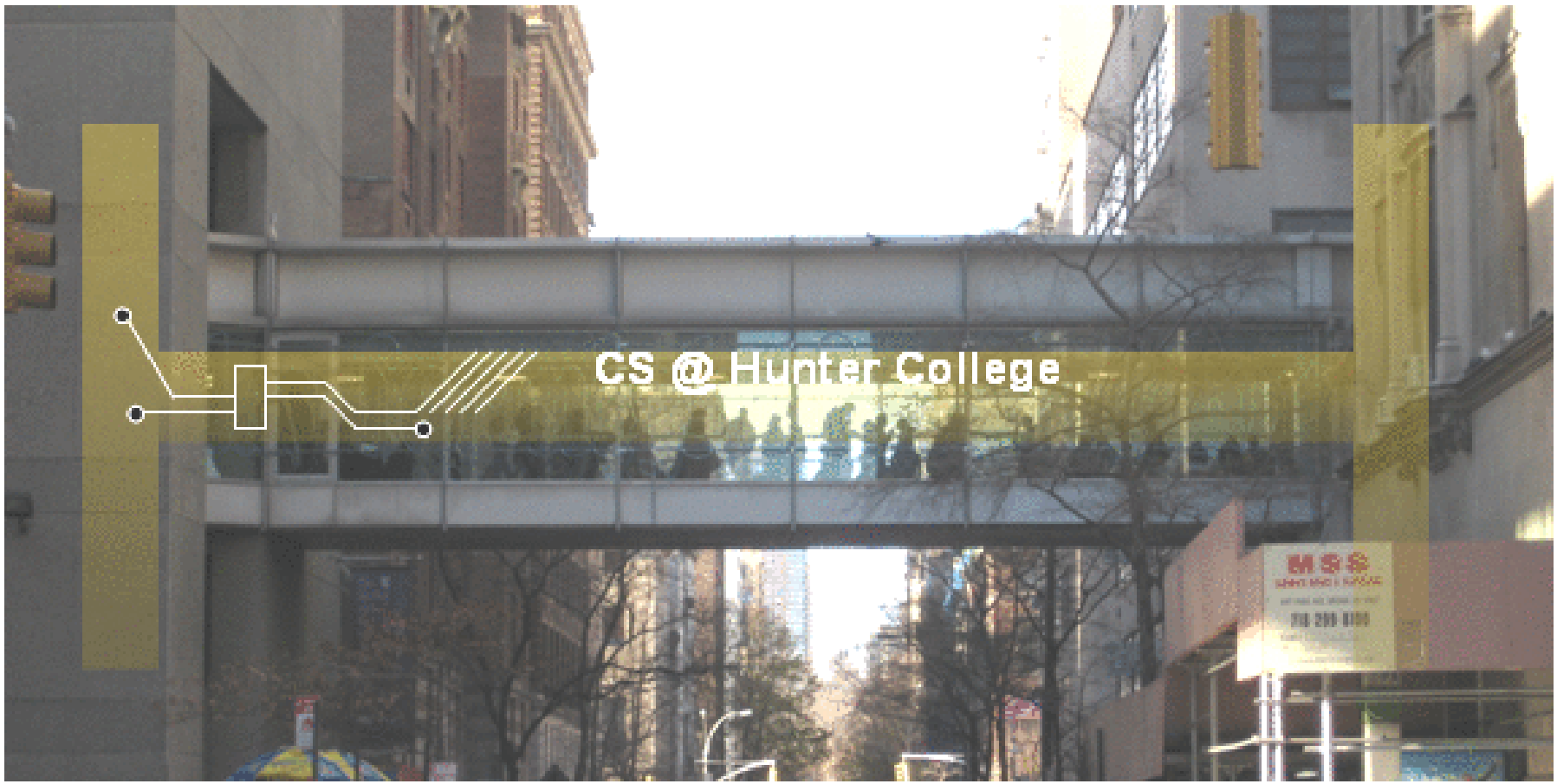
CSci 127: Introduction to Computer Science



Finished the lecture preview?

hunter.cuny.edu/csci

Announcements

- On-line research survey ($10 Amazon card): see email you use for Gradescope for more details.

Announcements

- On-line research survey ($10 Amazon card): see email you use for Gradescope for more details.
- Starting this week, each lecture will include a survey of computing research and the tech industry in NYC.

Announcements

- On-line research survey ($10 Amazon card): see email you use for Gradescope for more details.
- Starting this week, each lecture will include a survey of computing research and the tech industry in NYC.
- Today: Prof. William Sakas, Chair of Computer Science: Computational Linguistics.

Frequently Asked Questions

From lecture slips & recitation sections.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.
  More today!

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.
  More today!
- From lab: what is `numpy` really? And `matplotlib` & `pyplot`?

Frequently Asked Questions

From lecture slips & recitation sections.

- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.
  More today!
- From lab: what is `numpy` really? And `matplotlib` & `pyplot`?
  They are Python files that includes useful functions, definitions, etc.

Frequently Asked Questions

From lecture slips & recitation sections.

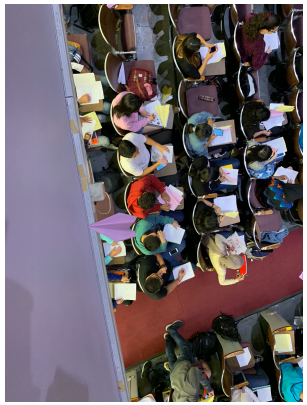
- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.
  More today!
- From lab: what is `numpy` really? And `matplotlib` & `pyplot`?
  They are Python files that includes useful functions, definitions, etc.
- Could you spend more time on problem solving & algorithms?

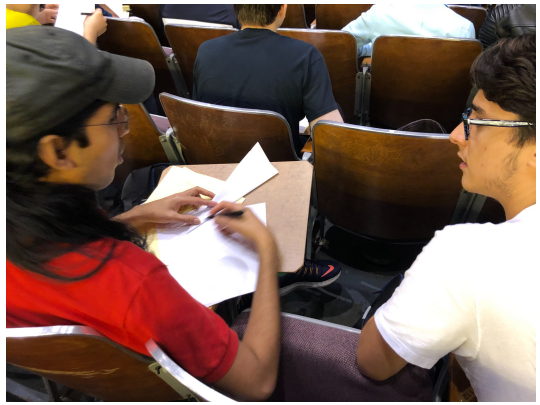
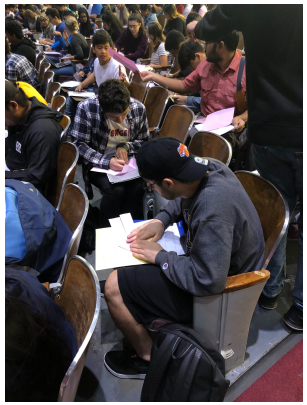
Frequently Asked Questions

From lecture slips & recitation sections.

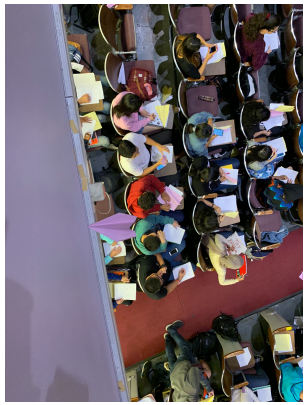
- I missed or did terrible on a quiz. What does that do to my grade?
  Nothing. The in-class quizzes (and lecture slips) only help your grade.
  If you do better than on the final; we use it. Otherwise, we use the final grade.
- Could you spend more time on colors?
  Yes! In today's lecture and the next couple of labs.
- Why hexadecimal? Why can't we just use decimal?
  Standard way of representing colors. And more! More in later classes.
- What does `len()` mean?
  `len(s)` *gives the length (# of items or chars.). Ex:* `len("hi!!")` *is 4.*
- When do you use :? What's a slice?
  The colon, :, gives a slice, substring or sublist, ex: `myString[3:5]`.
  More today!
- From lab: what is `numpy` really? And `matplotlib` & `pyplot`?
  They are Python files that includes useful functions, definitions, etc.
- Could you spend more time on problem solving & algorithms?
  Yes! More in upcoming lectures & labs.

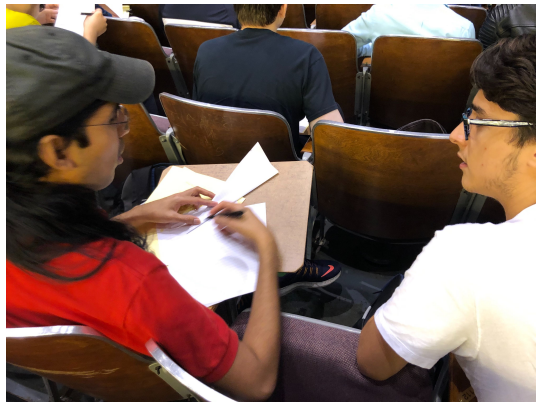
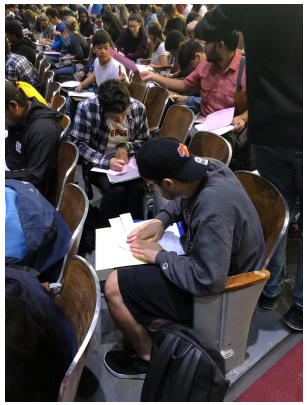
One More FAQ: Why Paper Planes?



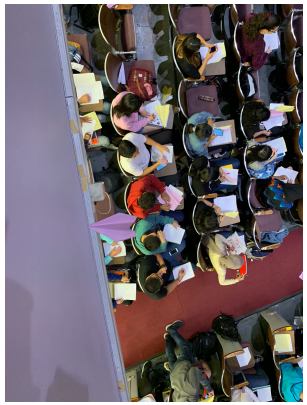
One More FAQ: Why Paper Planes?

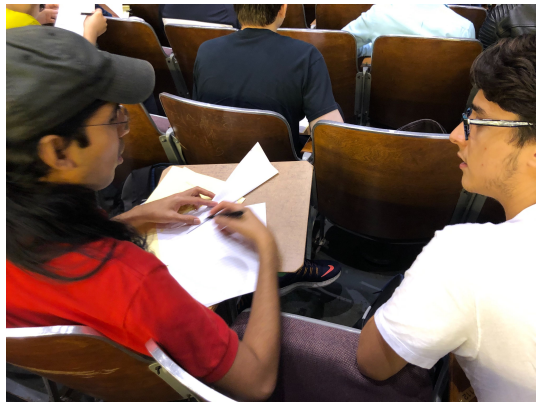
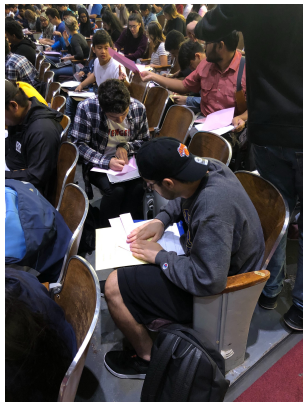


Why paper planes?

One More FAQ: Why Paper Planes?

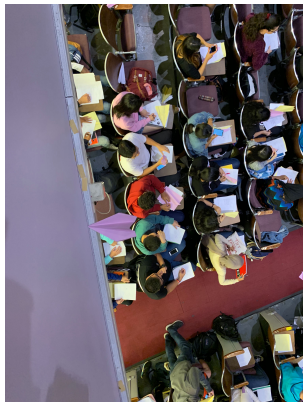


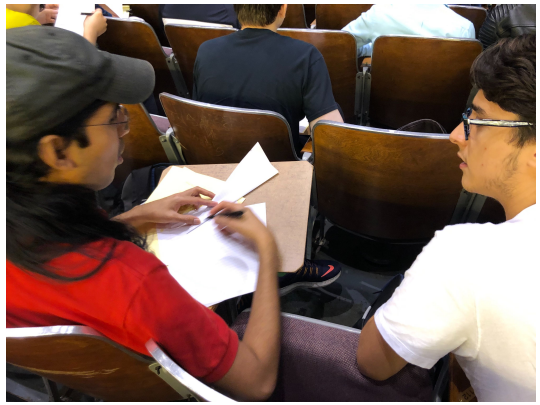
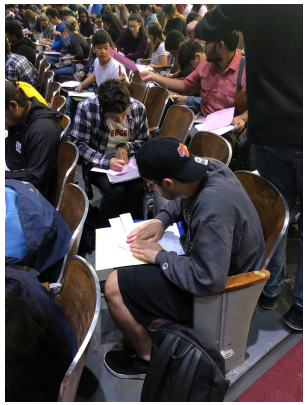



Why paper planes?

- It's a classic design question in introductory programming classes, since

One More FAQ: Why Paper Planes?

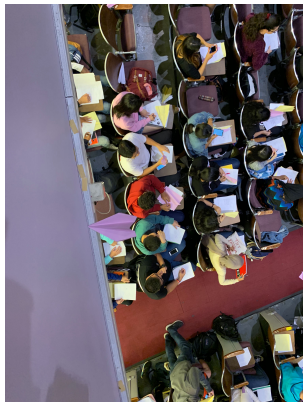


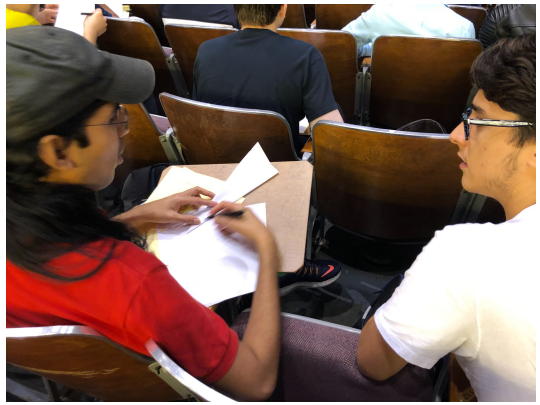
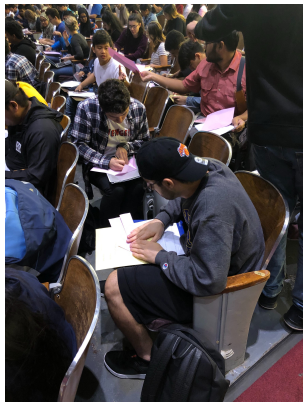



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).

One More FAQ: Why Paper Planes?

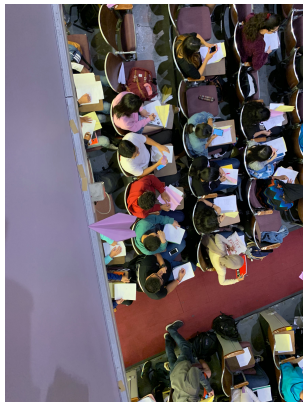


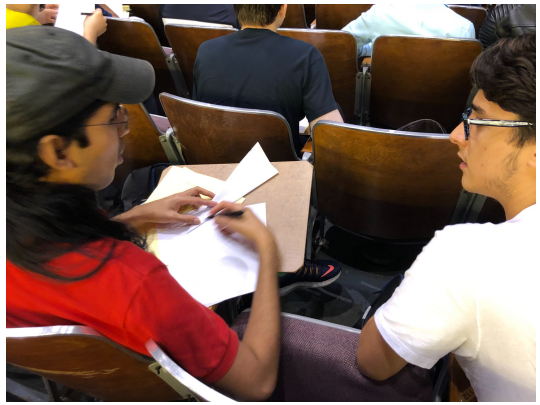
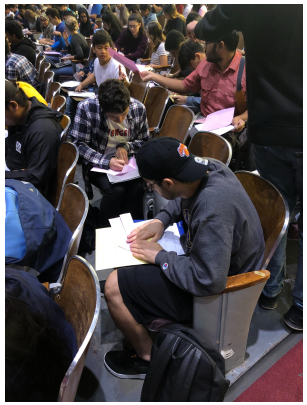



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.

One More FAQ: Why Paper Planes?

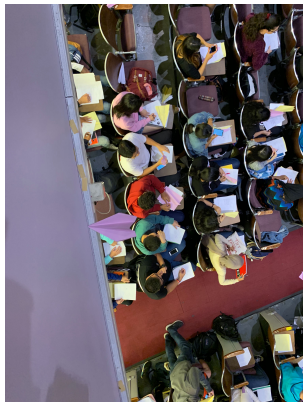


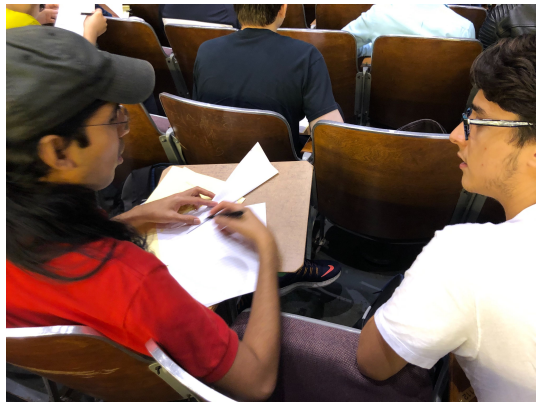
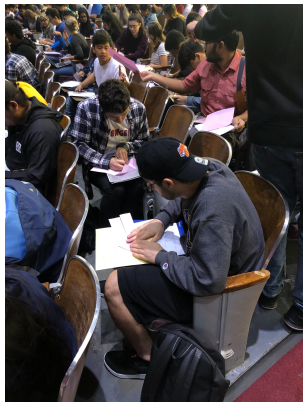



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.
- Why in groups?

One More FAQ: Why Paper Planes?

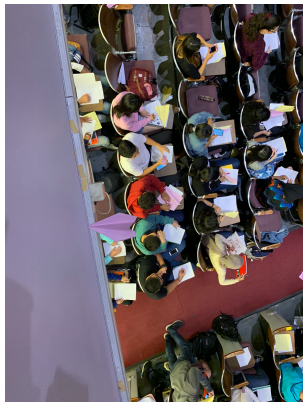


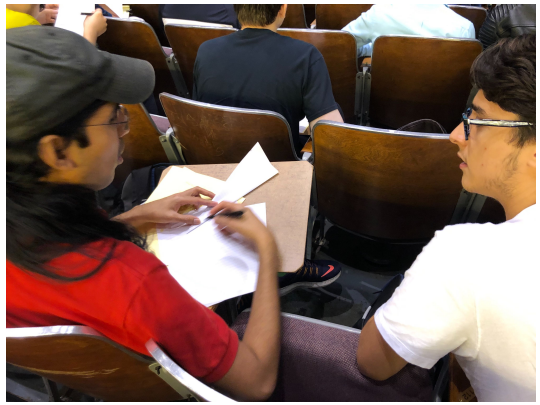
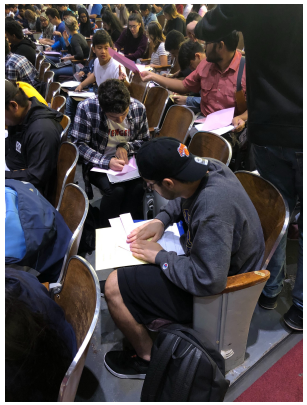



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.
- Why in groups?
  - Improves mastery of material.

One More FAQ: Why Paper Planes?

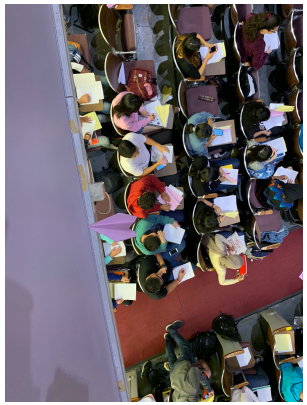


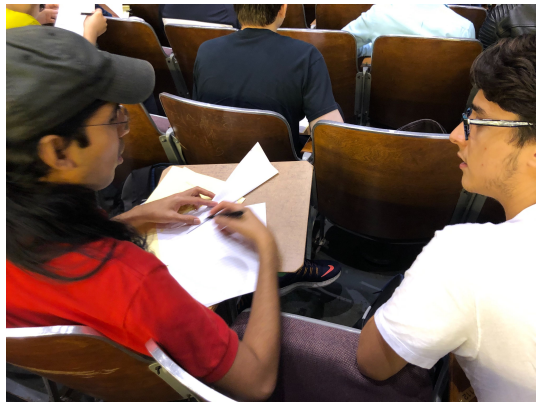
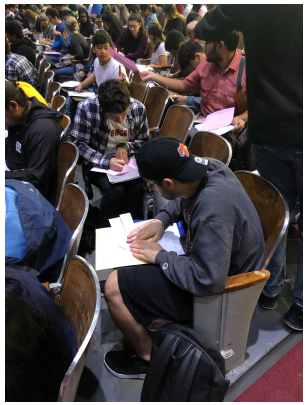



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.
- Why in groups?
  - Improves mastery of material.
  - Our industry partners want strong communication skills:

One More FAQ: Why Paper Planes?

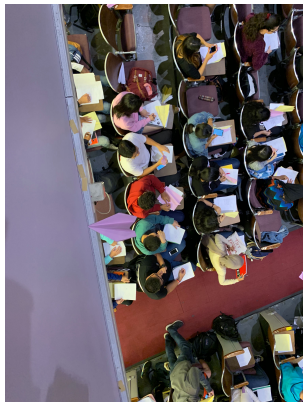


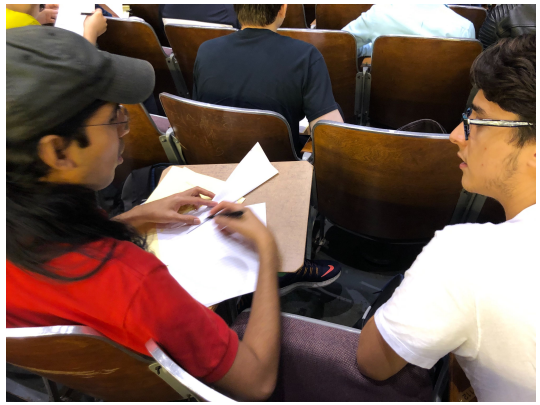
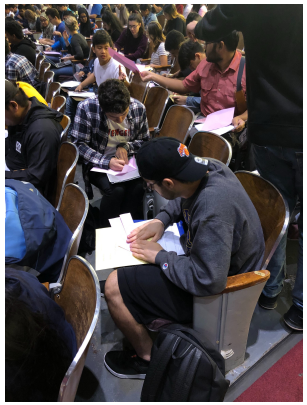



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.
- Why in groups?
  - Improves mastery of material.
  - Our industry partners want strong communication skills:
    - ★ communicating technical ideas precisely, and

One More FAQ: Why Paper Planes?



Why paper planes?

- It's a classic design question in introductory programming classes, since
  - Practice writing solutions in plain English (without worrying about syntax).
  - Practice thinking (and writing) precisely.
- Why in groups?
  - Improves mastery of material.
  - Our industry partners want strong communication skills:
    - ★ communicating technical ideas precisely, and
    - ★ communicating and working in teams.

Plane Winners

Come claim your prizes after lecture:

Design Team:	*Build Team:*
Alejandrina, Julianna, Matthew	Mayesha, Stefany, Donovan
Alex, Zeng	Diamimou, Nubeel
Ana, Yulia	*(empty)*
Anderson, Aberi, Beshoi	Arun, Massiel, Ful...
Casey W., Anthony R., Jessica	Brandon P., Jason, Taz, Rubin
Kevin, Danny, Sharwin	Fnu T., Maria F., Salma E.
Luis, Anthony	Akash, Alexsandre, Auditio
Maria	Justin, Karein, Shamin, Daniel
(empty)	*(empty)*

Today's Topics

- Recap: Colors
- 2D Arrays & Image Files
- Design Question: Hunter Logo
- Decisions
- CS Survey

Today's Topics

- **Recap: Colors**
- 2D Arrays & Image Files
- Design Question: Hunter Logo
- Decisions
- CS Survey

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #):

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`
- White: `F F F F F F`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`
- White: `F F F F F F`
- Blue: `0 0 0 0 F F`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`
- White: `F F F F F F`
- Blue: `0 0 0 0 F F`
- Purple: `F F 0 0 F F`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`
- White: `F F F F F F`
- Blue: `0 0 0 0 F F`
- Purple: `F F 0 0 F F`
- Gray: `4 2 4 2 4 2`

In Pairs or Triples

EmpID: CSci 127 Mock Final, S19

2. (a) Fill in the boxes with the appropriate hexcode to change the color to match the comments:

```
import turtle
thomasH = turtle.Turtle()
```

i. `#Change thomasH to be the color black:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

ii. `#Change thomasH to be the color white:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iii. `#Change thomasH to be the brightest color blue:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

iv. `#Change thomasH to be the color purple:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

v. `#Change thomasH to be the color gray:`

`thomasH.color("#` [ ][ ][ ][ ][ ][ ] `")`

- Need to fill in hexcodes (always start with #): `R R G G B B`
- Black: `0 0 0 0 0 0`
- White: `F F F F F F`
- Blue: `0 0 0 0 F F`
- Purple: `F F 0 0 F F`
- Gray: `4 2 4 2 4 2` (any choice where RR = GG = BB).

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:
    - ★ Black: 0% red, 0% green, 0% blue

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:
    - ★ Black: 0% red, 0% green, 0% blue
    - ★ White: 100% red, 100% green, 100% blue

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

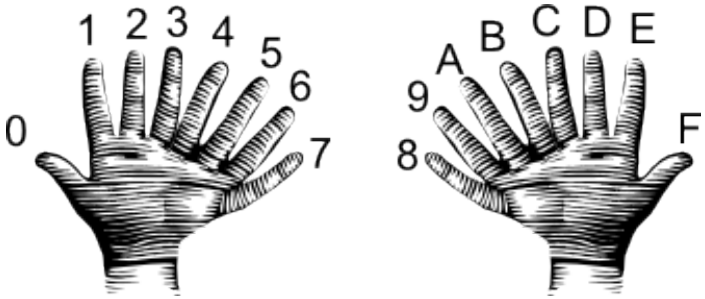
- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.

Recap: Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.
  - Hexcodes (base-16 numbers)...

Recap: Hexadecimal




```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.
  - Hexcodes (base-16 numbers):

Colors

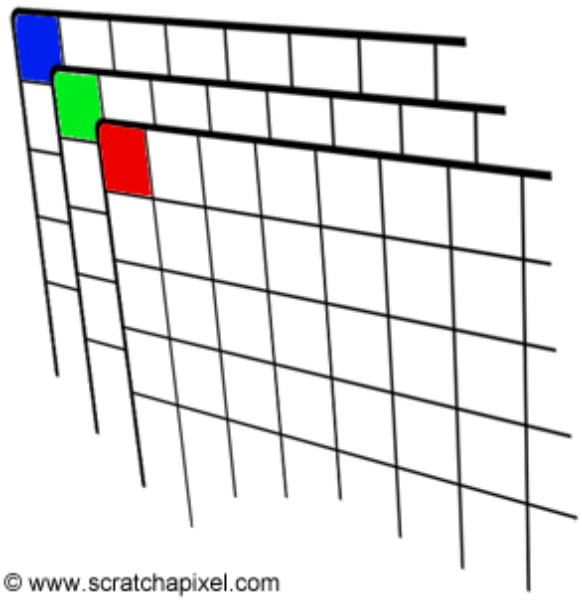
Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.
  - Hexcodes (base-16 numbers):
    e.g. `#0000FF` is no red, no green, and 100% blue.

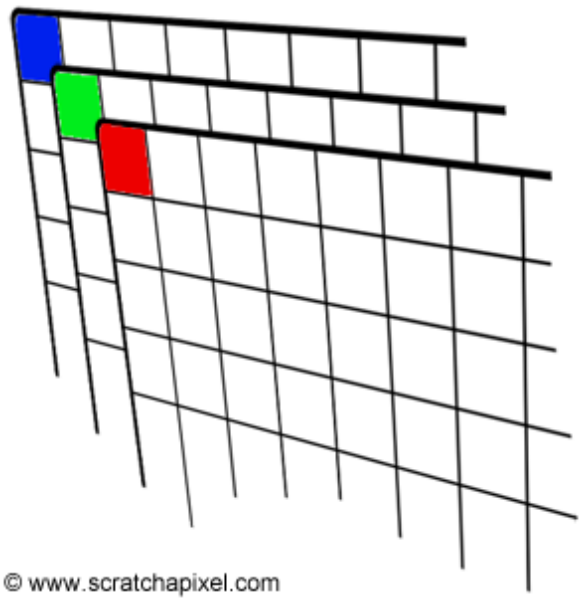
Today's Topics

- Recap: Colors
- **2D Arrays & Image Files**
- Design Question: Hunter Logo
- Decisions
- CS Survey

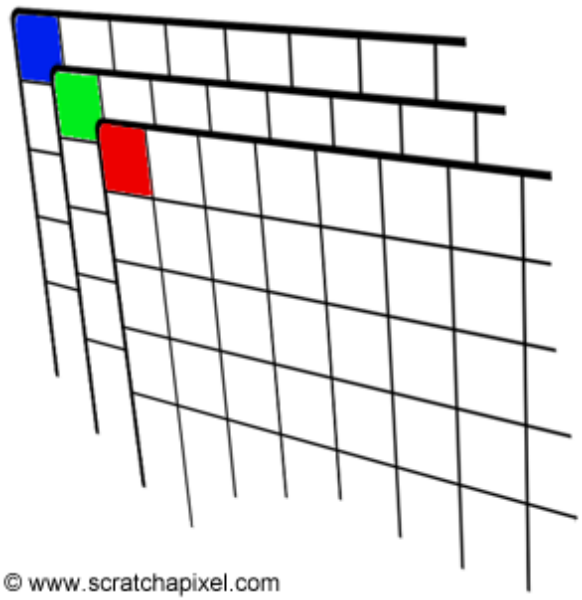
Images

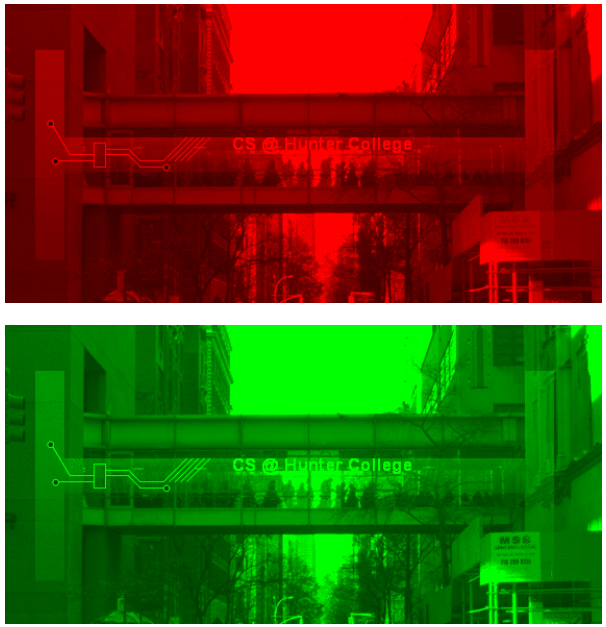


Images

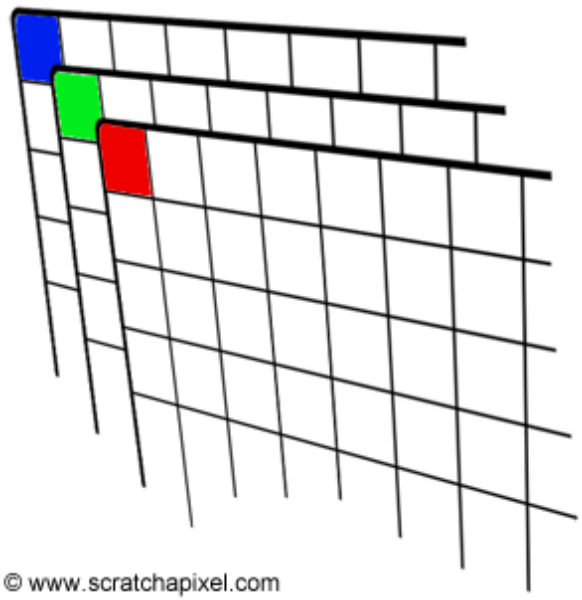


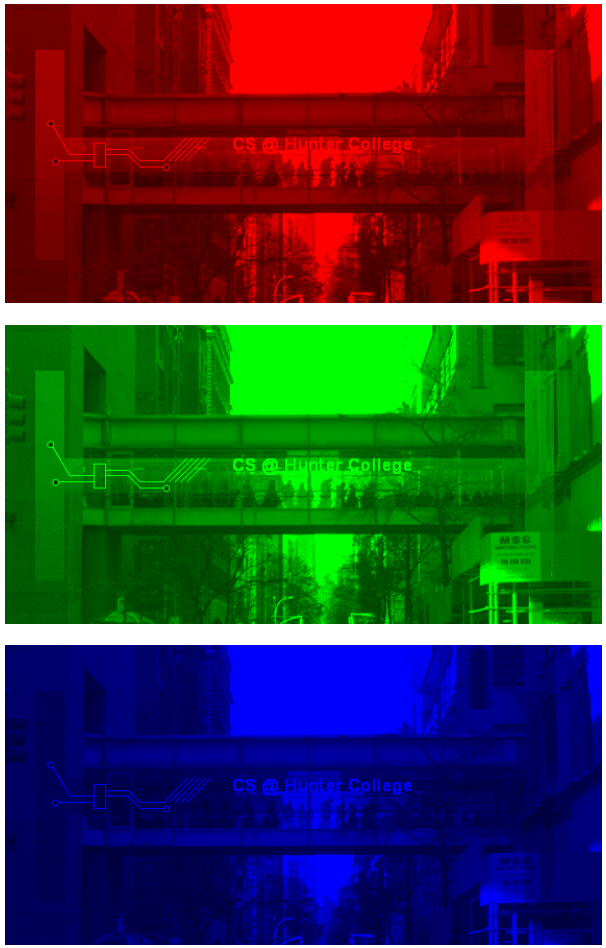
Images



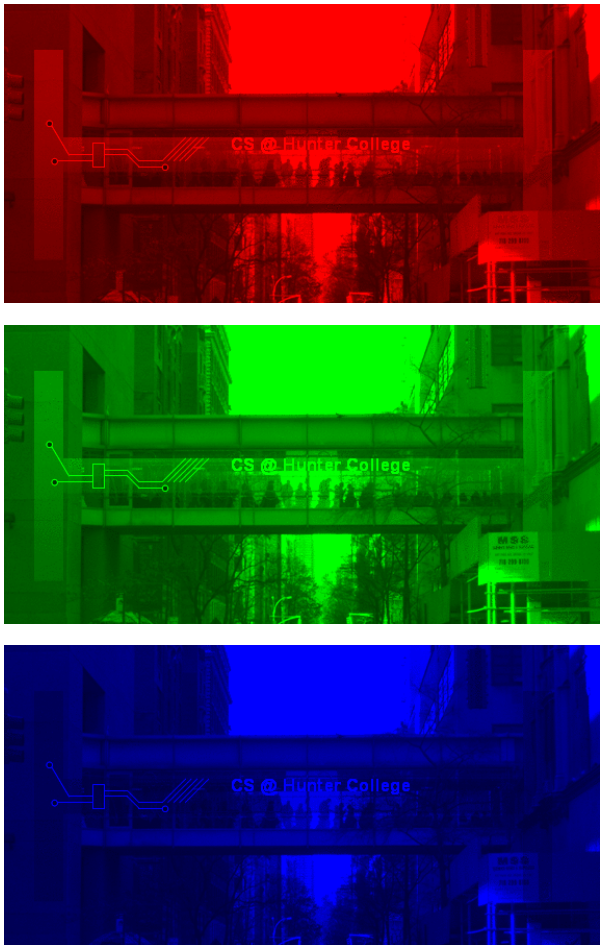


Images


© www.scratchapixel.com

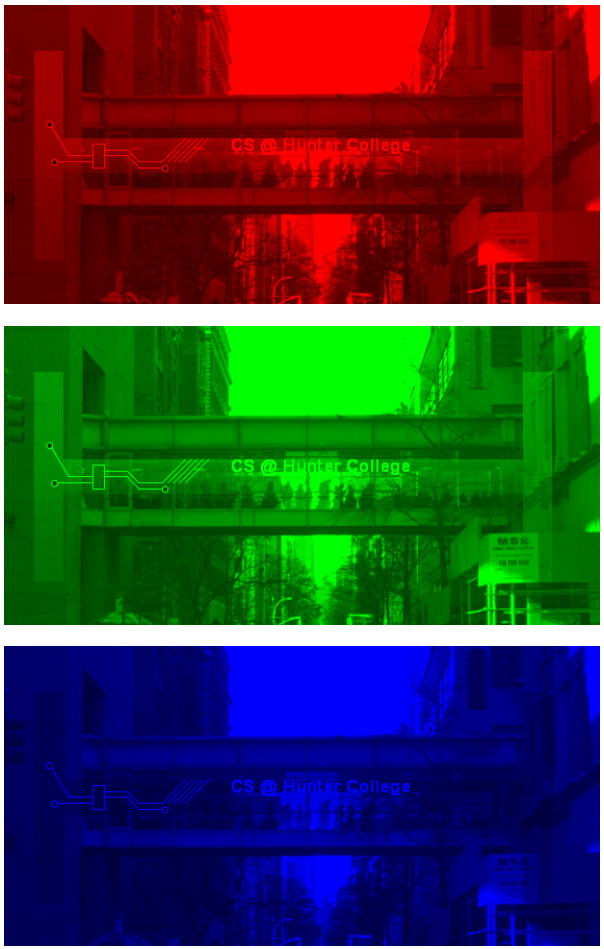

CS @ Hunter College
CS @ Hunter College
CS @ Hunter College

Useful Packages



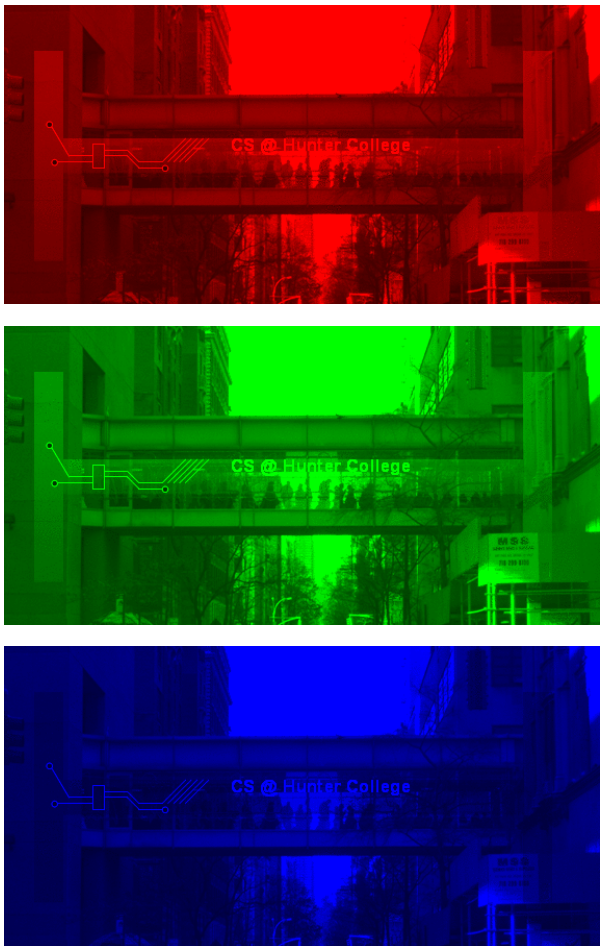
- We will use 2 useful packages for images:

Useful Packages



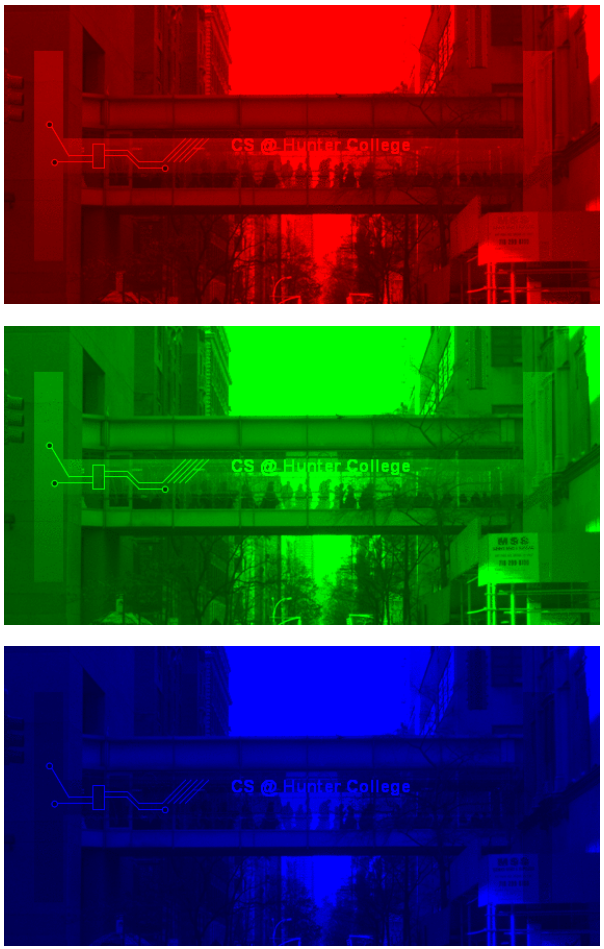
- We will use 2 useful packages for images:
  - `numpy`: numerical analysis package

Useful Packages



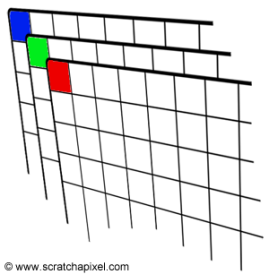
- We will use 2 useful packages for images:
  - `numpy`: numerical analysis package
  - `pyplot`: part of `matplotlib` for making graphs and plots

Useful Packages



- We will use 2 useful packages for images:
  - `numpy`: numerical analysis package
  - `pyplot`: part of `matplotlib` for making graphs and plots
- See lab notes for installing on your home machine.

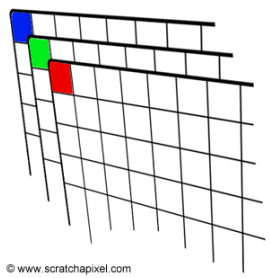
Images with pyplot and numpy




```
#Import the packages for images and arrays:
import matplotlib.pyplot as plt
import numpy as np


img = plt.imread('csBridge.png')    #Read in image from csBridge.png
plt.imshow(img)                      #Load image into pyplot
plt.show()                           #Show the image (waits until close

img2 = img.copy()          #make a copy of our image
img2[:,:,1] = 0            #Set the green channel to 0
img2[:,:,2] = 0            #Set the blue channel to 0

plt.imshow(img2)           #Load our new image into pyplot
plt.show()                 #Show the image (waits until closed to conti

plt.imsave('reds.png', img2)  #Save the image we created to the file:
```

Creating Images

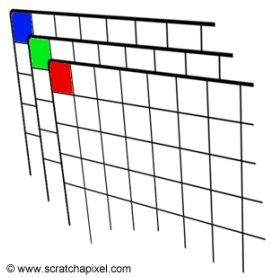
To create an image from scratch:



Creating Images

To create an image from scratch:

1. Import the libraries.

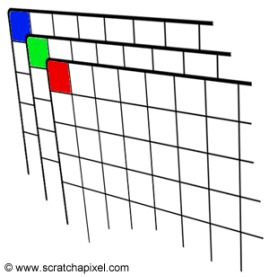


Creating Images

To create an image from scratch:

1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```



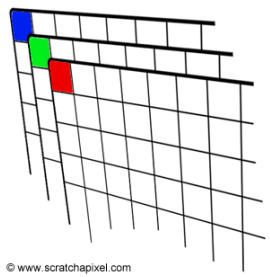
Creating Images

To create an image from scratch:

1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color



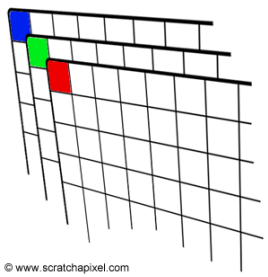
Creating Images

To create an image from scratch:

1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):



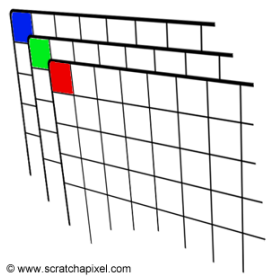
Creating Images

To create an image from scratch:

1. Import the libraries.

   ```
   import matplotlib.pyplot as plt
   import numpy as np
   ```

2. Create the image– easy to set all color
   1. to 0% (black):
      ```
      img = np.zeros( (num,num,3) )
      ```



Creating Images

To create an image from scratch:

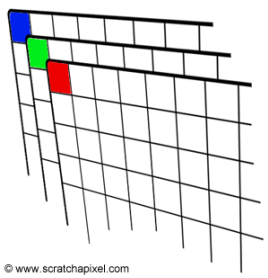
1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):

```
img = np.zeros( (num,num,3) )
```

   2. to 100% (white):



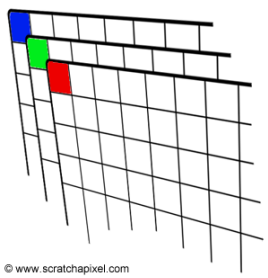
Creating Images

To create an image from scratch:

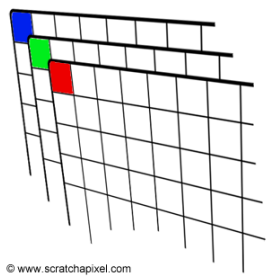
1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`



Creating Images



To create an image from scratch:

1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`
3. *Do stuff to the pixels to make your image*

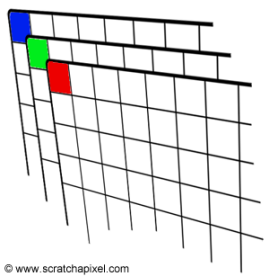
Creating Images

To create an image from scratch:

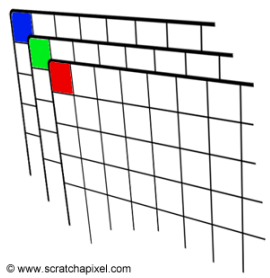
1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`
3. *Do stuff to the pixels to make your image*
4. You can display your image:



Creating Images



To create an image from scratch:

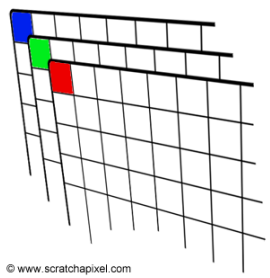
1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`
3. *Do stuff to the pixels to make your image*
4. You can display your image:

```
plt.imshow(img)
plt.show()
```

Creating Images



To create an image from scratch:

1. Import the libraries.

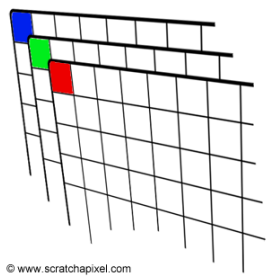
```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`
3. *Do stuff to the pixels to make your image*
4. You can display your image:

```
plt.imshow(img)
plt.show()
```

5. And save your image:

Creating Images



To create an image from scratch:

1. Import the libraries.

```
import matplotlib.pyplot as plt
import numpy as np
```

2. Create the image– easy to set all color
   1. to 0% (black):
      `img = np.zeros( (num,num,3) )`
   2. to 100% (white):
      `img = np.ones( (num,num,3) )`
3. *Do stuff to the pixels to make your image*
4. You can display your image:

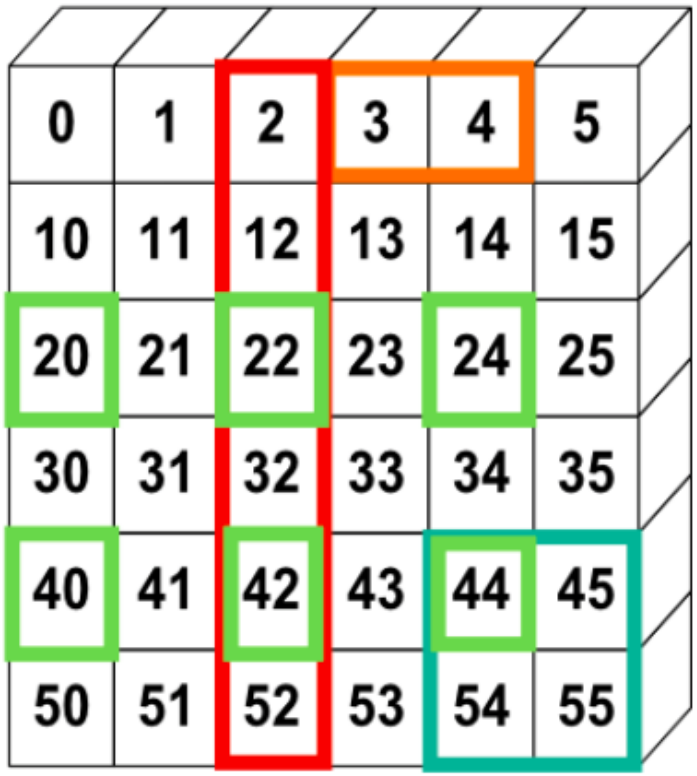
```
plt.imshow(img)
plt.show()
```

5. And save your image:

```
plt.imsave('myImage.png', img)
```

More on numpy arrays

```
>>> a[0,3:5]
array([3,4])

>>> a[4:,4:]
array([[44, 45],
       [54, 55]])

>>> a[:,2]
array([2,12,22,32,42,52])

>>> a[2::2,::2]
array([[20,22,24]
       [40,42,44]])
```

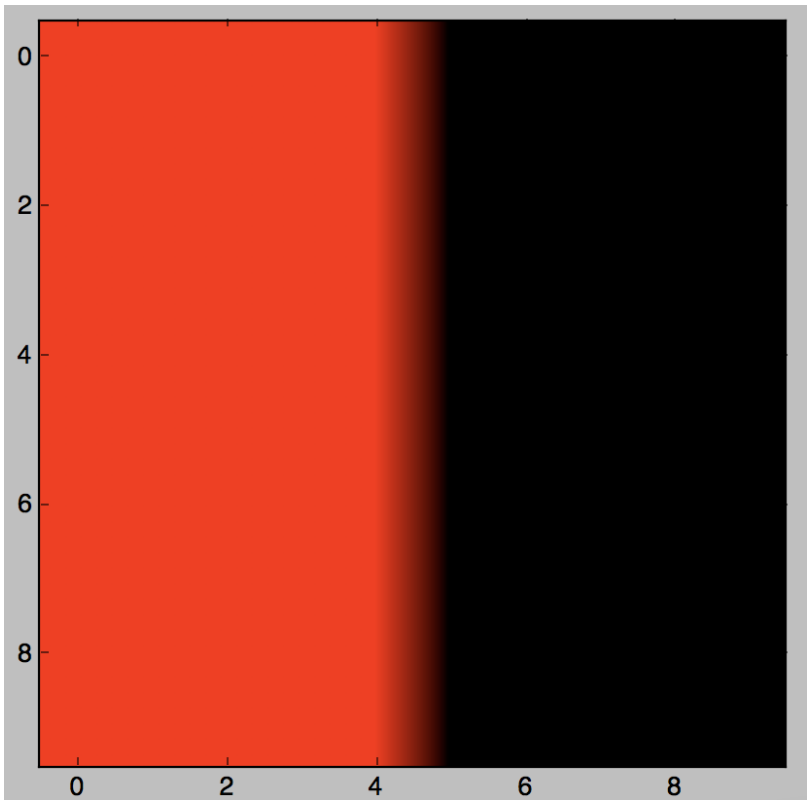


numpy tutorial

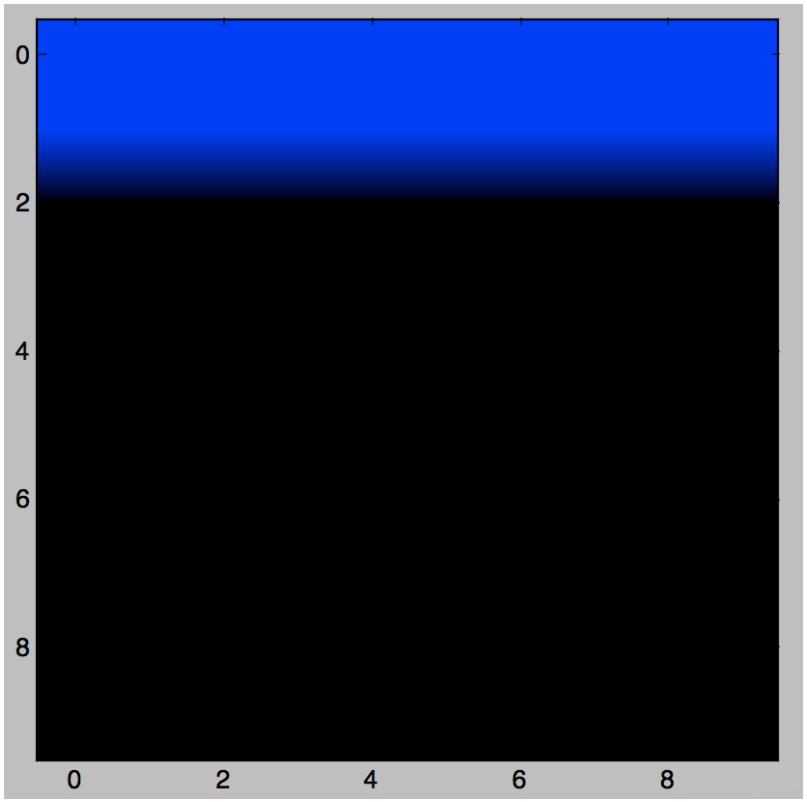
Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.

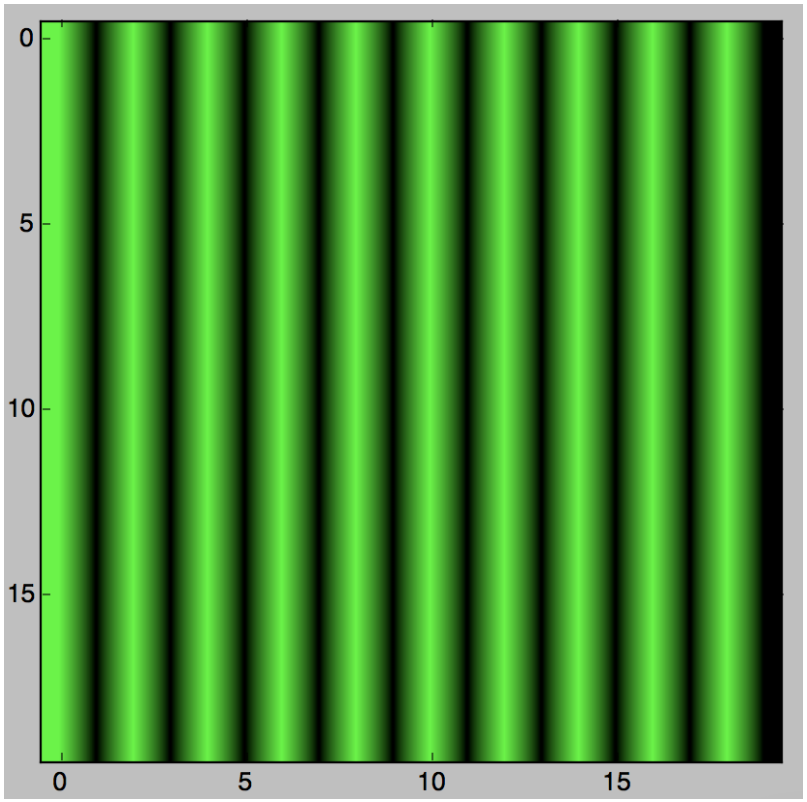
Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    img = np.zeros( (10,10,3) )
    img[0:10,0:5,0:1] = 1
    ```
    ```

Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    img = np.zeros( (10,10,3) )
    img[0:10,0:5,0:1] = 1
    ```


    ```

Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    num = 10
    img = np.zeros( (num,num,3) )
    img[0:2,:,2:3] = 1.0
    ```
    ```

Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    num = 10
    img = np.zeros( (num,num,3) )
    img[0:2,:,2:3] = 1.0
    ```


    ```

Slicing & Image Examples

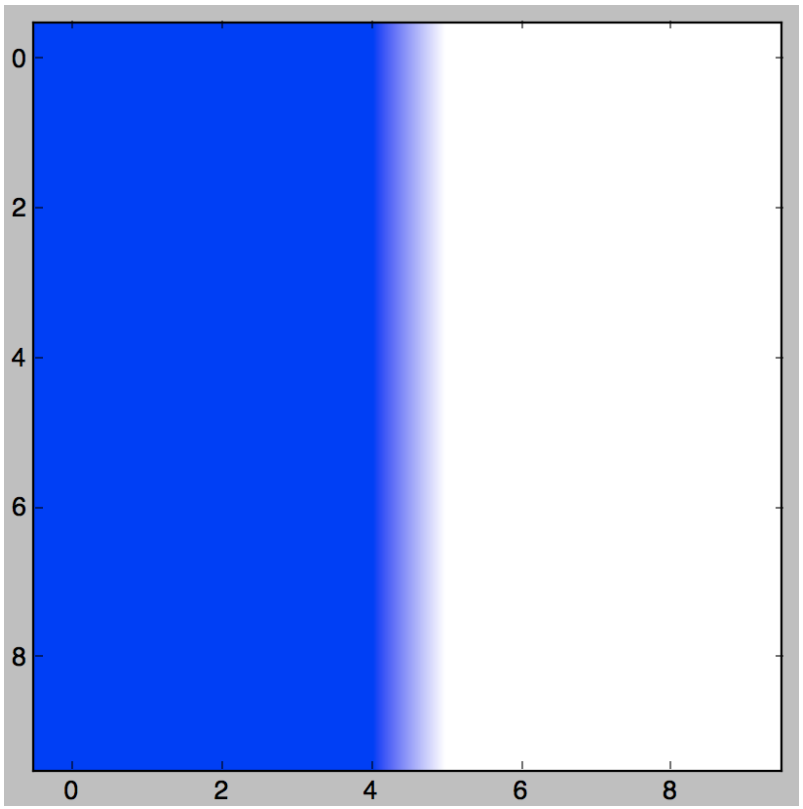
- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    num = int(input('Enter size'))
    img = np.zeros( (num,num,3) )
    img[:,::2,1] = 1.0
    ```
    ```

Slicing & Image Examples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    num = int(input('Enter size'))
    img = np.zeros( (num,num,3) )
    img[:,::2,1] = 1.0
    ```


    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:
  - ```
    img = np.ones( (10,10,3) )
    img[0:10,0:5,0:2] = 0
    ```
    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.ones( (10,10,3) )
    img[0:10,0:5,0:2] = 0
    ```

  - ```
    num = int(input('Enter size '))
    img = np.ones( (num,num,3) )
    img[::2,:,1:]  = 0
    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.ones( (10,10,3) )
    img[0:10,0:5,0:2] = 0
    ```

  - ```
    num = int(input('Enter size '))
    img = np.ones( (num,num,3) )
    img[::2,:,1:]  = 0
    ```

  - ```
    img = np.zeros( (8,8,3) )
    img[::2,::2,0] = 1
    ```
    ```

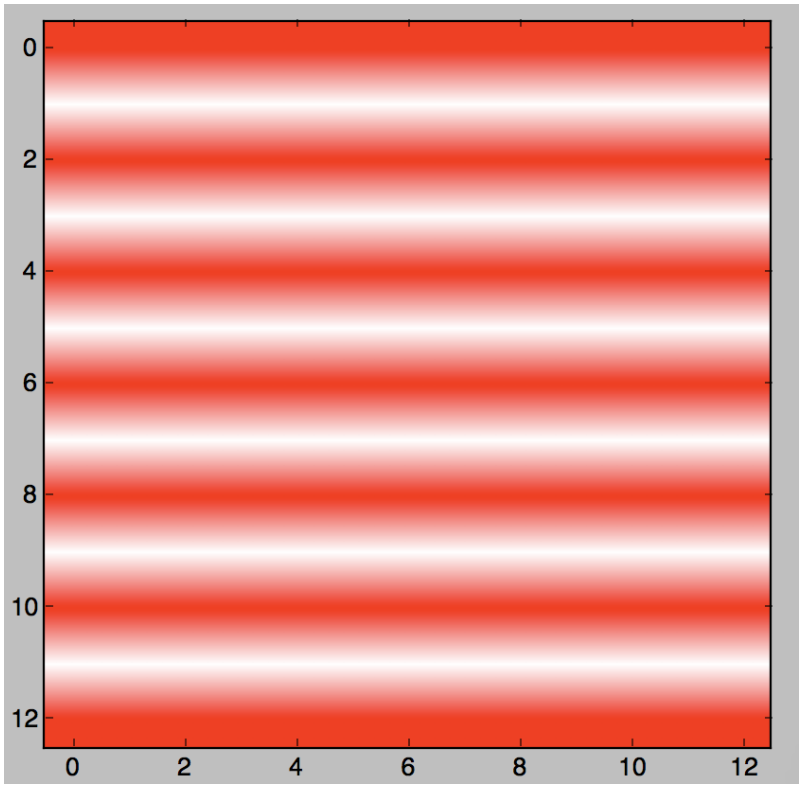
In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.ones( (10,10,3) )
    img[0:10,0:5,0:2] = 0
    ```
    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.ones( (10,10,3) )
    img[0:10,0:5,0:2] = 0
    ```


    ```

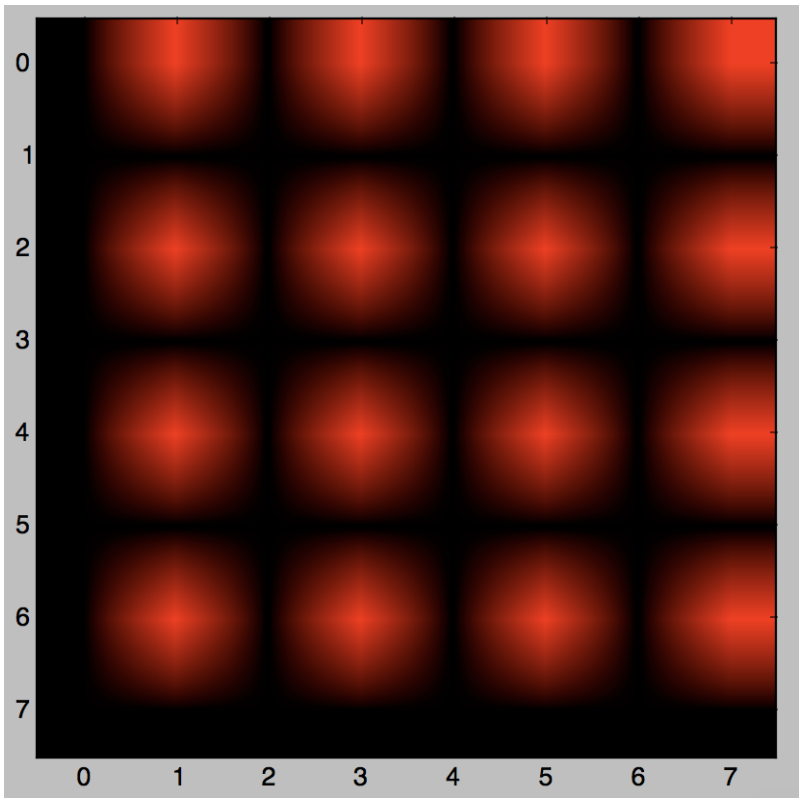
In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    num = int(input('Enter size '))
    img = np.ones( (num,num,3) )
    img[::2,:,1:]  = 0
    ```
    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    num = int(input('Enter size '))
    img = np.ones( (num,num,3) )
    img[::2,:,1:]  = 0
    ```


    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.zeros( (8,8,3) )
    img[::2,1::2,0] = 1
    ```
    ```

In Pairs or Triples

- Basic pattern: *img[rows, columns, channels]* with: *start:stop:step*.
- Assuming the libraries are imported, what do the following code fragments produce:

  - ```
    img = np.zeros( (8,8,3) )
    img[::2,1::2,0] = 1
    ```


    ```

Today's Topics

- Recap: Colors
- 2D Arrays & Images
- **Design Question: Hunter Logo**
- Decisions
- CS Survey

In Pairs or Triples...

	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

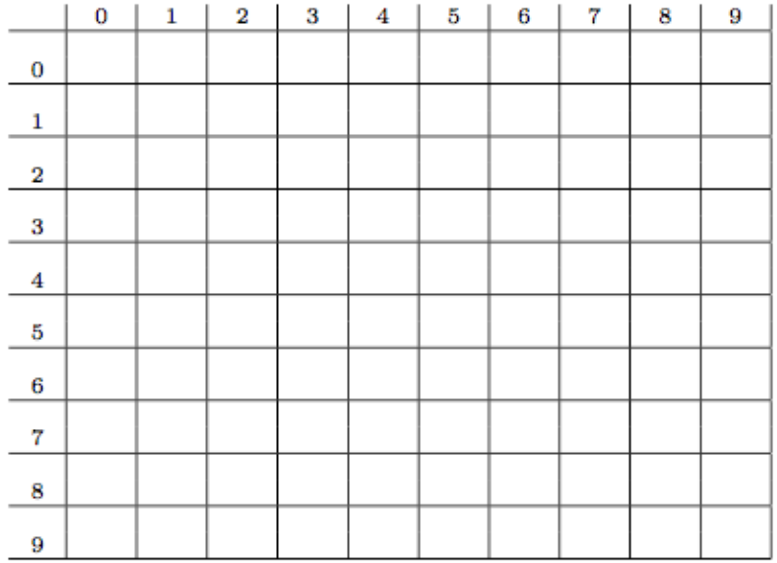
1. Design a 10 by 10 logo for Hunter College that contains a purple 'H'.

In Pairs or Triples...

	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

1. Design a 10 by 10 logo for Hunter College that contains a purple 'H'.
2. Your logo should only contain the colors purple and white.

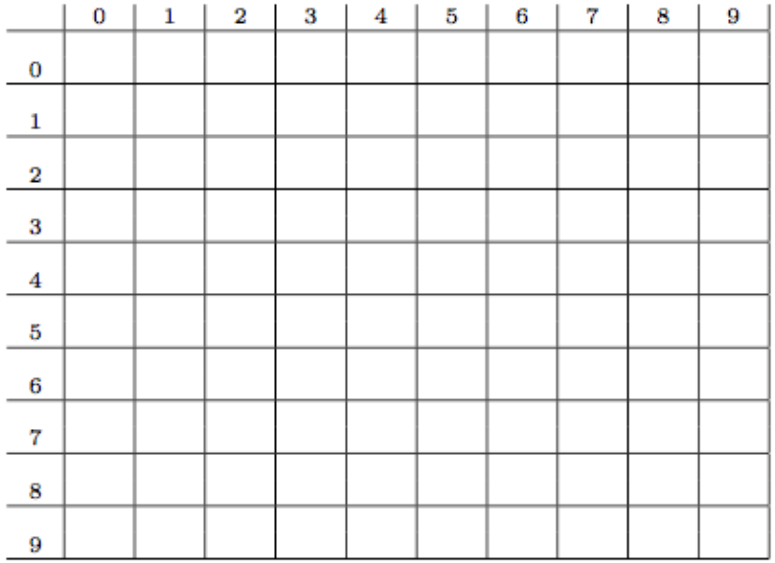
In Pairs or Triples...



	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

1. Design a 10 by 10 logo for Hunter College that contains a purple 'H'.
2. Your logo should only contain the colors purple and white.
3. How can you make Python draw the logo?
   Write down a "To Do" list of things you need to do.

In Pairs or Triples...

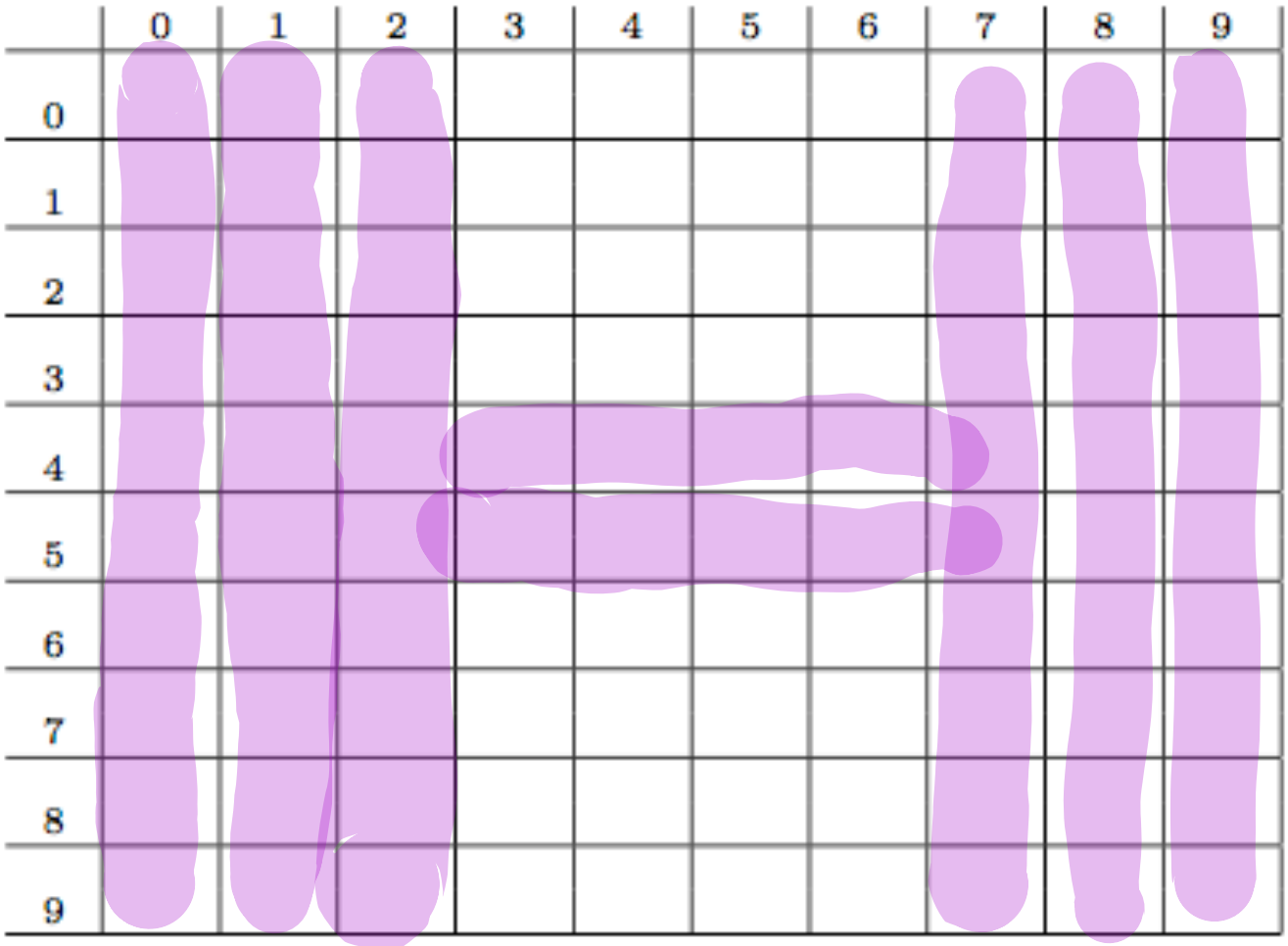


	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

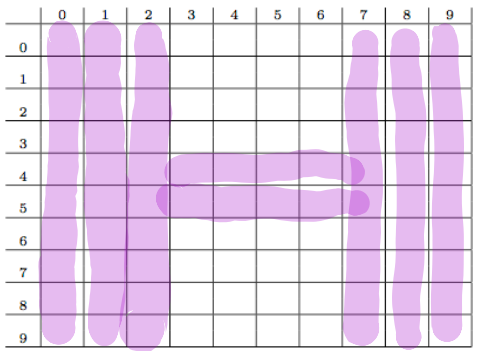
1. Design a 10 by 10 logo for Hunter College that contains a purple 'H'.
2. Your logo should only contain the colors purple and white.
3. How can you make Python draw the logo?
   Write down a "To Do" list of things you need to do.
4. If time, refine your steps above into a Python program.

Design a Hunter Logo

One possible solution:

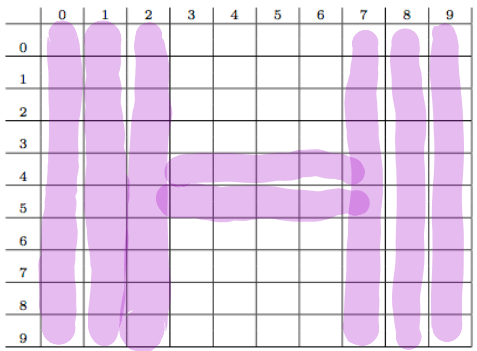


Design a Hunter Logo



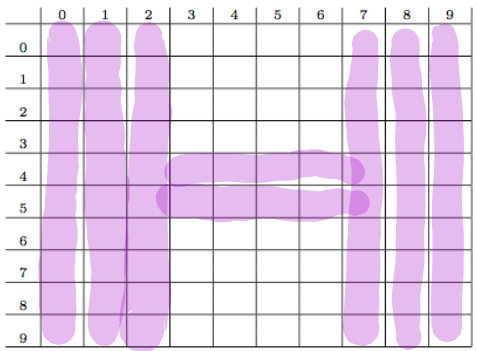
1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

Design a Hunter Logo



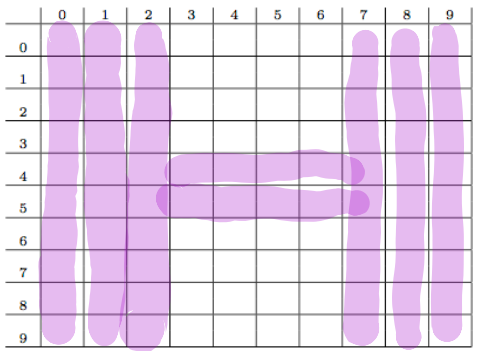
1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.
2. Set the 3 left columns to be purple.

Design a Hunter Logo



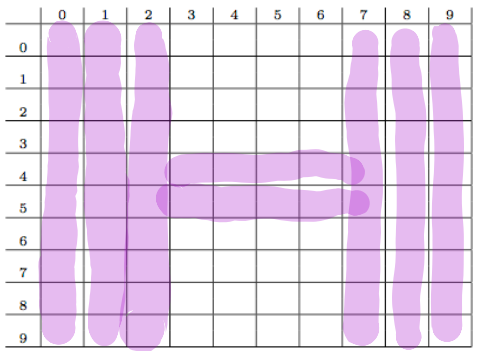
1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.
2. Set the 3 left columns to be purple.
3. Set the 3 right columns to be purple.

Design a Hunter Logo



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.
2. Set the 3 left columns to be purple.
3. Set the 3 right columns to be purple.
4. Set the middle 2 rows to be purple.

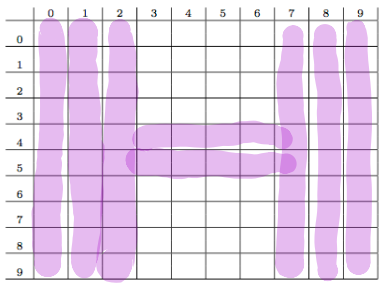
Design a Hunter Logo



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.
2. Set the 3 left columns to be purple.
3. Set the 3 right columns to be purple.
4. Set the middle 2 rows to be purple.
5. Save `logo` array to a file.

Translating the Design to Code

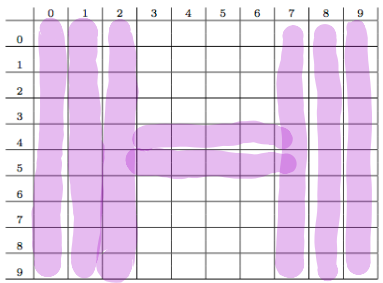
1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.



Translating the Design to Code

1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

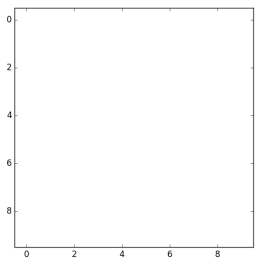
```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```



Translating the Design to Code

1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

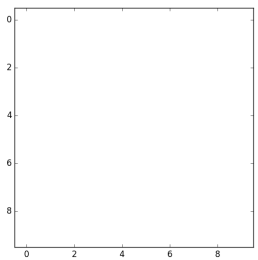


Translating the Design to Code

1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.



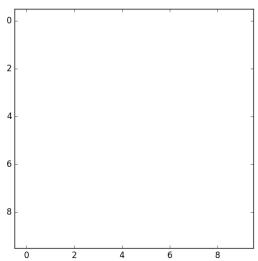
Translating the Design to Code

1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```



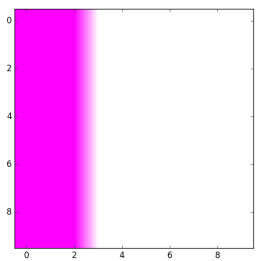
Translating the Design to Code

1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

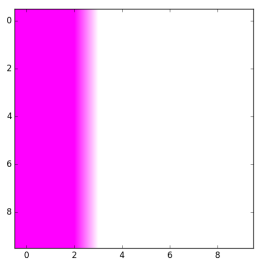
```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```



Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

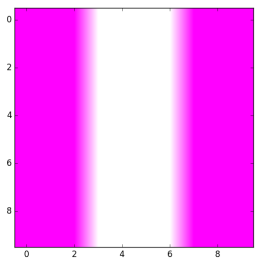
2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

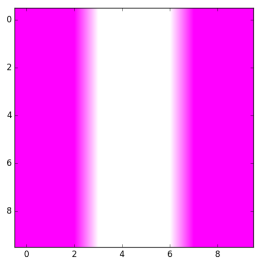
2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

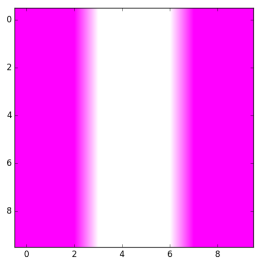
```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

4. Set the middle 2 rows to be purple.

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

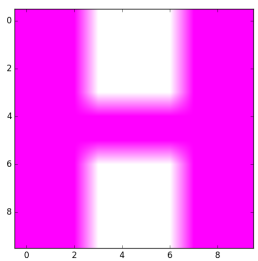
3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

4. Set the middle 2 rows to be purple.

```
logoImg[4:6,:,1] = 0 #Turn the green to 0 for middle rows
```

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

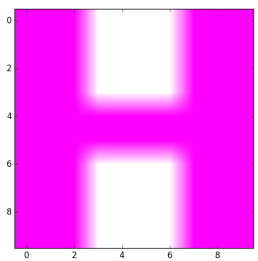
3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

4. Set the middle 2 rows to be purple.

```
logoImg[4:6,:,1] = 0 #Turn the green to 0 for middle rows
```

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

3. Set the 3 right columns to be purple.

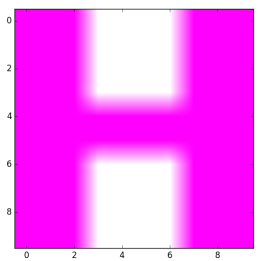
```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

4. Set the middle 2 rows to be purple.

```
logoImg[4:6,:,1] = 0 #Turn the green to 0 for middle rows
```

5. Save logo array to file.

Translating the Design to Code



1. Create a 10 by 10 array, `logo`, that starts out as all white pixels.

```
import matplotlib.pyplot as plt #import libraries for plotting
import numpy as np              #and for arrays (to hold images)
logoImg = np.ones((10,10,3))    #10x10 array with 3 sheets of 1's
```

2. Set the 3 left columns to be purple.

```
#To make purple, we'll keep red and blue at 100% and turn green to 0%
logoImg[:,:3,1] = 0 #Turn the green to 0 for first 3 columns
```

3. Set the 3 right columns to be purple.

```
logoImg[:,-3:,1] = 0 #Turn the green to 0 for last 3 columns
```

4. Set the middle 2 rows to be purple.

```
logoImg[4:6,:,1] = 0 #Turn the green to 0 for middle rows
```

5. Save logo array to file.

```
plt.imsave("logo.png", logoImg) #Save the image to logo.png
```

Today's Topics

- Recap: Colors
- 2D Arrays & Image Files
- Design Question: Hunter Logo
- **Decisions**
- CS Survey

In Pairs or Triples...

Predict what these will do (novel concepts):

```
yearBorn = int(input('Enter year born: '))
if yearBorn < 1946:
    print("Greatest Generation")
elif yearBorn <= 1964:
    print("Baby Boomer")
elif yearBorn <= 1984:
    print("Generation X")
elif yearBorn <= 2004:
    print("Millennial")
else:
    print("TBD")

x = int(input('Enter number: '))
if x % 2 == 0:
    print('Even number')
else:
    print('Odd number')
```

```
import turtle

tess = turtle.Turtle()
myWin = turtle.Screen()     #The graphics window
commands = input("Please enter a command string: ")

for ch in commands:
    #perform action indicated by the character
    if ch == 'F':           #move forward
        tess.forward(50)
    elif ch == 'L':         #turn left
        tess.left(90)
    elif ch == 'R':         #turn right
        tess.right(90)
    elif ch == '^':         #lift pen
        tess.penup()
    elif ch == 'v':         #lower pen
        tess.pendown()
    elif ch == 'B':         #go backwards
        tess.backward(50)
    elif ch == 'r':         #turn red
        tess.color("red")
    elif ch == 'g':         #turn green
        tess.color("green")
    elif ch == 'b':         #turn blue
        tess.color("blue")
    else:                   #for any other character
        print("Error: do not know the command:", c)
```

Python Tutor

```
yearBorn = int(input('Enter year born: '))
if yearBorn < 1946:
    print("Greatest Generation")
elif yearBorn <= 1964:
    print("Baby Boomer")
elif yearBorn <= 1984:
    print("Generation X")
elif yearBorn <= 2004:
    print("Millennial")
else:
    print("TBD")

x = int(input('Enter number: '))
if x % 2 == 0:
    print('Even number')
else:
    print('Odd number')
```

(Demo with pythonTutor)

IDLE

```
import turtle

tess = turtle.Turtle()
myWin = turtle.Screen()     #The graphics window
commands = input("Please enter a command string: ")

for ch in commands:
    #perform action indicated by the character
    if ch == 'F':           #move forward
        tess.forward(50)
    elif ch == 'L':         #turn left
        tess.left(90)
    elif ch == 'R':         #turn right
        tess.right(90)
    elif ch == '^':         #lift pen
        tess.penup()
    elif ch == 'v':         #lower pen
        tess.pendown()
    elif ch == 'B':         #go backwards
        tess.backward(50)
    elif ch == 'r':         #turn red
        tess.color("red")
    elif ch == 'g':         #turn green
        tess.color("green")
    elif ch == 'b':         #turn blue
        tess.color("blue")
    else:                   #for any other character
        print("Error: do not know the command:", c)
```

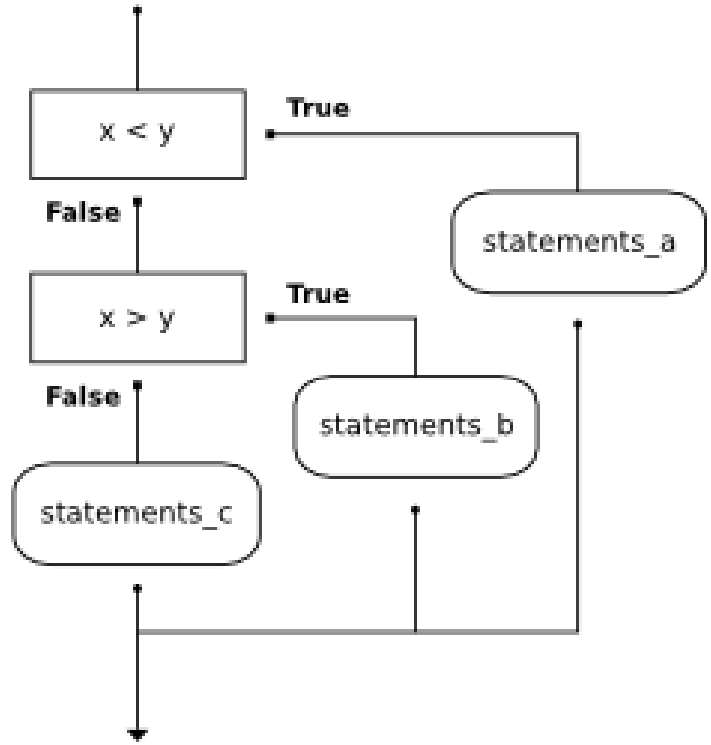
(Demo with IDLE)

Decisions

```
if x < y:
    print("x is less than y")
elif x > y:
    print("x is greater than y")
else:
    print("x and y must be equal")
```

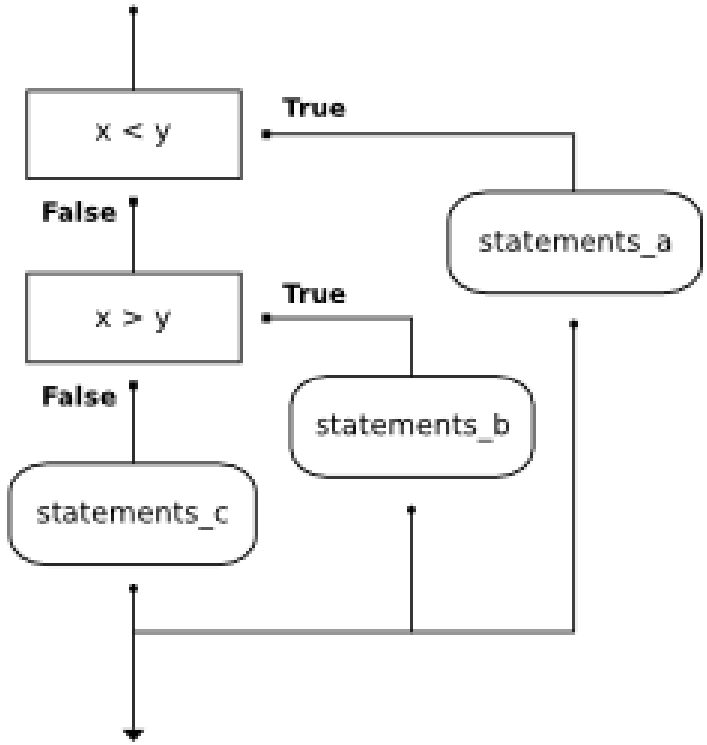
Decisions

```
if x < y:
    print("x is less than y")
elif x > y:
    print("x is greater than y")
else:
    print("x and y must be equal")
```



Decisions

```
if x < y:
    print("x is less than y")
elif x > y:
    print("x is greater than y")
else:
    print("x and y must be equal")
```

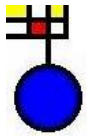


(This was just a first glance, will do much more on decisions over the next several weeks.)

Today's Topics

- Recap: Colors
- 2D Arrays & Image Files
- Design Question: Hunter Logo
- Decisions
- **CS Survey**

CS Survey: Prof. Sakas, Computational Linguistics

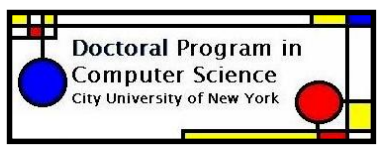


Language is Hard for Computers

Learning Language is Easy for my 3-year-old twins

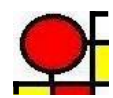
CSCI 12700 Guest Bullet Talk

William Gregory Sakas

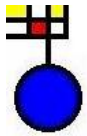


HUNTER
The City University of New York

M.A./Ph.D. Program in Linguistics
@ The City University of New York



CS Survey: Prof. Sakas, Computational Linguistics

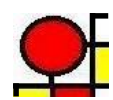


Language is Hard

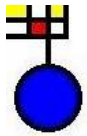
- *Buffalo buffalo, Buffalo buffalo buffalo, buffalo, Buffalo buffalo*

- *Someone shot the servant of the actress who was on the balcony.* **Who was on the balcony?**

- *Who do you think Mary kissed?*
- *Who do you think* ***that*** *Mary kissed?*
- *Who do you think bought a radio?*
- ****** *Who do you think* ***that*** *bought a radio?*



CS Survey: Prof. Sakas, Computational Linguistics



So how to explain language?

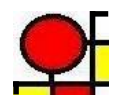
Treat Language as a **scientific field - like Physics.**

Example: *A* scientific principle about sentences:

Given <p> = [α [H β]],
where α = edge(*Spec's*) β then:
the head H of <p> is inert after the phase is completed, triggering no further grammatical operations.

Language is complex!!!
Understanding how language works is hard!!!

Unless you're 3.



CS Survey: Prof. Sakas, Computational Linguistics

Linguistic experts!

Lecture Slip

Linguistic experts!

Design a program that counts the number of plural nouns in a list of nouns. Think about:

- what the input is,
- what the output is, and
- how you can determine if a noun is plural.

Note: To simplify the problem, assume all plural nouns end in "s".

Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).

Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).
- In Python, we introduced:

Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).
- In Python, we introduced:
  - Recap: Colors
  - 2D Array & Image Files
  - Design Question: Hunter Logo
  - Decisions

Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).
- In Python, we introduced:
  - Recap: Colors
  - 2D Array & Image Files
  - Design Question: Hunter Logo
  - Decisions
- Pass your lecture slips to the aisles for the UTAs to collect.

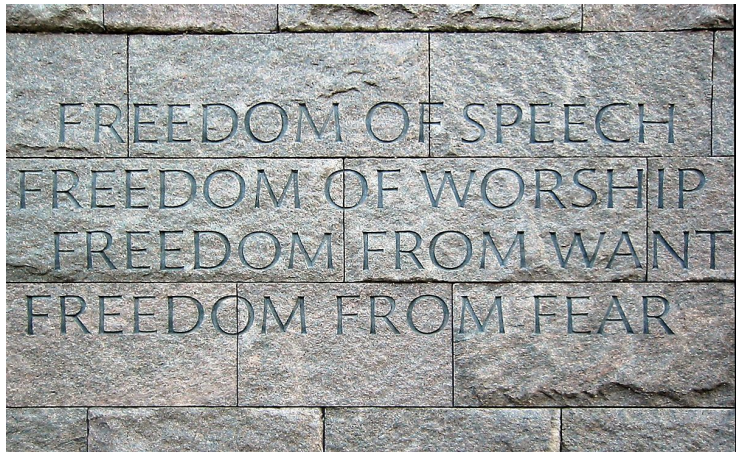
Recap

- On lecture slip, write down a topic you wish we had spent more time (and why).
- In Python, we introduced:
  - Recap: Colors
  - 2D Array & Image Files
  - Design Question: Hunter Logo
  - Decisions
- Pass your lecture slips to the aisles for the UTAs to collect.

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



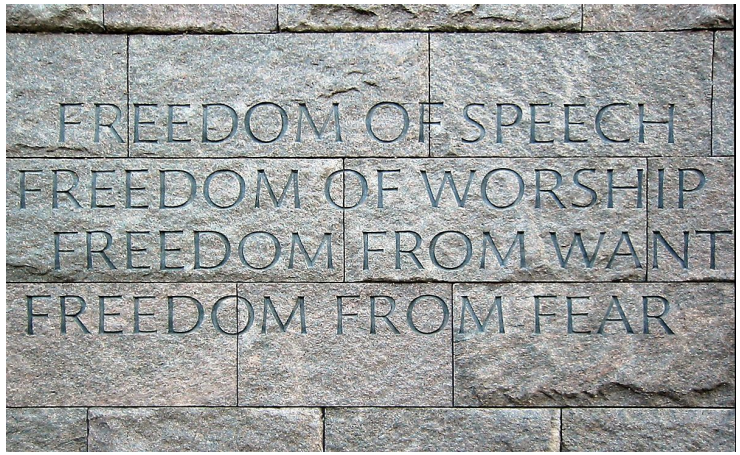
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



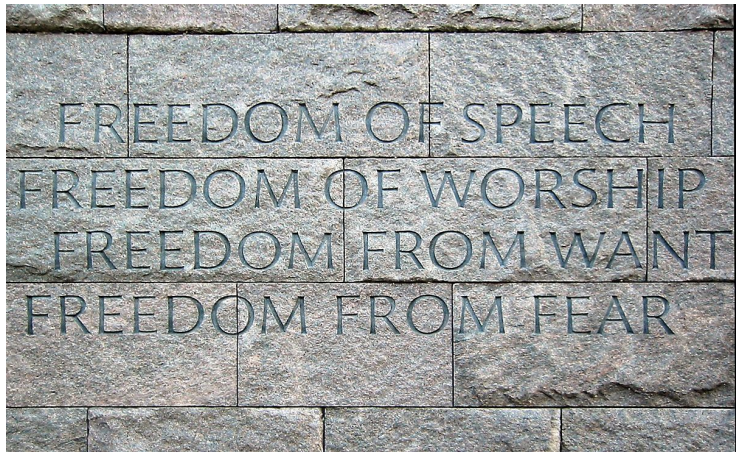
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



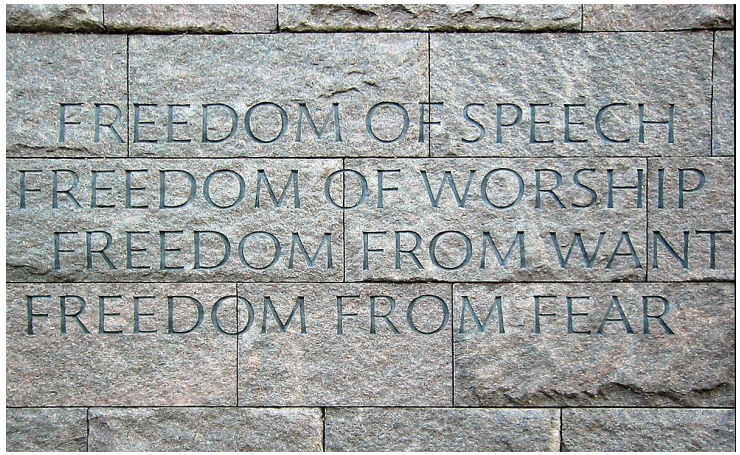
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



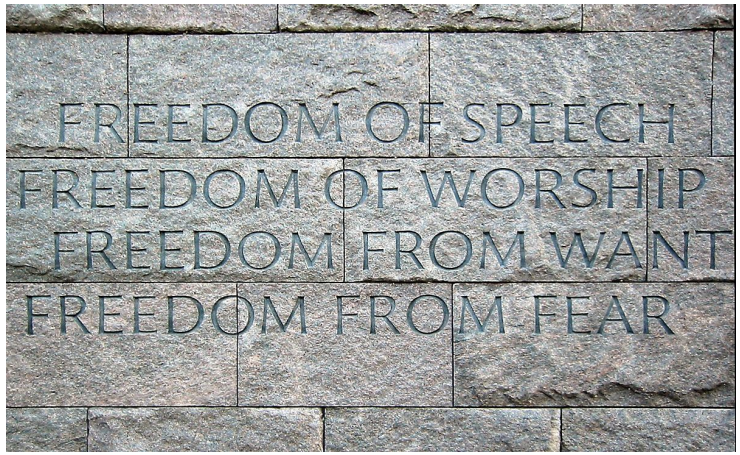
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



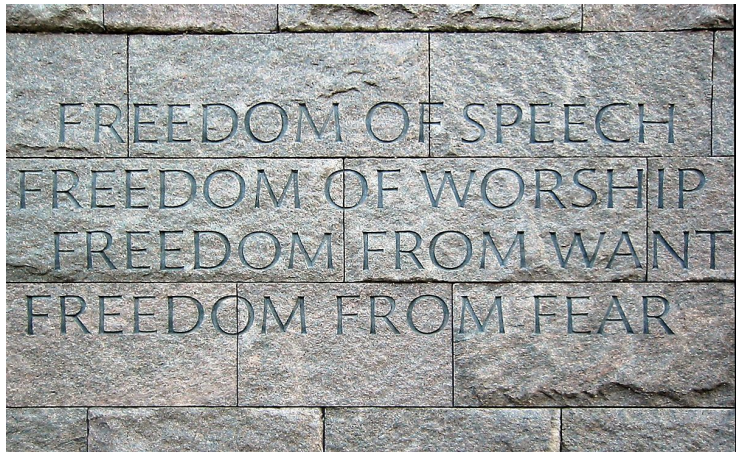
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



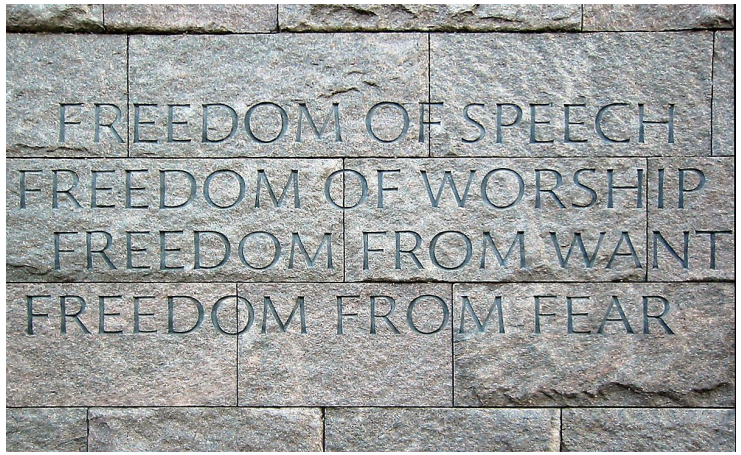
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.

Practice Quiz & Final Questions

(NYTimes)

(Hunter College)



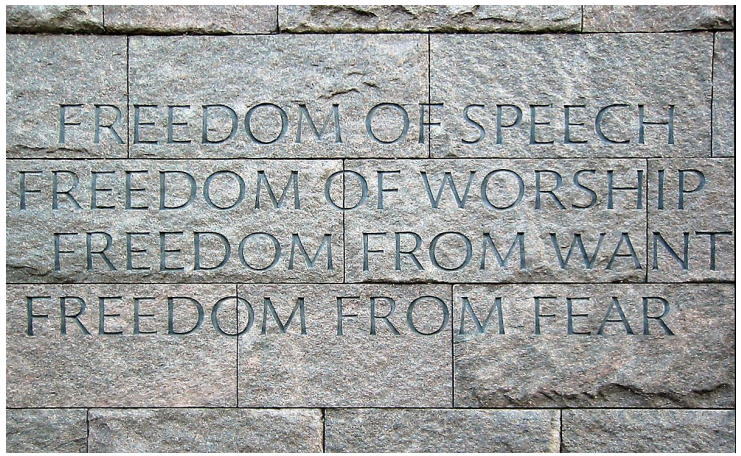
(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.
- Past exams are on the webpage (under Final Exam Information).

Practice Quiz & Final Questions

(NYTimes)

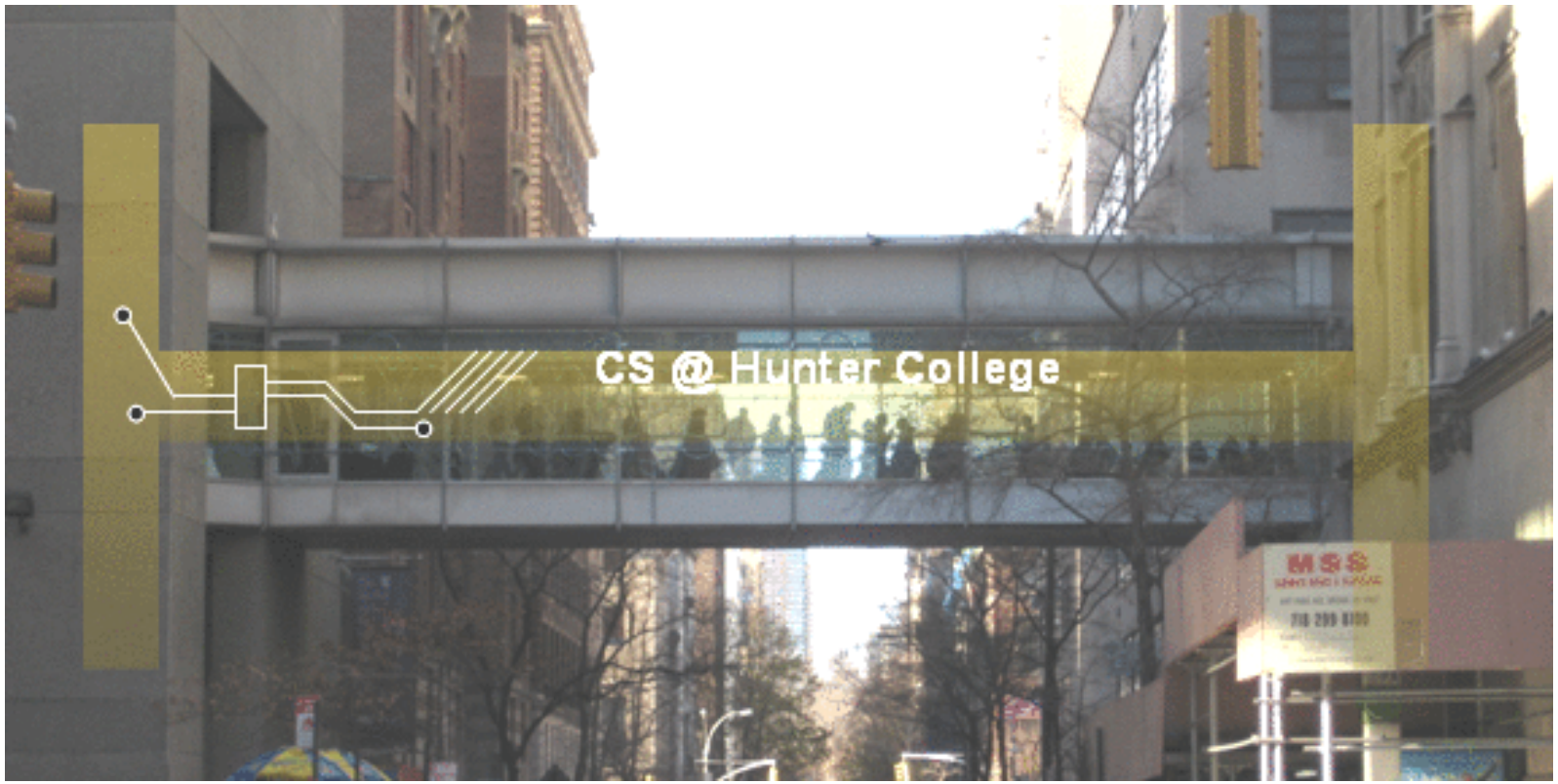
(Hunter College)



(FDR 4 FP)

- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.
- Past exams are on the webpage (under Final Exam Information).
- We're starting with Fall 2017, Version 3.

Writing Boards



- Return writing boards as you leave...