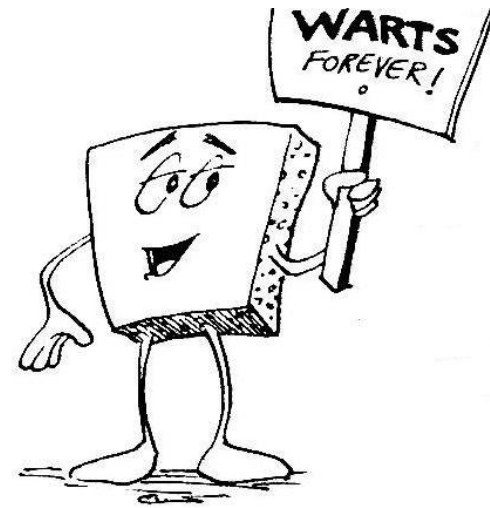


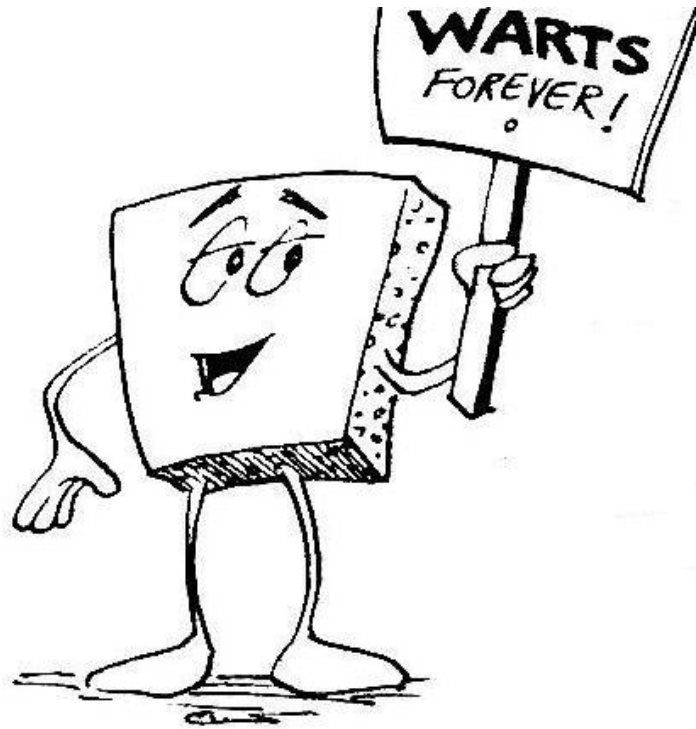
Welcome to CS 5 !



notes!

xkcd, CS's id

Welcome to CS 5 !



Wally Wart, a protrusive
advocate of **concrete**
computing

"Grab" these lecture notes...

Introduction to CS

We don't have words strong enough to describe this class.

- US News and Course Report

Everyone will get out of this course – a lot!

- NYTimes Review of Courses

We give this course two thumbs...

- Metametric

1 handout

slides & syllabus

handouts ~ class

laptops ~ lab

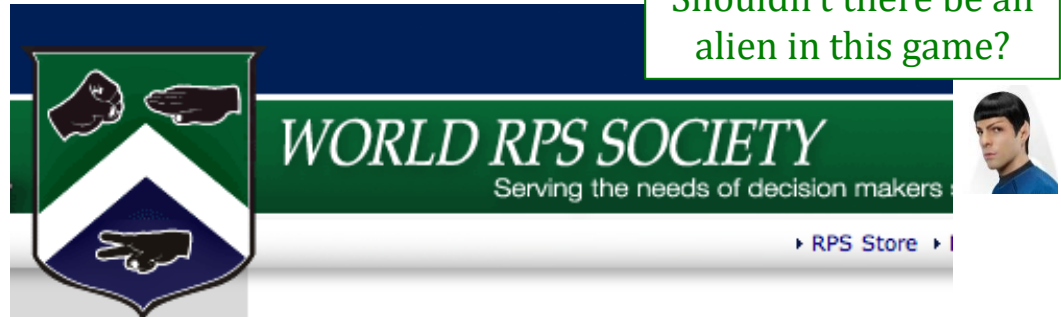
You're here! *Where next?*

0) Introductions!

1) How CS 5 *runs*...

2) Python?!

this Python hw is
choice:



3) What *is* CS?

Is CS programming?

Whatever CS is,
it's definitely *alien*...



Introductions...

Prof. Melissa
oneill+cs5@cs.hmc.edu



systems — “it ran my code.”
not into being photographed
retro-computing



randomness

Introductions...

Prof. George
gmontanez@g.hmc.edu



ML/AI — “it wrote my code?”
kinda into being photographed
retro-gaming



Speaking of
introductions



Introduction: *Home!*

I'm cornered!



CS5: Introduction to Computer Science at Harvey Mudd College
CS5 Web > WebHome
Submissions: CS submission site



CS 5: *Welcome!*

Administration

Using Python

Class Resources

Exams & Projects

Related Courses

Homework Assignments and Labs

Week 0

Lecture Slides

(Before class, the slides link will give a page not found error; shortly after class link the current slides will work.)

	Gold
Week 0	
1/16/24	Lecture 0: Introduction
1/18/24	Lecture 1: Pico-fun!

5-minute
Intro to CS5

text
syllabus
hwks
slides
guides
links
Piazza
GScope
e eggs

**Yay! in 2024:
... just Google for
hmc cs5**

What's in Lab this Friday.?

SW download, install, and dive in...

Help! I'm stuck in this webpage - with spam!



CS5: Introduction to Computer Science at Harvey Mudd College
CS5 Web > WebHome
Submissions: CS submission site

CS 5: *Welcome!*

Administration Using Python Class Resources Exams & Projects Related Courses

Homework Assignments and Labs

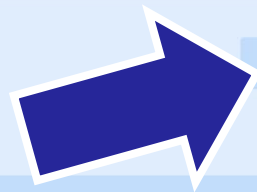
Lab **Gold HW**

Lecture Slides

(Before class, the slides link will give a page not found error; shortly after class link the current slides will work.)

	Gold
Week 0	
1/16/24	Lecture 0: Introduction
1/18/24	Lecture 1: Pico-fun!

text
syllabus
hwks
slides
guides
links
Piazza
GScope
e eggs



A minute of cs5 programming...

Python source code,
a plain-text file
(here, edited by the VS Code text editor)

Lab+hw

Edit

Run

lab and hw
instructions

shell or command-
line or terminal
(the execution environment)

Lab 0: getting everything running *on your own machine*

The image shows a composite of three windows. The top-left window is a web browser displaying a CS5 lab page with instructions and a task titled "Your task: four fours". The top-right window is a VS Code editor showing a Python file named "hw0pr1.py" with code for a "four fours" problem. The bottom window is a terminal window showing the execution of the Python script, with the output "Zero is 0".

Lab instructions from the browser:

- At the ipython prompt, type `run hw0pr1` (tab completion will work)
- This should run the file `hw0pr1.py`
- If all goes well, the program should run and you should see the output
- If not, please ask!
- Now, you can edit your file, save it, and hit *up-arrow* to re-run it. Awesome!

Your task: four fours

- The **four fours challenge!** Now, add several more lines similar to the one so that you compute **16 of the 21 values** from 0 through 20 using **exactly four fours**. You should use Python's arithmetic operations:
 - `+` addition
 - `-` subtraction or negation
 - `*` multiplication
 - `/` division
 - `()` parentheses for grouping
 - `**` power
- You may also use `44` or `4.4`, which count as two fours,
- or `.4`, which counts as one four.
- See below for two more allowable operations, `sqrt` and `factorial` both in the `math` library
- 21 is so that you can choose a few to skip!
- Here are the results, *but not the source code*, will look like. You need only 16 of the 21:

A minute of cs5 programming...

Python source code,
a plain-text file
(here, edited by the VS Code text editor)

The image shows a composite of three windows. On the left, a web browser displays a page with instructions for running a file and a task titled 'four fours'. In the center, a VS Code editor shows a Python file named 'hw0pr1.py' with comments and code. On the right, a terminal window shows the execution of the Python file, resulting in the output 'Zero is 0'. A large orange banner with the word 'Demo' is overlaid on the center.

```
# CS5 Gold/Black: Lab 0, Problem 1
# Filename: hw0pr1.py
# Name:
# Problem description: The four fours

from math import *

print("Zero is 0")
```

```
In [3]: pwd
Out[3]: '/Users/robotics/Desktop'

In [4]: run hw0pr1.py
Zero is 0

In [5]:
```

lab and hw instructions

shell or command-line or terminal
(the execution environment)

Lab 0: getting everything running *on your own machine*

A minute of cs5 programming...

Python source code,
a plain-text file
(here, edited by the VS Code text editor)

Lab+hw

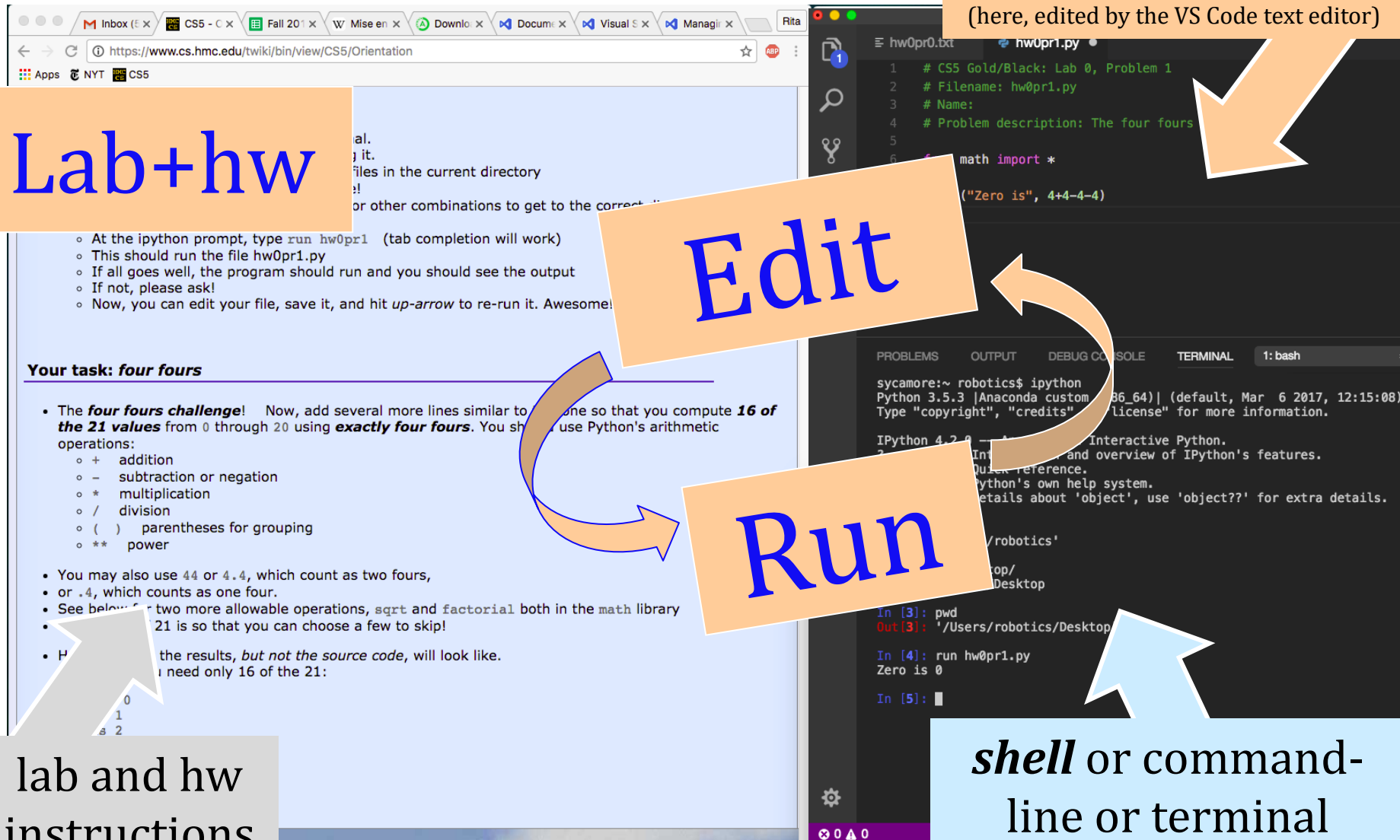
Edit

Run

lab and hw
instructions

shell or command-
line or terminal
(the execution environment)

Lab 0: getting everything running *on your own machine*



A minute of cs5 programming...

Python source code,
a plain-text file
(here, edited by the VS Code text editor)

The image shows a composite of three elements: a web browser window on the left displaying CS5 lab instructions, a VS Code editor in the center showing Python code for a problem, and a terminal window on the right showing the execution of the code. A large orange banner with the text "More, soon" is overlaid across the middle. Three arrows point from the text boxes to their respective elements: a grey arrow from the bottom-left box to the browser, an orange arrow from the top-right box to the VS Code editor, and a light blue arrow from the bottom-right box to the terminal window.

Running a file!

To run your file, go back over to the terminal.

- Type `ipython` if you're not yet running it.
- Type `ls` (windows or mac) to see the files in the current directory
- Make sure your `hw0pr1.py` file is there!
 - If not, use `cd ..` or `cd Desktop` or other combinations to get to the correct directory. Ask for help!
- At the `ipython` prompt, type `run hw0pr1` (tab completion will work)
- This should run the file `hw0pr1.py`
- If all goes well, the program should run and you should see the output
- If not, please ask!
- Now, you can edit your file, save it, and hit *up-arrow* to re-run it. Awesome!

Your task: four fours

- The *four fours* problem is to write a program that prints the number 0 using only the number 4 and the operators `+`, `-`, `*`, `/`, `()`, and `**`.
- You may also use the `math` library, but you must use `math.factorial` and `math.factorial` both in the `math` library.
- See below for a list of possible expressions and choose a few to skip!
- Print the results, *but not the source code*, will look like.
- You need only 16 of the 21:

```
0
1
2
```

```
# CS5 Gold/Black: Lab 0, Problem 1
# Filename: hw0pr1.py
# Name:
# Problem description: The four fours

from math import *

print("Zero is", 4+4-4-4)
```

```
1: bash
6 2017, 12:15:08)
ormation.
atures.
object', use 'object??' for extra details.
4: pwd
Out [1]: '/Users/robotics'

In [2]: cd Desktop/
/Users/robotics/Desktop

In [3]: pwd
Out [3]: '/Users/robotics/Desktop'

In [4]: run hw0pr1.py
Zero is 0

In [5]:
```

More, soon

lab and hw
instructions

shell or command-
line or terminal
(the execution environment)

Lab 0: getting everything running *on your own machine*

Lab Fri 2:45–4:45.?

Attend lab + submit by 5pm Thursday
~ *full credit for the lab*

Attend ~ *go to lab, sign in, check in, 2hr. (or finish)*

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. **Example:**

1 Draw the LCS matches for these two "species" strings:

'CHIMPANZEE'

'HUMAN'

4 matches shown

Try these 5

'ABOMASNOW'



'HUMAN'

2 There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

2 How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in total?

3 What if there were N+1 stars?



Is Nature "computing"?

Ice-breaking

5 Why... (ACC... no... first... the... DNA s...

Why might the software have made these "errors"?

Name: _____

+ other info if you'd like

Name: _____

Your favorite _____ is _____

Your least favorite _____

... break-out ...



Then, chat!

5+

What is something new you and your collegey you have in common?

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)


Keeps ordering, can skip letters. **Example:**



Try these 5

1 Draw the **LCS** matches for these two "species" strings:

'ABOMASNOW'



'HUMAN'

5 Which letter (**ACGT**) could **not** be the first match in these two DNA strings?

'CGCTGAGCTAGGCC...'

~3·10⁹ more

'ATCCTAGGTAAGT...'

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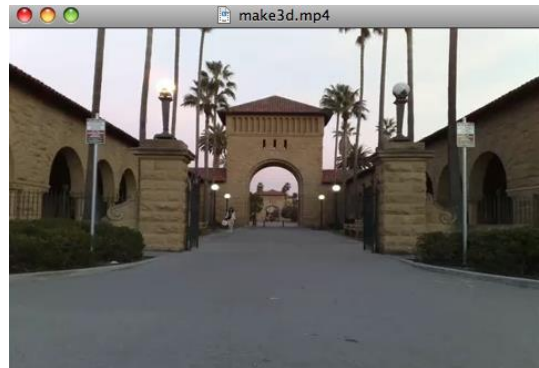
2 How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?

3 What if there were **N+1** stars?



Is Nature "computing"?

5 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.



What is something non-Claremont-collegey you have in common?

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

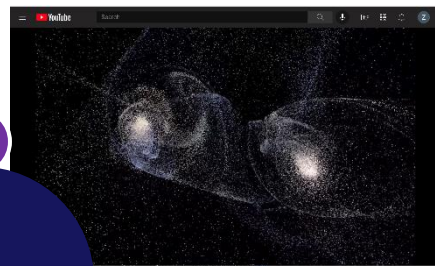
4 matches shown

Try these 5

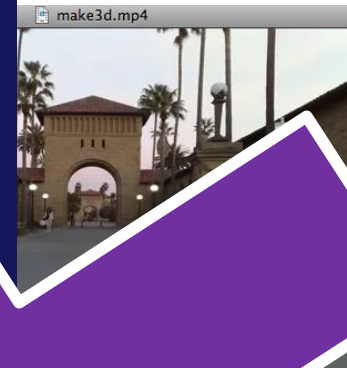
There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is

2



Is Nature "computing"?



Lower half ~ ice-breaking



Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

What is something non-C Claremont-colleggy you have in common?

Then, chat!

5+

Pair up with someone nearby – answer these questions together...

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'CHIMPANZEE'

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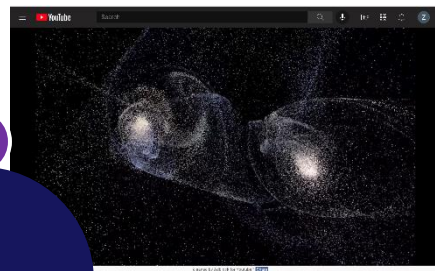
4 matches shown

Try these 5

There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is

2



Is Nature "computing"?

Lower half ~ ice-breaking



"errors"?

Name: George M, Ontario, CA

+ other info if you'd like

Your favorite composer is Vivaldi!

Your least favorite coffee is all coffee.

ice cream flavor show food sport team boba temperature ...

What is something non-Clairemont-collegey you have in common?

Name: Three-eyed Alien, "Space"

+ other info if you'd like

Your favorite poparts is S'mores!

Your least favorite coffee is spam.



Then, chat!

We both feel Lord of the Rings is nonfiction!

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

4 matches shown

Try these 5

'ABOMASNOW'



'HUMAN'

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CGCTGAGCTAGGCC...'

~3·10⁹ more

AGGTAAGTACTG...'

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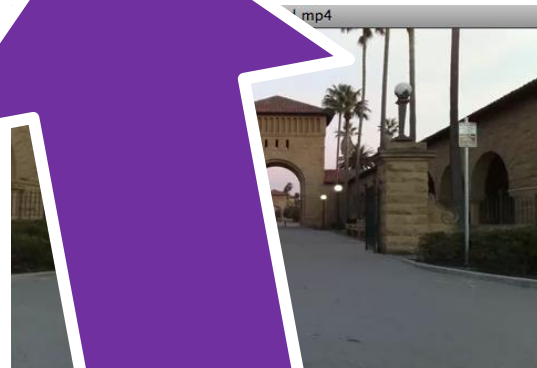
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3 What if there were N+1 stars?

Is Nature "computing"?

4 Circle the locations of at least two errors. If imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



2 "errors"?

Upper half ~ Q'ns

"thought experiments"

Then, chat!

5+

What is something non-Cl...

...in common?



You're here! *Where next?*

0) Introductions!

1) How CS 5 *runs*...

2) Python?!

this Python hw is
choice:



Is CS programming?

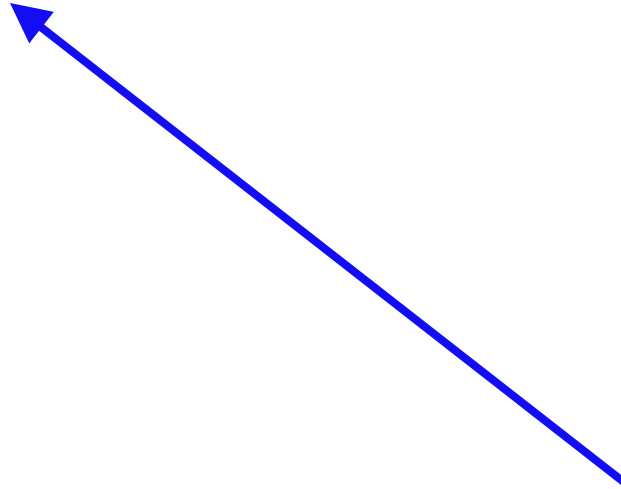
3) What *is* CS?

Whatever CS is,
it's definitely *alien*!



CS != programming

CS \neq programming



"not equal to"

CS != programming

So, what is CS?

Punctuation matters!
So what? *is* CS



What's CS a science of?

What's CS a science of?

physics

stars 'n' stuff

chemistry

water 'n' stuff

biology

cells, stuffed with water (the stuff is made by stars!)

cs

?

What's CS a science of?

the study of **composition**:

the study of **complexity**:

*How can **it** be done?*

*How well can **it** be done?*

*Can **it** be done at all?*

it ~ **information** 'n' stuff

or, more precisely, processes
transforming information
from one form to another

What's CS a science of?

the study of **composition**:

the study of **complexity**:

*How can **it** be done?*

*How well can **it** be done?*

*Can **it** be done at all?*

it ~ information 'n' stuff

or, more precisely, processes
transforming information
from one form to another

All CS in *five minutes!*

We'll look at 3 examples – each of
which you'll **construct** in CS 5
... at least to some extent!



3 examples?
That's **it** for me!

or... skip to slide 42!

What is CS?

'CHIMPANZEE'

*show
matches*

'HUMAN'

What is the **Longest Common Subsequence** between 2 strings?

same order, not necessarily neighboring

How can **it** be done?

How well can **it** be done?

Can **it** be done at all?

Can you solve the problem?

Can you create a *process* to solve such problems?

What is CS?

'CHIMPANZEE'



4

matches
shown

How can **it** be done?

How well can **it** be done?

Can **it** be done at all?

What is the **Longest Common Subsequence** between 2 strings?

same order, not necessarily neighboring

Can you solve the problem?

Can you create a *process* to solve such problems?

What is CS?

'HITMONCHAN'



*draw the
best
matches*

'HUMAN'

What is the **Longest Common Subsequence** between 2 strings?

same order, not necessarily neighboring

'CGCTGAGCTAGGCC...'

~3·10⁹ more

'ATCCTAGGTAAGT...'

only three letters from 'ACGT' could be the first match!

How can **it** be done?

How well can **it** be done?

Can **it** be done at all?

Can you solve the problem?

Can you create a *process* to solve such problems?

Eye oneder if this haz
othur applications?



What is CS?

'ABOMASNOW'



*draw the
best
matches*

1

'HUMAN'

What is the **Longest Common Subsequence** between 2 strings?

same order, not necessarily neighboring

How can **it** be done?

How well can **it** be done?

Can **it** be done at all?

'CGCTGAGCTAGGCC...'

~3·10⁹ more

'ATCCTAGGTAAGT...'

5 which letter (ACGT) could not be the first match?

Can you solve the problem?

Can you create a *process* to solve such problems?

Eye oneder if this haz
othur applications?





What is CS?

How can it be done?

*How well can **it** be done?* →

Can it be done at all?



How *quickly* can you find a solution?

Is your solution the "*best*" possible?

universe
SANDBOX
created by Dan Dixon

what is it? download buy forum contact
videos screenshots faq

Install Universe Sandbox
Requires Windows XP, Vista, or Windows 7

Interactive Space Simulator

Smash moons into planets, create new stars, and build new worlds from spinning discs of debris. Explore our solar system in 3D or destroy everything you've created with a super massive black hole.

You can simulate and interact with:

- ▶ Our solar system: the 8 planets, 160+ moons, and hundreds of asteroids
- ▶ Nearest 1000 stars to our Sun
- ▶ Our local group of galaxies
- ▶ An unlimited number of fictional scenarios

Tinker with your creation or sit back and watch the effects of gravity unfold. It's fun, accessible, and easy to use.

[Learn more...](#)

"Bringing new meaning to the term 'god game'."
bluesnews.com

"Simply amazing..."
Matt A.

Watch the Video

YouTube

0:38 / 1:15

View the YouTube page Watch in Larger Window

How much work is needed to simulate N stars?

chemistry's + physics's "N-body" problem

*What if N is 101?
or a million-and-one ...?*

What is CS?

*How can **it** be done?*

*How well can **it** be done?*

*Can **it** be done at all?* →

Is your problem *solvable*?

How can you tell !?

many problems are *unsolvable*...
... and you'll *prove* this!



*Can we build a 3d model
from one 2d image?*

Andrew Ng's "Make3d"

All three eyes tell me that Make3d
has just failed ~ epically!



Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

4 matches shown

Try these 5

'ABOMASNOW'



'HUMAN'

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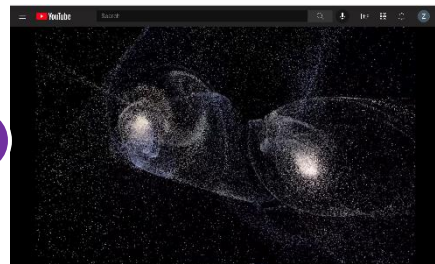
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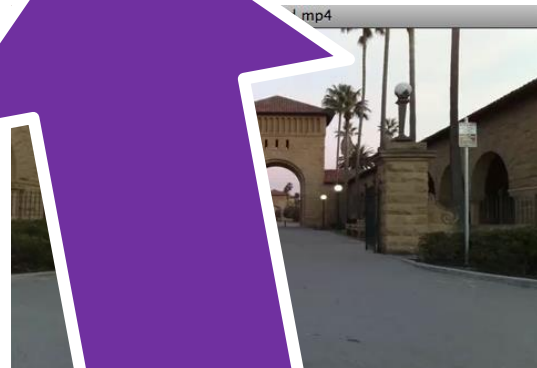
2 How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in total?



3 What if there were N+1 stars?

Is Nature "computing"?

4 Circle the locations of at least two errors. If imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



2 "errors"?

Upper half ~ Q'sns

"thought experiments"

Then, chat!

5+

What is something non-Cl...

...in common?



Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

4

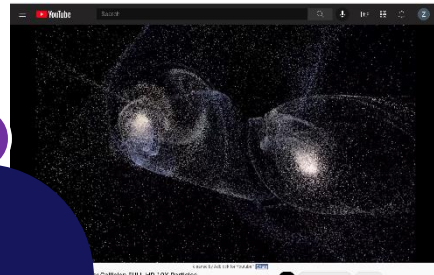
matches shown

Try these 5

There are **101** stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is

2



Is Nature "computing"?

Lower half ~ ice-breaking



...e "errors"?

Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.



Then, chat!

5+

What is something non-C Claremont-collegey you have in common?

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

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'CHIMPANZEE'

'HUMAN'

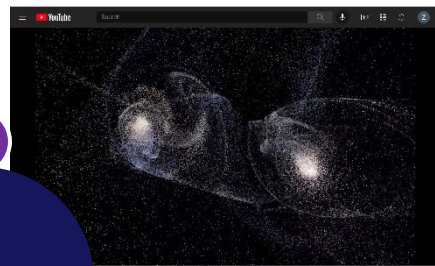
4 matches shown

Try these 5

There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is

2



Is Nature "computing"?

Lower half ~ ice-breaking



...e "errors"?

Name: **Zach Dodds, Pittsburgh, PA**

+ other info if you'd like

Your favorite **poptarts** is **strawberry!**

Your least favorite **coffee** is **decaf**

Name: **Three-eyed Alien, "Space"**

+ other info if you'd like

Your favorite **poptarts** is **S'mores!**

Your least favorite **coffee** is **spam**



Then, chat!

What is something non-Claremont-collegey you have in common?

We both feel Stranger Things is nonfiction!

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

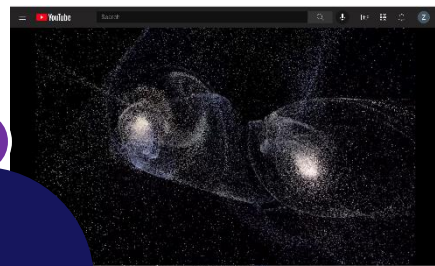
4 matches shown

Try these 5

There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is

2



Is Nature "computing"?

Lower half ~ ice-breaking



Why might the organisms have "errors"?

Name: **Zach Dodds, Pittsburgh, PA**

+ other info if you'd like

Your favorite **poptarts** is **strawberry!**

Your least favorite **coffee** is **decaf**.

ice cream flavor **show** **food** **sport** **team** **boba** **temperature** **...**

What is something non-Clairemont-collegey you have in common?

We both feel Stranger Things is nonfiction!

Name: **Three-eyed Alien, "Space"**

+ other info if you'd like

Your favorite **poptarts** is **S'mores!**

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Then, chat!

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. **Example:**



Try these 5

1 Draw the **LCS** matches for these two "species" strings:

'ABOMASNOW'

'HUMAN'

5 Which letter (**ACGT**) could **not** be the first match in these two DNA strings?

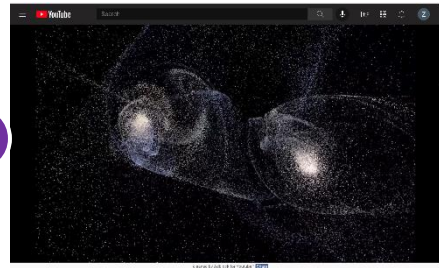
'CGCTGAGCTAGGCC...'

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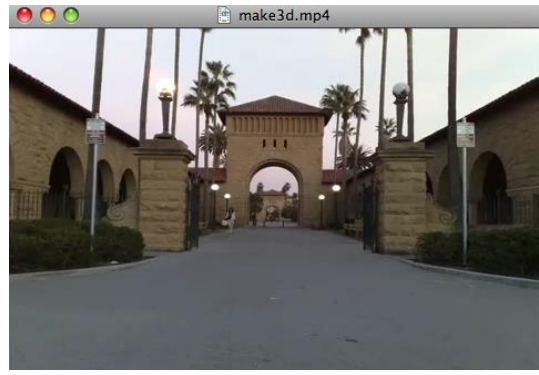
How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?



3 What if there were **N+1** stars?

Is Nature "computing"?

4 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.



Then, chat!

5+

What is something non-C Claremont-collegey you have in common?

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. **Example:**

'CHIMPANZEE'

'HUMAN'

4 matches shown

Try these 5

'ABOMASNOW'



'HUMAN'

1 Draw the LCS matches for these two "species" strings:

'CGCTGAGCTAGGCC...'

~3·10⁹ more

'ATCCTAGGTAAGT...'

5 Which letter (ACGT) could **not** be the first match in these two DNA strings?

2 There are **101** stars in a galaxy far, far away. Each exerts a force on each other.

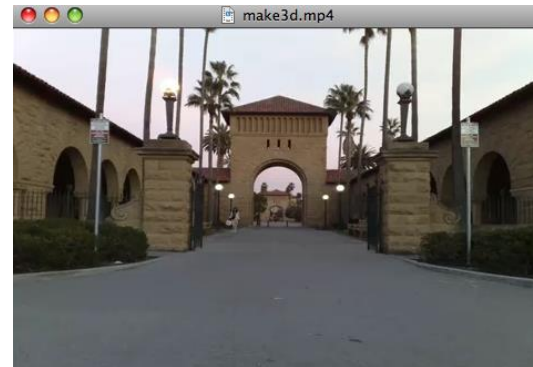
2 How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?



3 What if there were **N+1** stars?

Is Nature "computing"?

4 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____
+ other info if you'd like



Upper half ~ Q'sns

"thought experiments"

chat!

5+

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

'CHIMPANZEE'

'HUMAN'

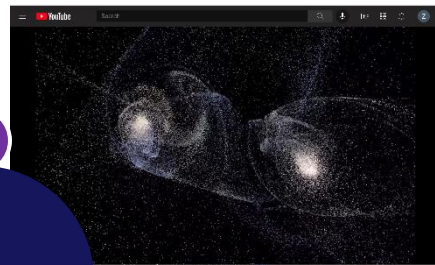
4 matches shown

Try these 5

There are 101 stars in a galaxy far, far away. Each exerts a force on each other.

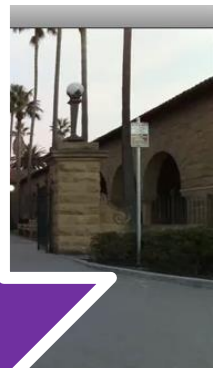
How many interstellar forces is

2



Is Nature "computing"?

Lower half ~ ice-breaking



"errors"?

Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____

+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.



Then, chat!

5+

What is something non-Claremont-collegey you have in common?

Pair up with someone nearby – answer these questions together...


Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. **Example:**



Try these 5

1 Draw the **LCS** matches for these two "species" strings:

'ABOMASNOW' 

'HUMAN'

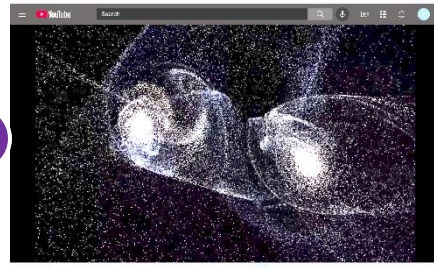
5 Which letter (**ACGT**) could **not** be the first match in these two DNA strings?

'CGCTGAGCTAGGCC...!' ~3·10⁹ more

'ATCCTAGGTAAGT...'

2 There are **101** stars in a galaxy far, far away. Each exerts a force on each other.

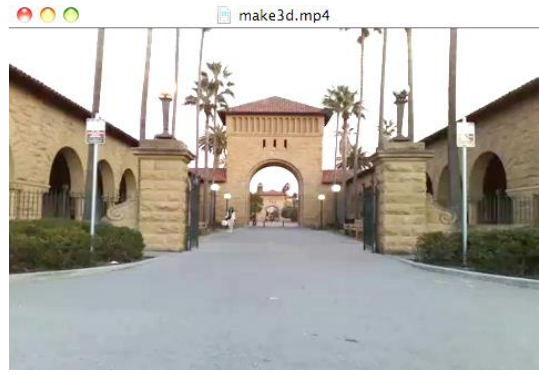
How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?



3 What if there were **N+1** stars?

Is Nature "computing"?

4 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.

Name: _____
+ other info if you'd like

Your favorite _____ is _____.

Your least favorite _____ is _____.



Then, chat!

5+

What is something non-Clairemont-collegey you have in common?

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. **Example:**



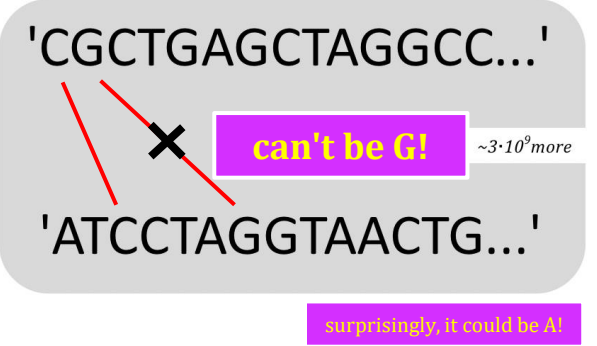
Answers

1 Draw the **LCS** matches for these two "species" strings:



1

5 Which letter (**ACGT**) could **not** be the first match in these two DNA strings?



5

2 There are **101** stars in a galaxy far, far away. Each exerts a force on each other.

2 How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?



3 What if there were **N+1** stars?

3 Is Nature "computing"?

4 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____

+ other info if you'd like

Your favorite **poptarts** is **strawberry!**

Your least favorite _____

Name: _____

+ other info if you'd like

Your favorite **poptarts** is **S'mores!**

Your least favorite _____ is _____



I hope there were some shared favorites found!

Then, chat!

What is something non-_____ you have in common?

5+

Pair up with someone nearby – answer these questions together..

Longest Common Subsequence (LCS)

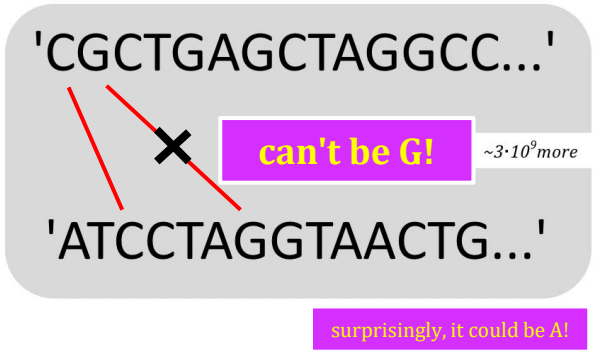
Keeps ordering, can skip letters. **Example:**

1 Draw the **LCS** matches for these two "species" strings:

5 Which letter (**ACGT**) could **not** be the first match in these two DNA strings?



Answers



surprisingly, it could be A!

2 There are **101** stars in a galaxy far, far away. Each exerts a force on each other.

How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in **total**?



3 What if there were **N+1** stars?

Is Nature "computing"?
 $(N+1) * N / 2$

4 Circle the locations of at least two errors, or imperfections, you noticed in the 3d model (fly-through) created from this 2d image?



Why might the software have made these "errors"?

Name: _____

+ other info if you'd like

Your favorite **poptarts** is **strawberry!**

Your least favorite _____

Name: _____

+ other info if you'd like

Your favorite **poptarts** is **S'mores!**

_____ is _____



I hope there were some shared favorites found!

Then, chat!

What is something non-_____ you have in common?

5+

Pair up with someone nearby – answer these questions together...

Longest Common Subsequence (LCS)

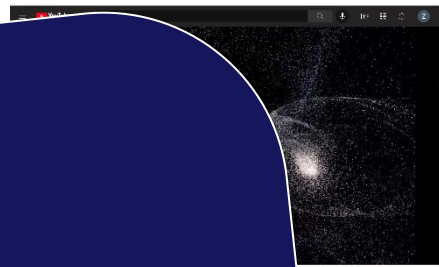
Keeps ordering, can skip letters. **Example:**

'CHIMPANZEE'



4 matches shown

There are **101** stars in a galaxy far far away. For 1



computing"?

Draw the matches between the two strings.

Tear off, and pass up to the front

(take a photo, if you'd like!)

Which DNA sequence (ACGT) is not a first match? These DNA strings

Name: _____
+ other info if you want

Your favorite

Your least favorite

Let's get a nice stack: Thank you!!!

IS _____.

Then, chat!

What is something non-C Claremont-collegey you have in common?

5+

What is CS?

CS is the study of *complexity*

How can *it* be done?

How well can *it* be done?

Can *it* be done at all?

CS's 6 big questions

Only one is programming. Which one?

Can you solve this problem?

Can you create a process to solve such problems?

How quickly can you find solutions?

Do you have the "best" solution?

Is every problem solvable?

Is there a way to tell?

There isn't always!

What is CS?

CS is the study of *complexity*

How can *it* be done?

How well can *it* be done?

Can *it* be done at all?

CS's 6 big questions

Only one is programming. Which one?

Can you solve this problem? CS

Can you create a process to solve such problems? programming + CS

How quickly can you find solutions? CS

Do you have the "best" solution? CS

Is every problem solvable? CS

Is there a way to tell? CS
There isn't always!

CS's – and CS5's –
philosophy:

*Whatever you are,
be a good one.*

- Abraham Lincoln

*More and more,
CS amplifies just this...*

You're here! *Where next?*

0) Introductions!

1) How CS 5 *runs...*

2) Python?!

this Python hw is
choice:



WORLD RPS SOCIETY
Serving the needs of decision makers



Shouldn't there be an
alien in this game?

▶ RPS Store ▶

Is CS programming?

3) What *is* CS?

Whatever CS is,
it's definitely *alien!*



Syllabus, briefly

Lectures

TTh: 1:15–2:30 or 2:45–4:00

Key skills, topics, and their motivation

Ins (y, how)

We'd like to see you! Let us know if you're out...

Come to Lectures!

"Lab"

labs are recommended
by 5 out of 5 CS5 alums!



F: 2:45–4:45pm

Guided progress on the week's first hw problem

Inc g by Fri @ 5.

Come to Labs!

Office and grutoring hrs

Lots!

hwk or

Lots of help is available!

HW

Tuesdays

hw due Tuesdays...

Syllabus, briefly

Lectures

TTh: 1:15–2:30 or 2:45–4:00

Key skills, topics, and their motivation

Insight into the HW problems (what, **why**, how)

We'd like to see you! Let us know if you're out...

"Lab"

labs are recommended
by 5 out of 5 CS5 alums!



F: 2:45–4:45pm

Guided progress on the week's first hw problem

Incentivized: full credit for lab-effort + submitting by Fri @ 5.

Office and grutoring hrs

Lots!

See our "grutoring" page ...

} hwk or
other q'ns

HW

Tuesdays due by 22:22:22 pm

Syllabus, briefly

Lectures

TTh: 1:15–2:30 or 2:45–4:00

Key skills, topics, and their motivation

Insight into the HW problems (what, **why**, how)

We'd like to see you! Let us know if you're out...

"Lab"

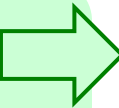
labs are recommended
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Office and grutoring hrs

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See our "grutoring" page ...

} hwk or
other q'ns

HW

Tuesdays due by 22:22:22 pm



CS5 Lab

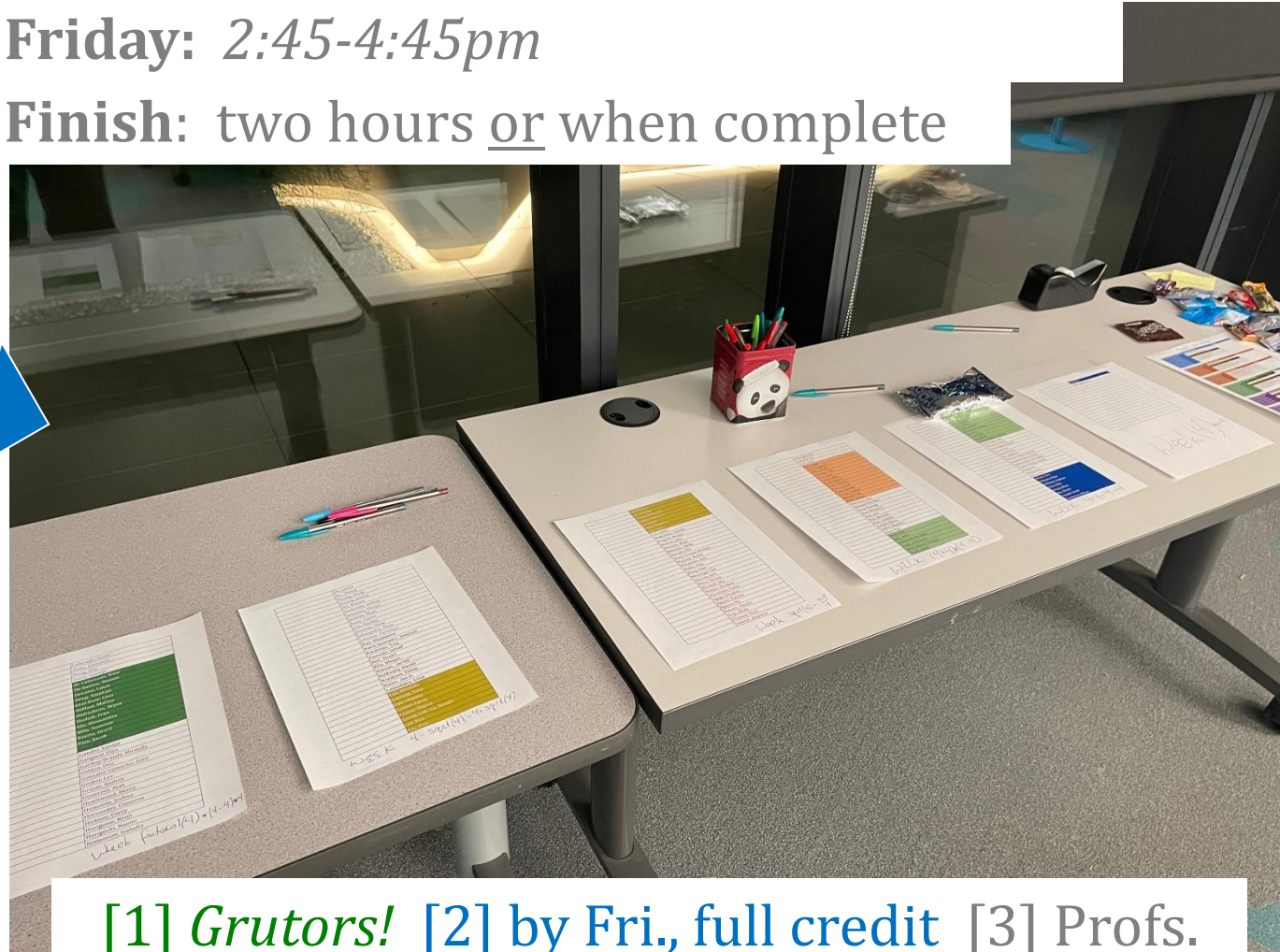
McGregor
203, 204,

Join in

Friday: 2:45-4:45pm

Finish: two hours or when complete

Sign in



Check in!

chat with one of the profs
about one of the lab parts

Why?!

[1] *Grutors!* [2] by Fri., full credit [3] Profs.

Grutors!



McGregor!



McGregor

Sign in lists...





NOT LABELED FOR INDIVIDUAL SALE
K 120179 (03LJ)

Smith, Henry R.
Smith, Ian
Smith, Natalie
Spoor, Slader
Stralka, Emmett
Subramanian, Shreya
Tan, Alvin
Tang, Adam
Tang, Irene
Teekamongkol, Supakrai
Thien-Ngern, Ben
Thiessen, Audrey
Torres Aguilar, Daniel
Tran, Steven
Traub, Monika
Tsai, Angelina
Tzunun Palomo, Cristina
Venkatachalam, Ananya
Vithiananthan, Niranthari
Wambo Wendja, Wendy
Wang, Erin
Wang, Kevin
Wang, Rita
Wexler, Sara
Wibawa, C
Willia

Homework

Assignments

~ 5 problems/week

Due Tuesday evenings by 22:22:22 (10:22 pm.)

Extra credit is available (fun!)

You have 3 **CS 5 Euros** to use...
"Late Days"

Eur-allowed to use
Euros for any
homework problems
in the course.

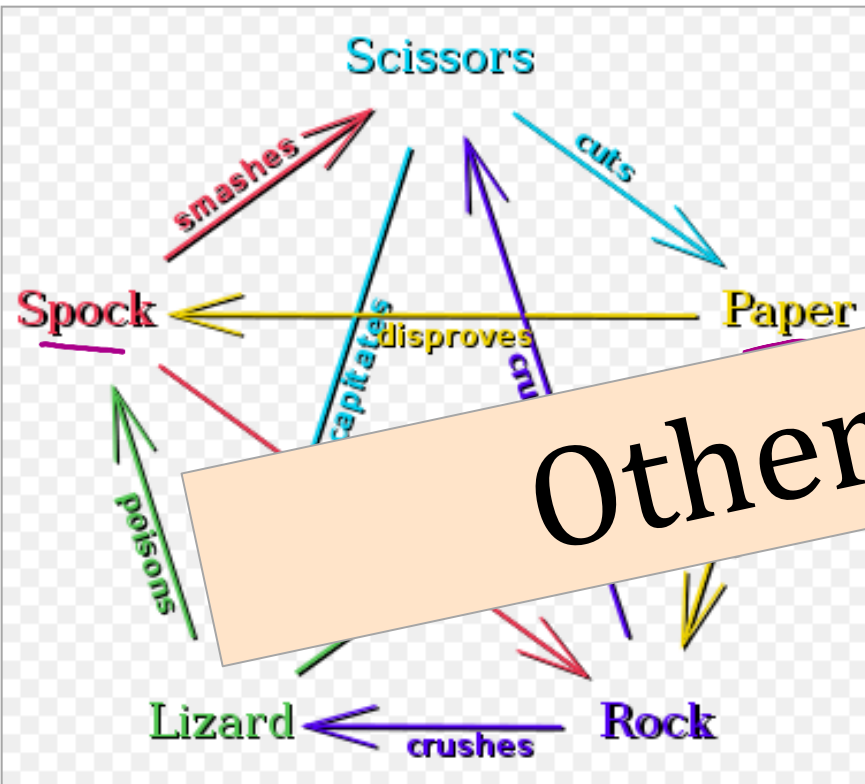
No need to let us know, even.



Collaborate!

Some problems are specified “individual-only.”
Others offer the option of working as pairs/partners:

- You don't have to work in pairs/partners (that said, it's fun!)
- If you do, you must share the work equally
- Be sure to indicate who your partner was at the submission site!



Other hw?

rock – paper – scissors – lizard – Spock!

hw0pr2rps ~ rock-paper-scissors

Let's play! Maybe two out of three?



Logically, I've got game!

Pairs



one computer

tradeoff typing/debugging ~
about every 20 minutes

Partners



two computers

both partners type/debug ~
provide help as needed

Standard is the same either way:

After finishing the hw, (a) *each person has contributed equally* and (b) *both could complete the problems on their own*

Submit with a partner as ***full co-owners*** of the work.

Honor Code

- You're *encouraged* to **discuss** problems with other students – or tutors - or any instructors.
- You may **not** share written, electronic or verbal solutions with other students, present or past:

Please **do** use the internet for Python language references.

Pleas **do** use other's eyes for finding syntax errors.

Do **not** use the internet to find solutions (or try to)

If you work as a pair/partners, this applies for the duo.

Sign & submit CS's honesty policy, part of this week's lab.

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ChatGPT is useful! Cite w/"" (triple quotes) *Build from there*


ChatGPT?



ChatGPT



Z how do I express 42 as an arithmetic combination of four 4's?

 You can express the number 42 using four 4's through various arithmetic operations. Here's one way to do it:



$$(4! + 4) - (4/4) = 42$$

Explanation:

- $4!$ is the factorial of 4, which is $4 \times 3 \times 2 \times 1 = 24$.
- Adding another 4 to it gives 28.
- Dividing 4 by 4 results in 1.
- Subtracting 1 from 28 gives you 27.
- Adding 15 (which is 4×4) to 27 gives you the final result of 42.

So, $(4! + 4) - (4/4) = 42$ using four 4's in an arithmetic combination.

SaaS

GaaS

ChatGPT

- You're *encouraged* to **discuss** problems with other students – **or ChatGPT** - or any instructors.
- ChatGPT – and its siblings – can be great for bridging your thinking and Python's "thinking"

1. **Cite ChatGPT's help.**

Don't understand ChatGPT's help? *Constrain it! Ask it to explain!*

```
# ChatGPT: """(4!+4)-(4/4) = 42"""  
# I started with this, removed the unhelpful stuff, and built a  
# solution that's correct, understood, and shown here:
```

2. **Understand, cut, add, and edit any "help."**

It's not always helpful...

3. **Your submission is yours.**

This is always the case...

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Please **do** use the internet for Python language references.

Please **do** use other's eyes for finding syntax errors.

Do **not** use the internet to find solutions (or try to)

If you work as a pair/partners, this applies for the duo.

ChatGPT is useful! Cite w/"" (triple quotes) *Build from there*

Even with three eyes, I need to borrow others to find the syntax errors here!



Sign & submit CS's honesty policy, part of this week's lab.

Grading

~ 60% Assignments

~ 30% Exams

~ 10% Participation/“quizzes”

```
if perc > .95:  
    print('A')  
elif perc > .90:  
    print('A-')  
elif perc > .70:  
    print('Pass')
```

some take
cs5 P/NC

see online syllabus for the full grade list..

Exams

Midterm
Final

Thursday, March 7 , in-class
Monday, May 6, 2–5 PM

Midterm? This feels
more like a 2/3-term!



using a page of notes is OK on exams

exams are *written*, not typed (???)


Choices, choices!

Let's set the value of `perc` to 0.91...

↓
`perc = 0.91`

```
if perc > 0.95:  
    print 'A'  
elif perc > 0.90:  
    print 'A-'  
elif perc > 0.70:  
    print 'Pass'  
else:  
    print 'Aargh!'
```

First - there
are several
syntax
"errors"
here!



Choices, choices!

Let's set the value of `perc` to 0.91...

↓
`perc = 0.91`

```
if perc > 0.95:  
    print('A')  
elif perc > 0.90:  
    print('A-')  
elif perc > 0.70:  
    print('Pass')  
else:  
    print('Aargh!')
```

('Aargh ; - ')

English's syntax struggles:
"Parens" vs "Parenthesises"



Seeing syntax...

Let's set the value of `perc` to 0.91...

↓
`perc = 0.91`

```
if perc > 0.95:  
    print('A')  
elif perc > 0.90:  
    print('A-')  
elif perc > 0.70:  
    print('Pass')  
else:  
    print('Aargh!')
```

What will this program print,
if `perc` is 0.91?

What's here?

of LINES here:



of BLOCKS here:



of TESTS here:



of CONTROL STRUCTURES here:



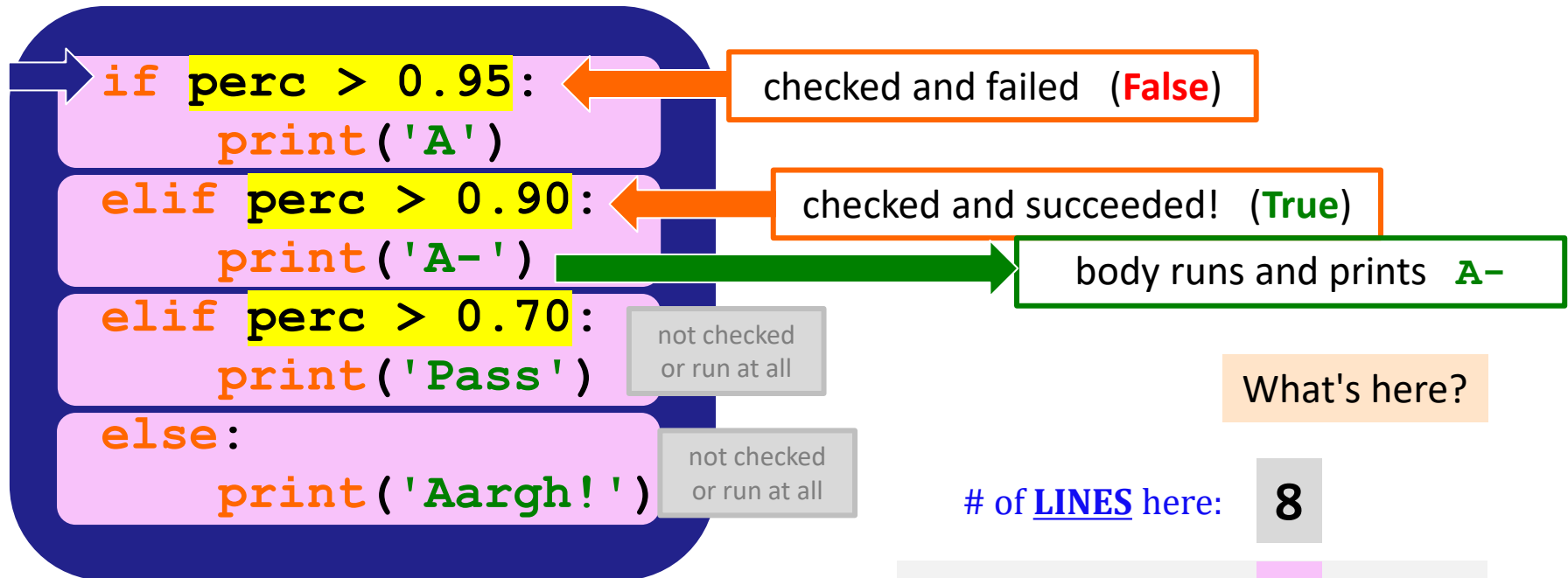
how many tests
are *tested*?



Seeing syntax...

Let's set the value of `perc` to 0.91...

↓
`perc = 0.91`



What will this program print, if `perc` is 0.91?

A-

What's here?

# of <u>LINES</u> here:	8	
# of <u>BLOCKS</u> here:	4	
# of <u>TESTS</u> here:	3	how many tests are <i>tested</i> ?
# of <u>CONTROL STRUCTURES</u> here:	1	2

Left



Choices, choices!

Right



```
perc = 0.80
```

```
if perc > 0.95:
    print('A')
elif perc > 0.90:
    print('A-')
elif perc > 0.70:
    print('Pass')
else:
    print('Aargh!')
```

```
perc = 0.80
```

```
if perc > 0.00:
    print('Aargh!')
elif perc > 0.70:
    print('Pass')
elif perc > 0.90:
    print('A-')
else:
    print('A')
```

What does each of these programs print out, if `perc` is 0.8?

What value of `perc` gives an 'A-' on the right?

How can you get a *better* grade on the right than the left?

Exclusive Choices

if ... elif ... else

```
if perc > 0.95:  
    print('A')  
  
elif perc > 0.90:  
    print('A-')  
  
elif perc > 0.70:  
    print('Pass')  
  
else:  
    print('Aargh!')
```

`elif` and `else` are optional

When using
`if . elif else`
at most one block will run:
the first whose test is **True**.
If all fail, the `else` will run

4 mutually exclusive blocks
in a single control structure

Exclusive Choices

Every **if** starts a new control structure.

at most one block will run:
the first whose test is **True**.
If all fail, the **else** will run

4 mutually exclusive blocks

Every **elif** and **else** continues an existing control structure.

elif and **else** are both optional

```
if per > 0.90:  
    print('A')
```

```
elif per > 0.90:  
    print('B')
```

```
elif per > 0.90:  
    print('C')
```

```
else:  
    print('D')
```

elif and **else** are optional

What's the difference?

mutually exclusive blocks

nonexclusive blocks

What if `perc == .99` ? (How would we set it?)

How many separate *control structures* does each side have?

`perc = .99`

```
if perc > .95:  
    print('A')  
  
elif perc > .90:  
    print('A-')  
  
elif perc > .70:  
    print('Pass')
```

`perc = .99`

```
if perc > .95:  
    print('A')  
  
if perc > .90:  
    print('A-')  
  
if perc > .70:  
    print('Pass')
```


What's the difference?

mutually exclusive blocks

nonexclusive blocks

What if `perc == .99` ? (How would we set it?)

How many separate *control structures* does each side have?

`perc = .99`

```
if perc > .95:  
    print('A')  
  
elif perc > .90:  
    print('A-')  
  
elif perc > .70:  
    print('Pass')
```

1

thing

`perc = .99`

```
if perc > .95:  
    print('A')  
  
if perc > .90:  
    print('A-')  
  
if perc > .70:  
    print('Pass')
```

3

things

for *decision-making*, we now have it ***all***...

for *decision-making*, we now have it *all*...

Next ~ *Nest!*

CS ~ the study of *composition*

Nesting

for *decision-making*, we now have it ***all...***



Nesting

Blocks ?



Tests ?



C. Structures ?



```
comp = 'rock'  
user = 'paper'
```

```
if comp == 'paper' and user == 'paper':  
    print('We tie. Try again?')
```

```
elif comp == 'rock':  
    if user == 'scissors':  
        print('I win! *_*')  
    else:  
        print('You win. Aargh!')
```

Does this program print the correct RPS result *this time*?

Does it *always*?

(0) Find the 3 tests and 4 blocks here.

(1) What does this code print?

```
comp = 'rock'
user = 'rock'

if comp == 'rock':
    if user == 'paper':
        print('I win *_*!')
    elif user == 'scissors':
        print('You win.')
else:
    print('Tie.')
```

(2) As written, what does this program print?

```
comp = 'rock'
user = 'rock'
```

(3) **Change** these inputs to produce a completely correct RPS output.

without changing the code below

```
if comp == 'rock':
    print('I win *_*!')
if user == 'paper':
    print('You win.')
else:
    print('Tie: Ugh')
```

(4) How many of the 9 RPS input cases are *fully correct*, as handled by the code above?

(Extra) What is the *smallest* number of **blocks** and **tests** needed for a fully-correct RPS?

(Extra #2) What if it were RPS-5? (w/ Lizard and Spock)
How about RPS-25? RPS-101?

		comp		
		'rock'	'paper'	'scissors'
user	'rock'			
	'paper'			
	'scissors'			



(0) Find the 3 tests and 4 blocks here.

(1) What does this code print?

```
comp = 'rock'
user = 'rock'
```

```
if comp == 'rock':
    if user == 'paper':
        print('I win *_*!')
    elif user == 'scissors':
        print('I win *_*!')
else:
```

(2) As written, what does this program print?

```
comp = 'rock'
user = 'rock'
```

(3) **Change** these inputs to produce a completely correct RPS output.

without changing the code below

```
if comp == 'rock':
    print('I win *_*!')
if user == 'paper':
    print('I win *_*!')
```

Second breakout...
Keep + Use!!!

(1) How many blocks and how many tests for a fully-correct RPS?

(Extra #2) What if it were RPS-5? (w/ Lizard and Spock)
How about RPS-25? RPS-101?

	rock	paper	scissors
rock			
paper			
scissors			



"Quiz" ~ problems 0+1

```
comp = 'rock'  
user = 'rock'
```

```
if comp == 'rock':  
  
    if user == 'paper':  
        print('I win *_*!')  
    elif user == 'scissors':  
        print('You win.')  
else:  
    print('Tie.')
```

————— ... what if this **else** block were indented? —————

"Quiz" ~ problems 2-4

```
comp = 'rock'
user = 'rock'

if comp == 'rock':
    print('I win *_*!')

if user == 'paper':
    print('You win.')

else:
    print('Tie: Ugh')
```

What does this program print?

"Quiz" ~ problems 2-4

```
comp = 'rock'  
user = 'rock'
```

```
if comp == 'rock':  
    print('I win *_*!')
```

```
if user == 'paper':  
    print('You win.')
```

```
else:  
    print('Tie: Ugh')
```

user

	comp		
	'rock'	'paper'	'scissors'
'rock'			
'paper'			
'scissors'			

Three large grey question marks are overlaid on the table cells.

How many possible "input cases" are there?
For how many is this program correct?

How *efficient* can we be?
For RPS-3? RPS-5? RPS-101?

"Quiz" ~ problems 2-4


```
comp = 'rock'  
user = 'rock'
```

```
if comp == 'rock':  
    print('I win *_*!')
```

```
if user == 'paper':  
    print('You win.')
```

```
else:  
    print('Tie: Ugh')
```

user

		comp		
		'rock'	'paper'	'scissors'
user	'rock'	I win *_*! Tie: Ugh	Tie: Ugh	Tie: Ugh
	'paper'	I win *_*! You win.	You win.	You win.
	'scissors'	I win *_*! Tie: Ugh	Tie: Ugh	 Tie: Ugh <i>only one fully correct!</i>

How many possible "input cases" are there?
For how many is this program correct?

How *efficient* can we be?
For RPS-3? RPS-5? RPS-101?

"Quiz" ~ problems 2-4

```
comp = 'rock'  
user = 'rock'
```

```
if comp == 'rock':  
    print('I win *_*!')
```


```
if us  
    p
```

```
else if ... elif ... else!  
    print('Tie: Ugh')
```

A correct RPS is possible with only one if ... elif ... else!

user
'rock'

comp

	'rock'	'paper'	'scissors'
'rock'	I win *_*! Tie: Ugh	Tie: Ugh	Tie: Ugh
'paper'	*_*! win.	You win.	You win.
'scissors'	*_*! Ugh	Tie: Ugh	Tie: Ugh  <i>only one fully correct!</i>

How many possible "input cases" are there?
For how many is this program correct?

How **efficient** can we be?
For RPS-3? RPS-5? RPS-101?

Remember ~ **Lab** on Friday

Getting started with Python/text editor/cmdline/4 4's!

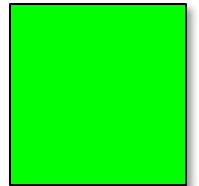
See you in lab!

(at 14:44:44 on Friday...?)

though this is a bit early



Alien defeats everything –
even Alien



How about a peek at the rest of the week's HW... ?

... you must mean *Pic* !

