Welcome to CS 5!

Introduction to CS

Wally Wart, a protrusive advocate of concrete computing

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...
- Metametacritic
You're here! Where next?

1) Introductions!

2) What is CS?

3) How CS 5 runs...

4) Python?!
Introductions...

my happy place – Fall 2021 Sabbatical

Julie Medero
jmedero@hmc.edu

I also teach:
- Writ 1
- CS35
- Core 79
- CS70
- NLP
- Making CS
- CS Clinic

Speaking of introductions
Draw the LCS matches for these two "species" strings:

'CHIMPANZEE'

'HUMAN'

Try these 5

Try these 5

'ABOMASNOW'

'HUMAN'

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

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?

What if there were N+1 stars?

Is Nature "computing"?

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 ________.

What is something non-academic interest college you have in common?
Longest Common Subsequence (LCS)

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

![LCS example diagram]

**Try these 5**

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

   'ABOMASNOW'
   'HUMAN'

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

   CGCTGAGCTAGGCCC...
   ATCCTAGGTAACTG...

3. 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?

4. What if there were N+1 stars?

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"?**

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

**Try these 5**

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

**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-collegiate you have in common?**
Longest Common Subsequence (LCS)

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

```
'CHIMPANZEE'
\///
'HUMAN'
```

**Try these 5**

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

```
'ABOMASNOW'
\///
'HUMAN'
```

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?

What if there were N+1 stars?

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

Is Nature "computing"?

Try these 5

1. 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.
3. How many interstellar forces is Mother Nature "keeping track of" in this galaxy, in total?
4. What if there were N+1 stars?
5. Circle the locations of at least two errors/imperfections, you noticed in the 3d model (fly-through) created from this 2d image?

**Upper half ~ Q'ns "thought experiments"**

What is something non-Chinese culture we have in common?
Pair up with someone nearby – answer these questions together...

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?

What if there were **N+1** stars? Is Nature “computing”?

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”?

Then, chat!

Try these 5

1. **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. 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?**
5. **Why might the software have made these “errors”?**

### Lower half ~ ice-breaking

**Name:** ____________________________

* + other info if you’d like

Your favorite _________ is ____________.

Your least favorite ____________ is ____________.

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

**Name:** ____________________________

* + other info if you’d like

Your favorite _________ is ____________.

Your least favorite ____________ is ____________.
Longest Common Subsequence (LCS)

Keeps ordering, can skip letters. Example:

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

L

ongest

C

ommon

S

ubsequence (LCS)

Keeps ordering, can skip letters. Example:

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 Mother Nature "keeping track of" in this galaxy, in total?

What if there were N+1 stars?

Is Nature "computing"?

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"?

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

Is Nature "computing"?

Try these 5

Name: Julie Medero

Your favorite dog is Willow!

Name: Willow

Your favorite stuffy is Squirrel.

Your least favorite state is Florida.

Your least favorite weather is rain.

We both haaaaate car trips!

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

Lower half ~ ice-breaking

1. 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. 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. Why might the software have made these "errors"?

5. Pair up with someone nearby – answer these questions together...
Draw the LCS matches for these two "species" strings:

Longest Common Subsequence (LCS)
Keeps ordering, can skip letters. Example:

'CHIMPANZEE'
     \___
     \___
     \___
     \___
     \___

'HUMAN'

There are 101 stars in a galaxy far, far away. Each exerts a force on each other. How many interstellar forces is Nature "keeping track of" in this galaxy, in total?

Try these 5
1. Name: ________________ + other info if you'd like
   Your favorite dog is Willow!
   Your least favorite state is Florida.
   ice cream flavor show food sport team boba temperature ...

2. Name: ________________ + other info if you'd like
   Your favorite stuffy is Squirrel.
   Your least favorite weather is rain.
   ice cream flavor show food sport team boba temperature ...

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

We both haaaaate car trips!
Longest Common Subsequence (LCS)
Keeps ordering, can skip letters. Example:

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

'CHIMPANZEE'
\/
\/
\/
\/'HUMAN'

'ABOMASNOW'
\/
\/
\/'HUMAN'

'CGCTGAGCTAGGCC...' 
\/
\/
\/
\/
\/'ATCCTAGGTAACTG...'

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

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2. Which letter (ACGT) could not be the first match in these two DNA strings?
3. Which letter (ACGT) could not be the first match in these two DNA strings?
4. Which letter (ACGT) could not be the first match in these two DNA strings?
5. Which letter (ACGT) could not be the first match in these two DNA strings?

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?

What if there were N+1 stars?

Is Nature “computing”?

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"?

Why might they be 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?
Draw the LCS matches for these two "species" strings:

'CHIMPANZEE'
\///\
'HUMAN'

'ABOMASNOW'
\///\
'HUMAN'

3 matches
\---\---
can't use that first A...

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

'CGCTGAGCTAGGCC...'
/\/\/
'ATCCTAGGTAACTG...'

Can't be G! 
\---\---
~3*10^9 more

What letter (ACGT) could not be the first match in these DNA strings?

Can't be G!

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...

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?

What if there were N+1 stars?

Is Nature "computing"?

(N+1)*N / 2

Why might the software have made these "errors"?

Then, chat! 5+
A Challenge

1. Learn *everyone’s* name
2. ....
3. Prosper!

Incentive TBD … even I don’t know what it is yet!
You're here!  Where next?

1) Introductions!

2) What *is* CS?

3) How CS 5 runs...

4) Python?!
CS ≠ programming
CS \(!=\) 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!
What's CS a science of?

the study of *composition*:

*How can it be done?*

*How well can it be done?*

*Can it be done at all?*

the study of *complexity*:

*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!
**What is CS?**

- **Can you solve the problem?**
- **Can you create a process to solve such problems?**
- **How can it be done?**
  - **How well can it be done?**
  - **Can it be done at all?**

**'CHIMPANZEE'**

**'HUMAN'**

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

*same order, not necessarily neighboring*
What is CS?

Can you solve the problem?
Can you create a process to solve such problems?

How can \textit{it} be done?
How well can \textit{it} be done?
Can \textit{it} be done at all?

What is the Longest Common Subsequence between 2 strings?
same order, not necessarily neighboring

'CHIMPANZEE'
\[\backslash \backslash \backslash \backslash \]
'HUMAN'

4 matches shown
What is CS?

Can you solve the problem?
Can you create a process to solve such problems?

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

'CGCTGAGCTAGGCC...'
'ATCCTAGGTAACTG...'

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

~3·10^9 more

Eye oneder if this haz othur aplications?
What is CS?

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 the Longest Common Subsequence between 2 strings?

's Abomasnow'

'HUMAN'

What is CS?

'CGCTGAGCTAGGCC...'

'ATCCTAGGTAACTG...'

~3 \times 10^9 more

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

Eye oneder if this haz othur aplications?
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?

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 ...?

Feels like home!
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!

https://www.youtube.com/watch?v=GWWIn29ZV4Q&feature=emb_logo
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?

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!

CS's 6 big questions

Only one is programming. Which one?
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**

- 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!

Only one is programming. Which one?
Please pass these up to the front right.
(take a photo, if you'd like!)

"Receiver," if you can grab + stack these: Thank you!!

"Name:"

"Name:"

Your least favorite thing about college?…

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

"Receiver," if you can grab + stack these: Thank you!!

Then, chat!

There are 101 stars in a galaxy far, far away.

"CHIMPANZEE"

"HUMAN"

Write the LCS matches for these two "species" strings:

Longest Common Subsequence (LCS): Keeps ordering, can skip letters. Example:

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

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

There are 101 stars in a galaxy far, far away.

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

What if there were \(N+1\) stars? Is Nature "computing"?

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"?
You're here!  Where next?

1) Introductions!

2) What is CS?

3) How CS 5 runs...

4) Python?!
How CS5 Works: **Home!**

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**CS 5: Welcome!**

- Administration
- Using Python
- Class Resources
- Exams & Projects

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Homework Assignments and Labs

<table>
<thead>
<tr>
<th>Week 0</th>
<th>Week 1</th>
</tr>
</thead>
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Yay! in 2023: just Google for hmc cs5

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5-minute **Intro to CS5**
A minute of cs5 programming...

Introduction to Computer Science

Lab+hw

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

lab and hw instructions

Lab 0: getting everything running on your own machine
Syllabus Scavenger Hunt

- Count off!
- For your topic:
  - Summarize for everyone (on the board)
  - Raise questions and points of clarification
Syllabus Scavenger Hunt

1. CS5 Labs
2. CS5 Grutoring
3. CS5 Homework and Projects
4. CS5 Exams and Grading
5. CS5 Academic Integrity
6. Piazza (linked from Canvas – make a test post, and share what you learn)
7. Gradescope (linked from Canvas – there’s a practice assignment open now!)
CS5 Black vs Gold

• Some weeks we will meet here
• Other weeks we will join Gold in Galileo
• Homework is the same!
• Exams are the same!
• We will have extra time; please share your ideas for things you want to get out of that time!
What is **Lab today/Thurs.?**

SW download, install, and dive in...
Grutors!
## Grutors!

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>1:00 PM to 3:00 PM</th>
<th>3:00 PM to 5:00 PM</th>
<th>7:00 PM to 9:00 PM</th>
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<tbody>
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<td>Sunday</td>
<td></td>
<td>Liselotte Ryan</td>
<td>Nicholas Mondello</td>
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<td>Camilo Morales</td>
<td>Katy Shaw</td>
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<td>Isabel Godoy</td>
<td>Rena Reshmi Mukh...</td>
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<td>Monday</td>
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<td>Ria Rajasekar</td>
<td>Jaanvi Chopra</td>
<td>Conor Floyd</td>
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<td>7:00 PM to 9:00 PM</td>
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<td>Kate Riggs</td>
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<td>Tuesday</td>
<td>Lab! 2:45 PM to 4:45 PM</td>
<td>Alex Silver</td>
<td>Sarah Lammert</td>
<td>Elena Miller</td>
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<td>Lab: grutters,Unitl!</td>
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<td>Audrey Gruian</td>
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<td>6:00 PM to 8:00 PM</td>
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<td>Corey Hickson</td>
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<td>Ai Tong Zhong</td>
<td>Kerry Chen</td>
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<td>Vicente Valdes Pine...</td>
<td>Savva Ignatov</td>
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<td>Annabelle Teng</td>
<td>Lydia Yang</td>
<td>William Sedo</td>
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<td>Thursday</td>
<td>Lab! 2:45 PM to 4:45 PM</td>
<td>Erika Moore</td>
<td>Grace Everts</td>
<td>Julia Manese</td>
</tr>
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</table>
McGregor!

Swag the Bear
You're here! Where next?

1) Introductions!

2) What *is* CS?

3) How CS 5 *runs*...

4) Python?!
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!')
(0) Find the 3 tests and 4 blocks here.

(1) What does this code print?

```python
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?

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

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

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

```python
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?
How many possible “input cases” are there?

comp = 'rock'
user = 'rock'

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

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

A correct RPS is possible with only one

if ... elif ... else!

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

How many possible “input cases” are there?
For how many is this program correct?
Remember ~ Lab today+Thurs.

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

Alien defeats everything – even Alien

See you in lab!
(perhaps at 14:44:44 today...?)

though this is a bit early

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

... you must mean Pic!