

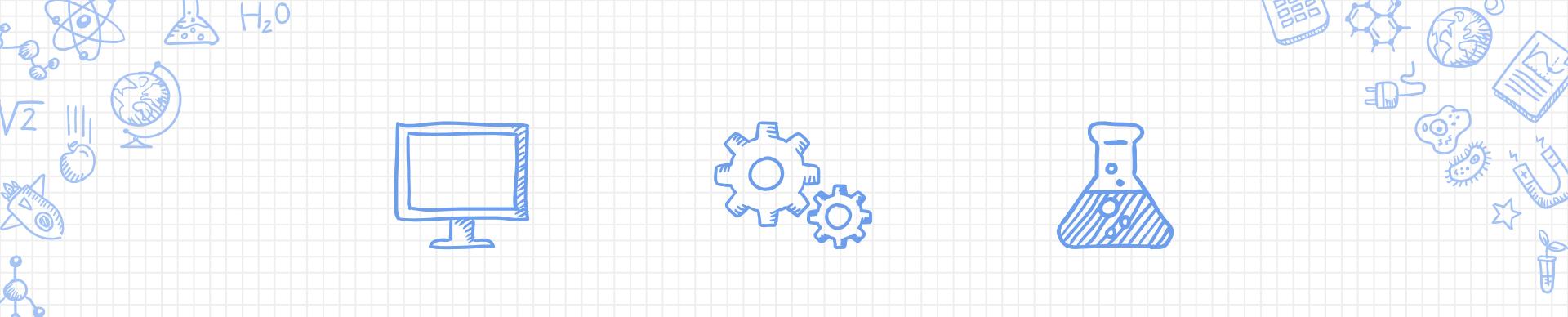
EE16A Lab

Friday 11am-2pm

TA: Seiya

LA: Cameron, Ed, Ryan

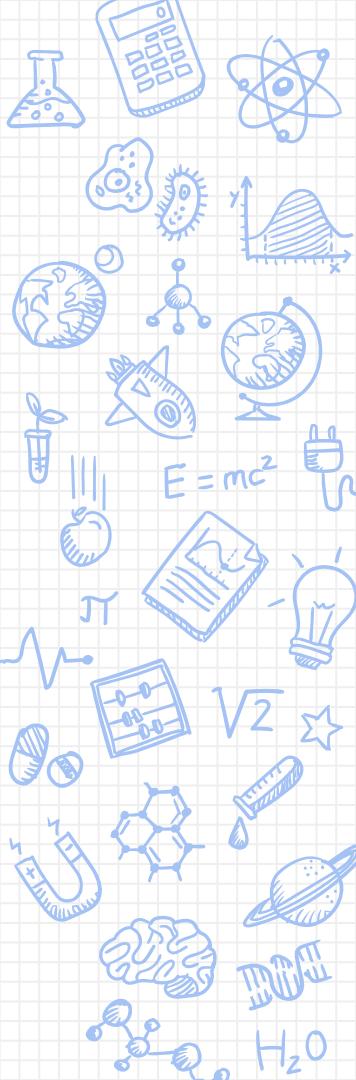




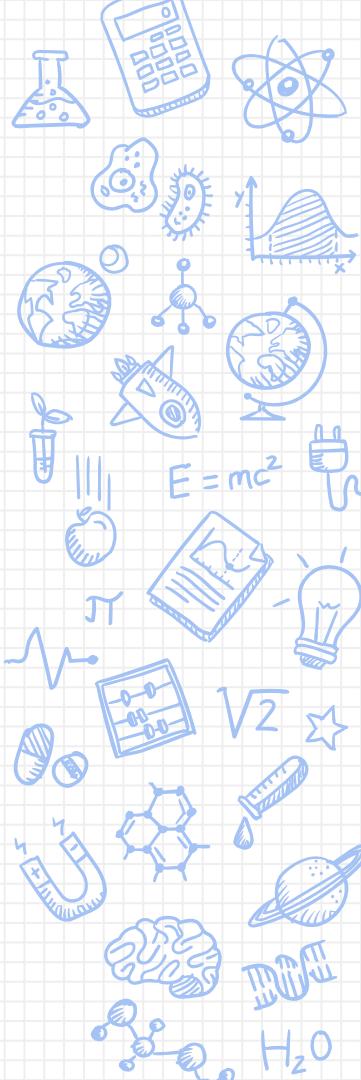
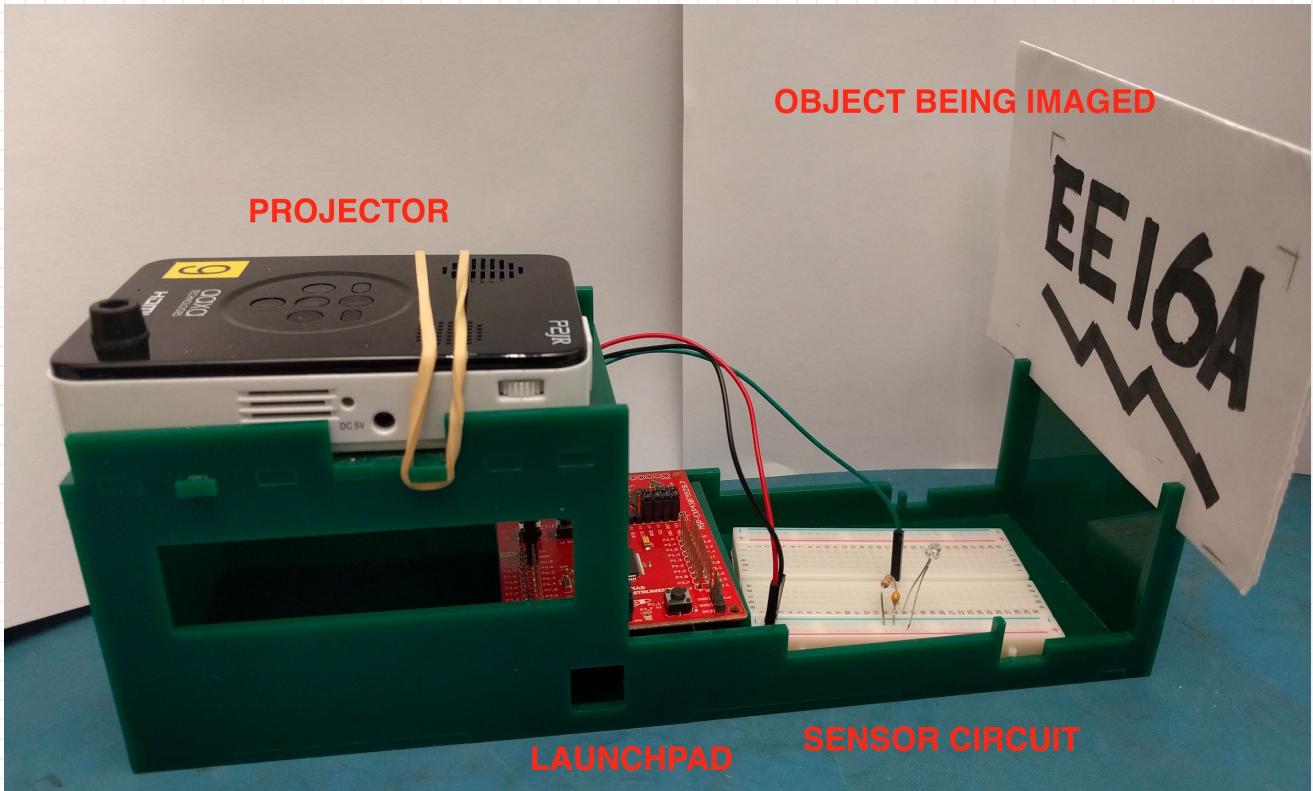
Imaging - Part 2

Today's Lab: Single Pixel Scanning

- ✗ Circuit from last week measures **light** intensity
 - ✗ Projector illuminates card in a controlled way
 - ✗ Python programming to reconstruct image

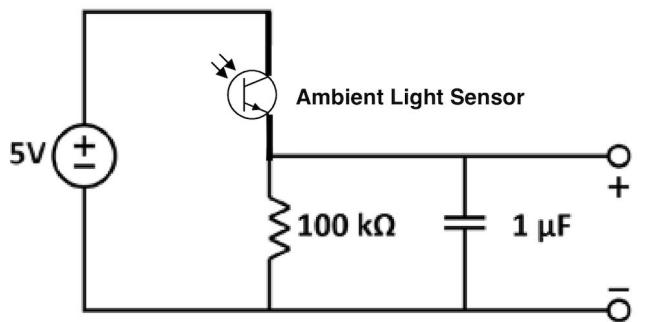


Setup:

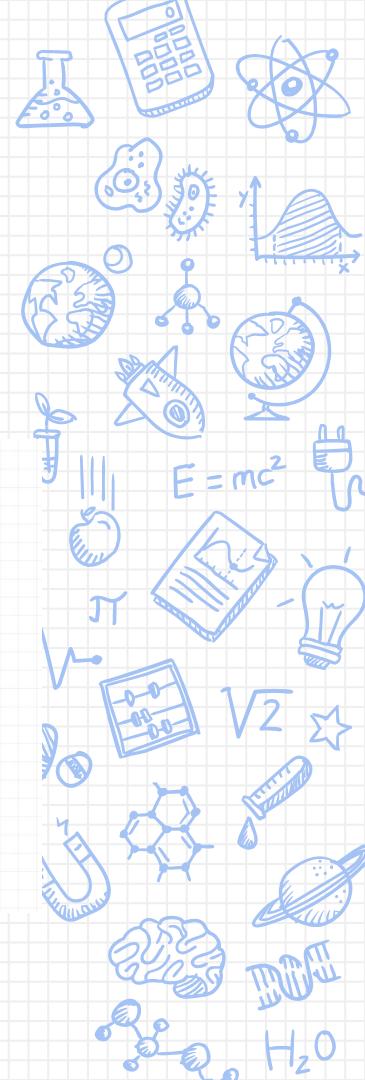
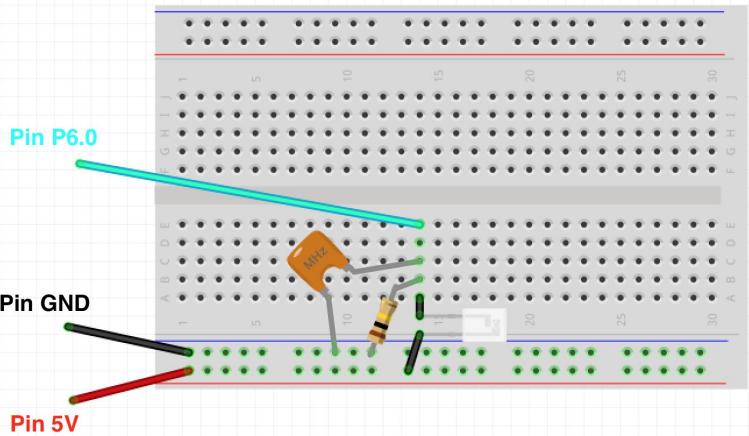


Circuit From Last Week

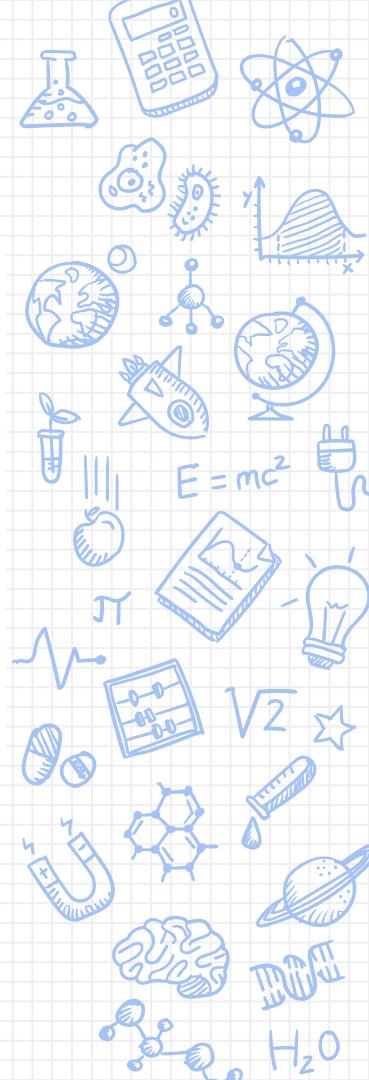
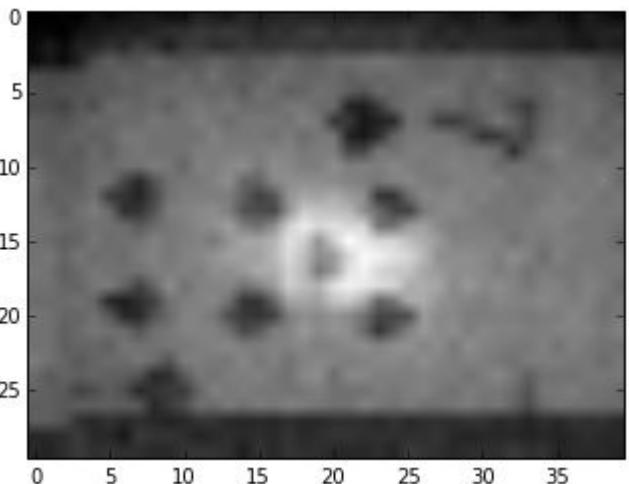
Circuit Diagram



Breadboard Diagram

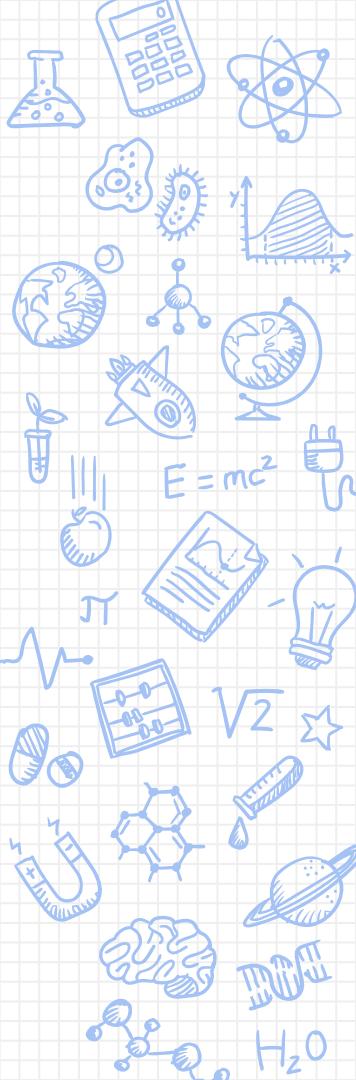
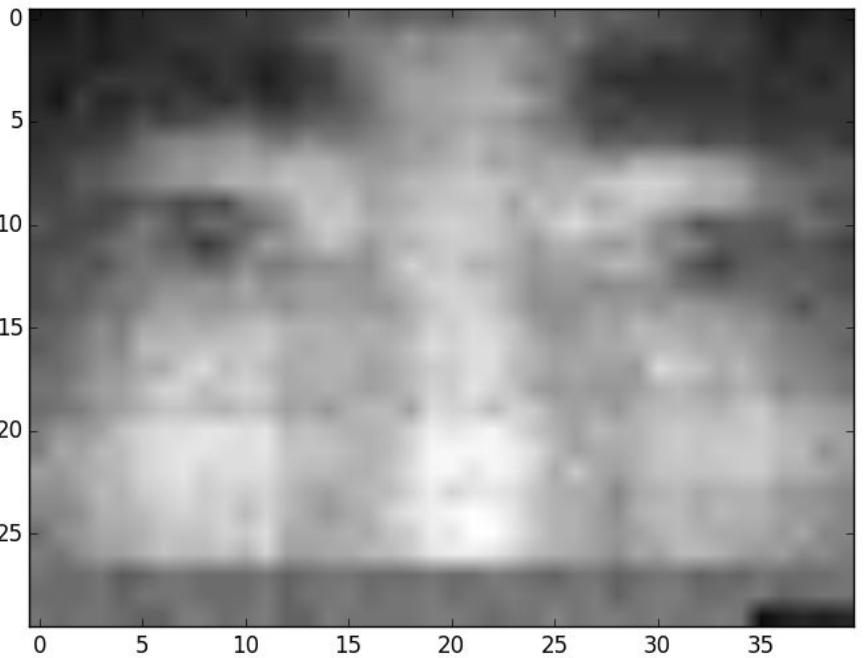


Sample Images



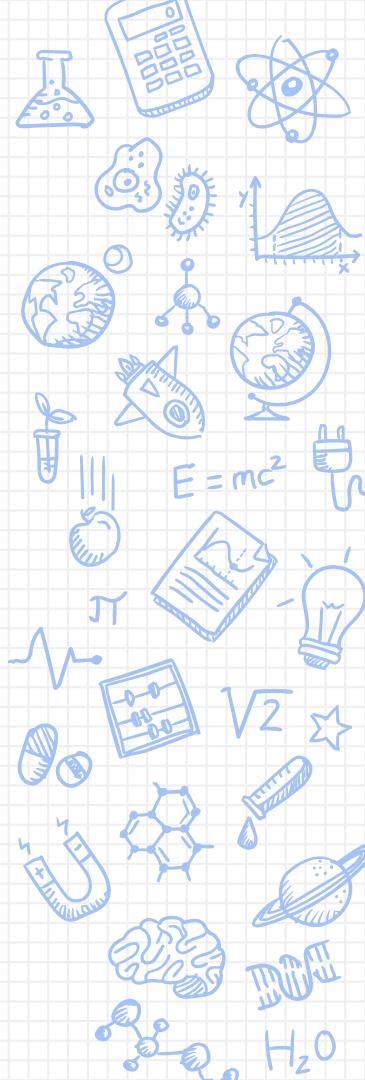
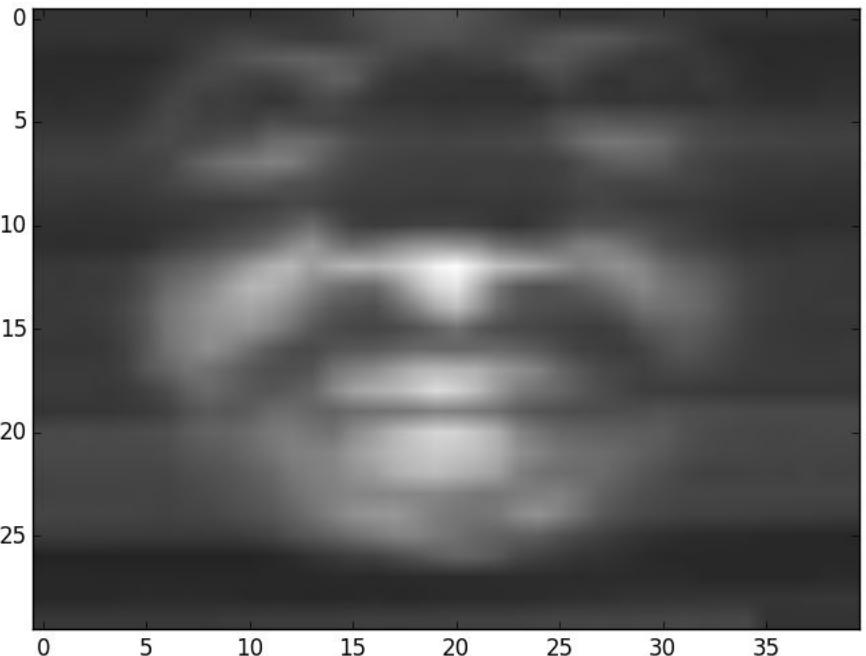
Sample Images

Me:

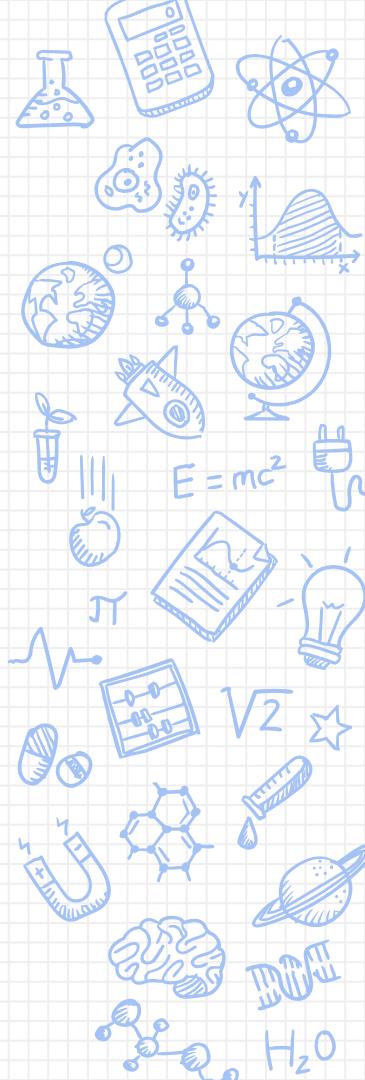
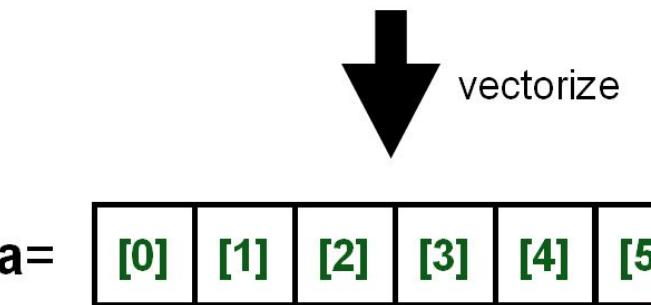
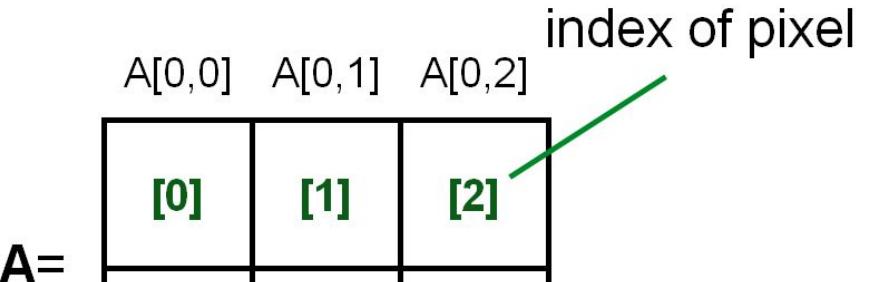
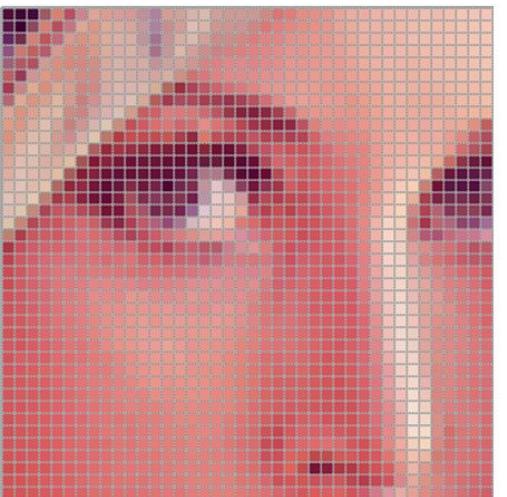


Sample Images

Nightmare
Fuel: Lab
Assistant
Nick

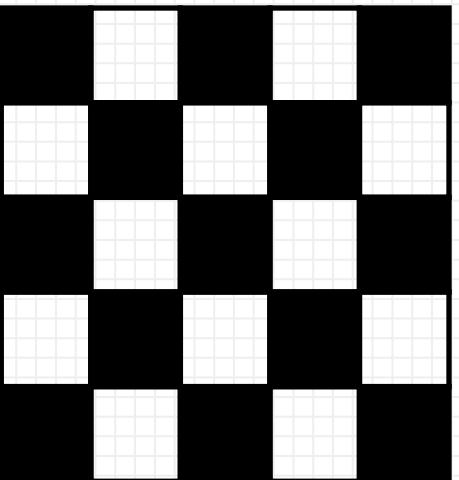


Images, Matrices, Vectors

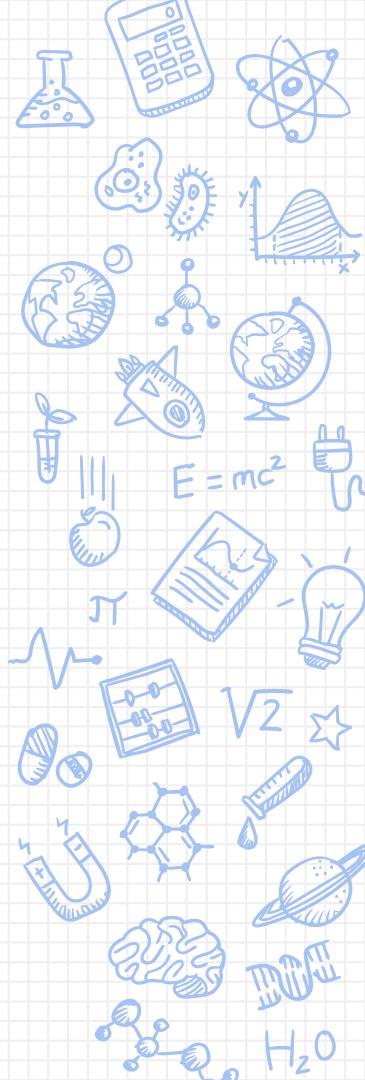
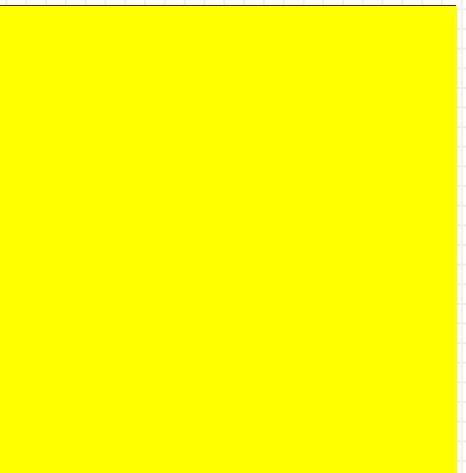


How Scanning Works?

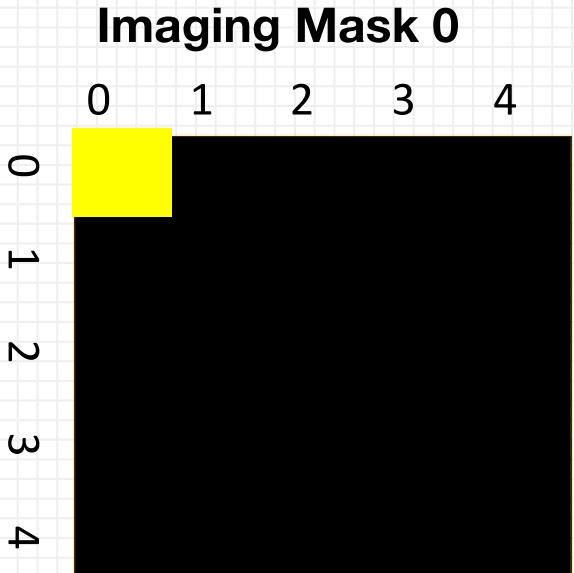
Real World Object



Imaging Mask

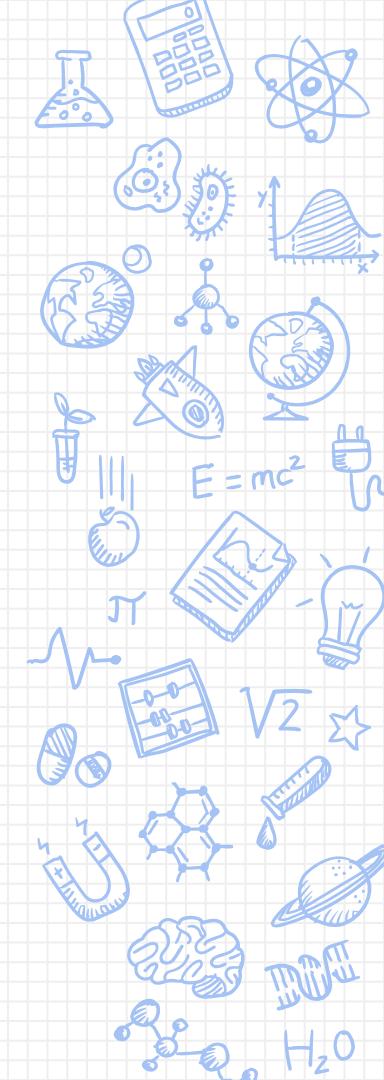


How Scanning Works: iPython



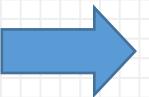
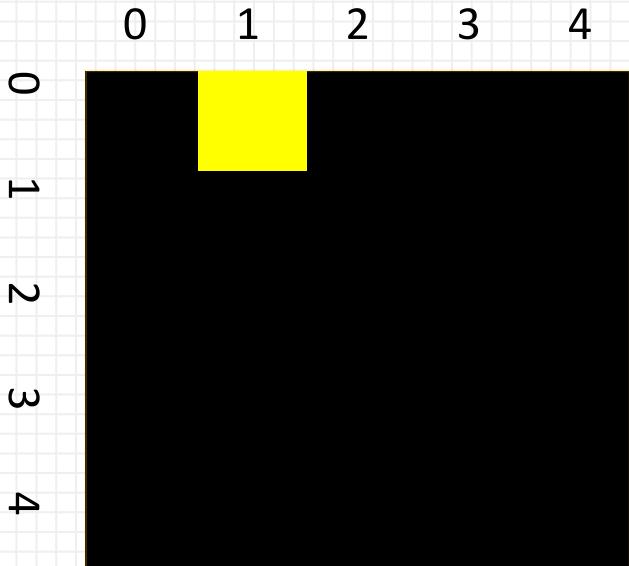
mask0 =

```
np.array([ [ 1, 0, 0, 0, 0 ]  
          [ 0, 0, 0, 0, 0 ]  
          [ 0, 0, 0, 0, 0 ]  
          [ 0, 0, 0, 0, 0 ]  
          [ 0, 0, 0, 0, 0 ] ])
```



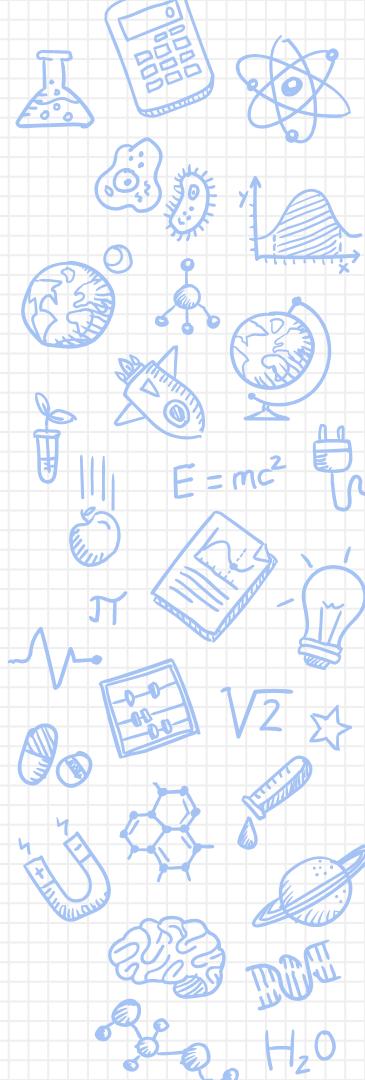
How Scanning Works: iPython

Imaging Mask 1



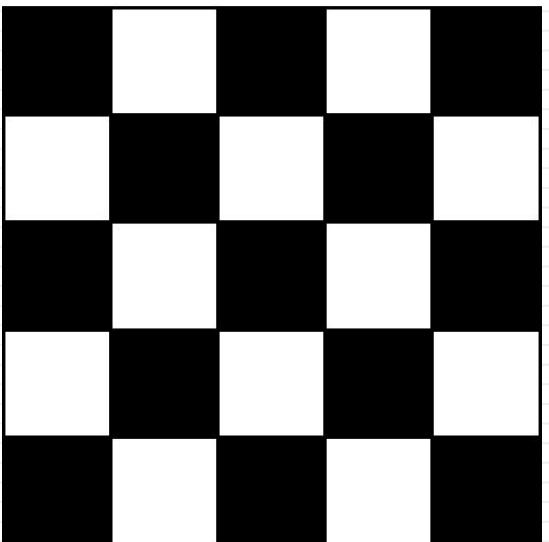
mask1 =

```
np.array([
    [ 0,  1,  0,  0,  0 ],
    [ 0,  0,  0,  0,  0 ],
    [ 0,  0,  0,  0,  0 ],
    [ 0,  0,  0,  0,  0 ],
    [ 0,  0,  0,  0,  0 ]])
```

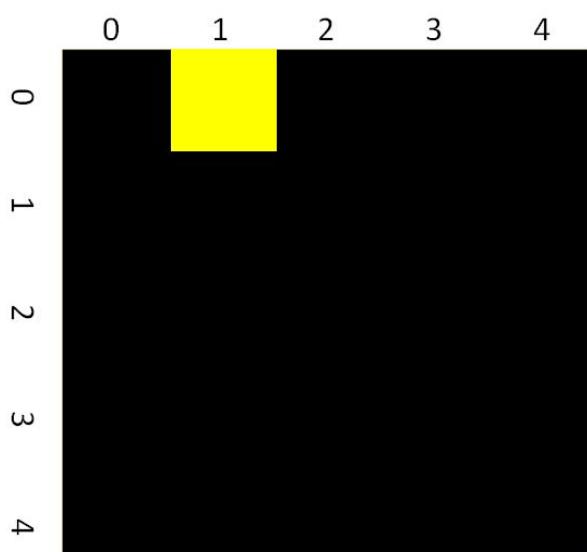


How Scanning Works: iPython

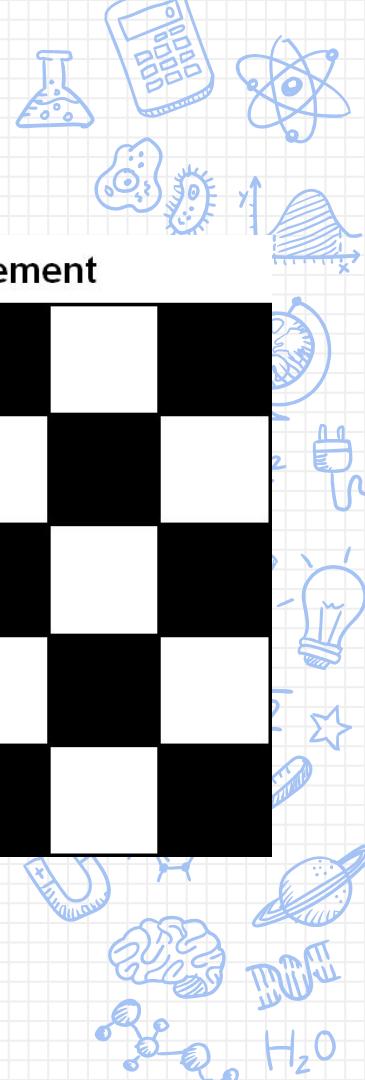
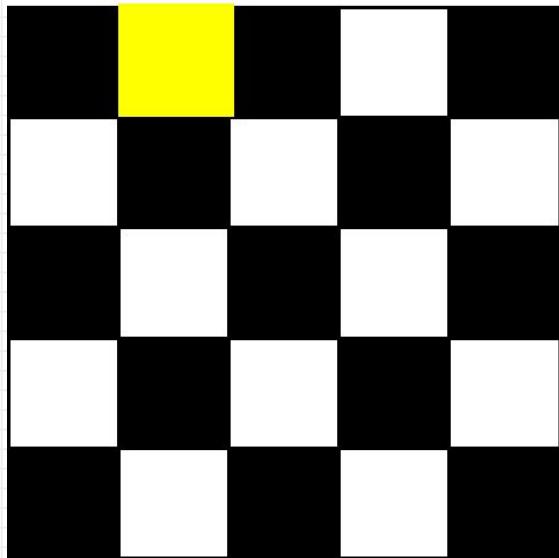
Real World Object



Imaging Mask 1

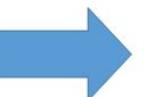


Measurement

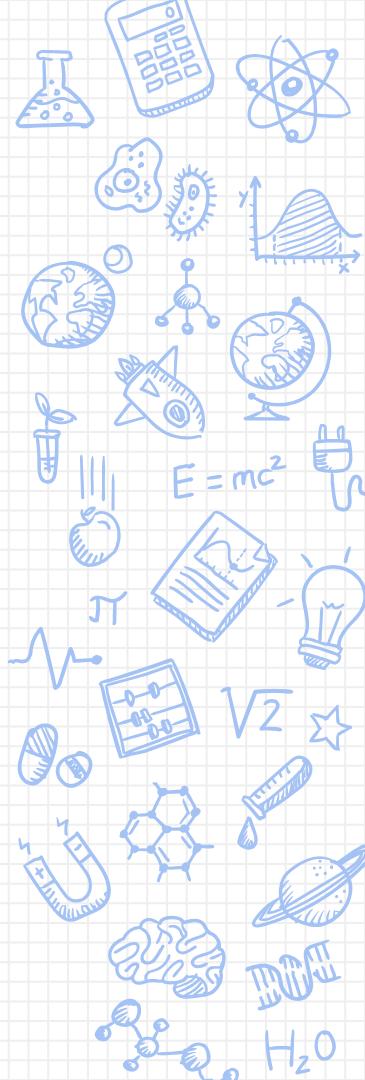


How Scanning Works: iPython

```
mask0 = [[ [ 1, 0, 0, 0, 0 ],  
           [ 0, 0, 0, 0, 0 ],  
           [ 0, 0, 0, 0, 0 ],  
           [ 0, 0, 0, 0, 0 ],  
           [ 0, 0, 0, 0, 0 ] ]]
```

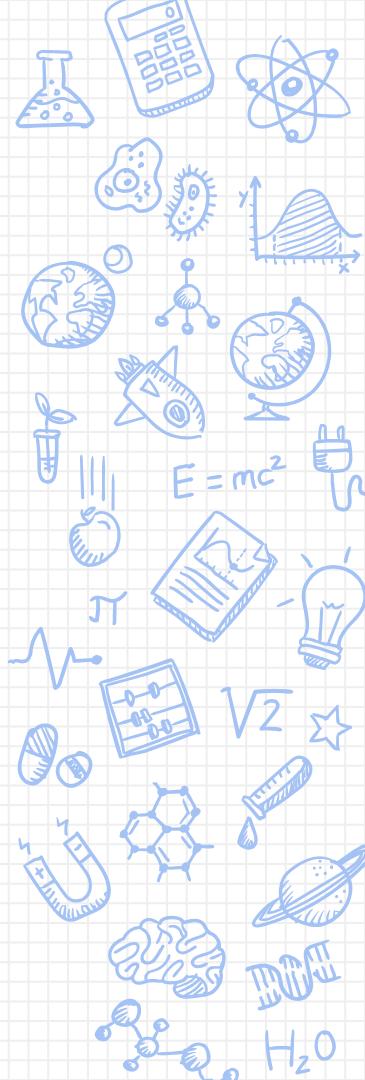
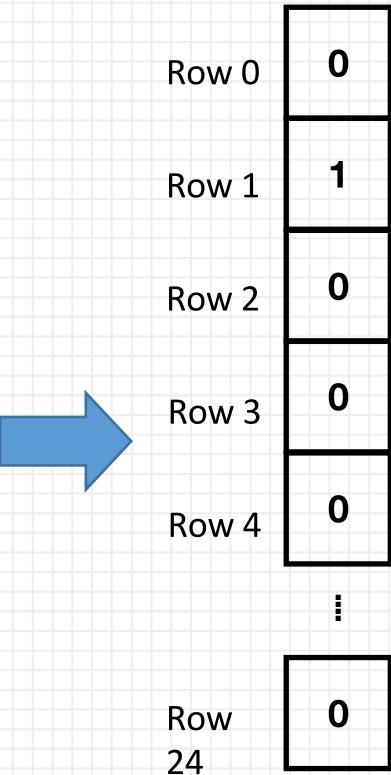


Row 0	1
Row 1	0
Row 2	0
Row 3	0
Row 4	0
⋮	⋮
Row 24	0



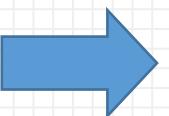
How Scanning Works: iPython

```
mask1 = [[0, 1, 0, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0]]
```

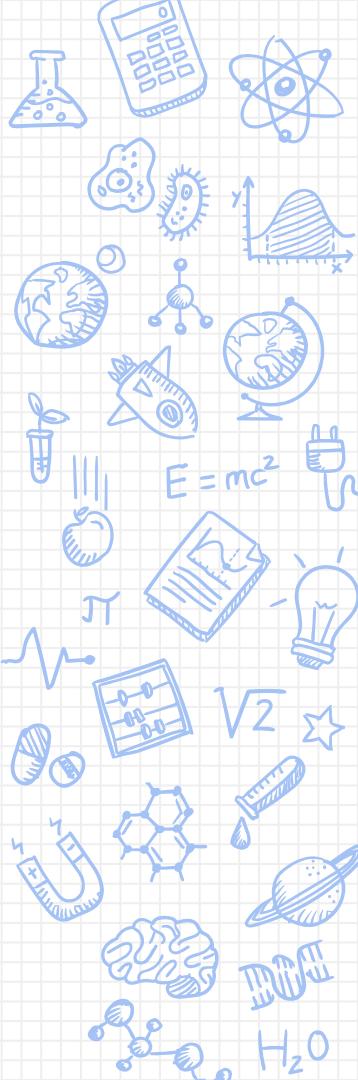


How Scanning Works: iPython

```
mask2 = [[0, 0, 1, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0],  
         [0, 0, 0, 0, 0]]
```



Row 0	0
Row 1	0
Row 2	1
Row 3	0
Row 4	0
⋮	⋮
Row 24	0



How Scanning Works: iPython

```
mask0 = [[ 1, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ]]]
```

```
mask1 = [[ 0, 1, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ]]]
```

```
mask2 = [[ 0, 0, 1, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ],  
         [ 0, 0, 0, 0, 0 ]]]
```

H =

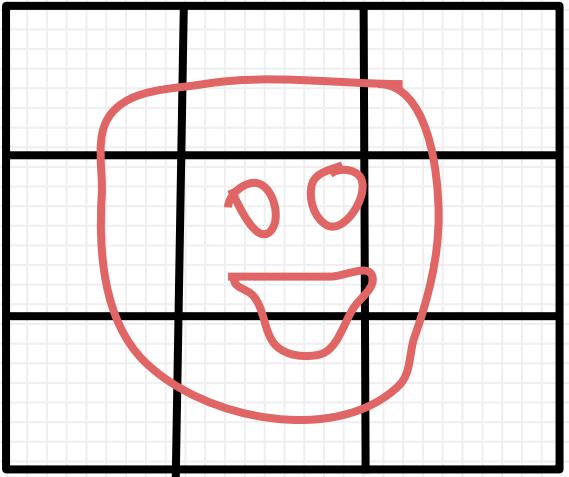
	mask0	mask1	mask2
Row 0	1	0	0
Row 1	0	1	0
Row 2	0	0	1
Row 3	0	0	0
Row 4	0	0	0
...	⋮	⋮	⋮
Row 24	0	0	0

What is the total size of this matrix?

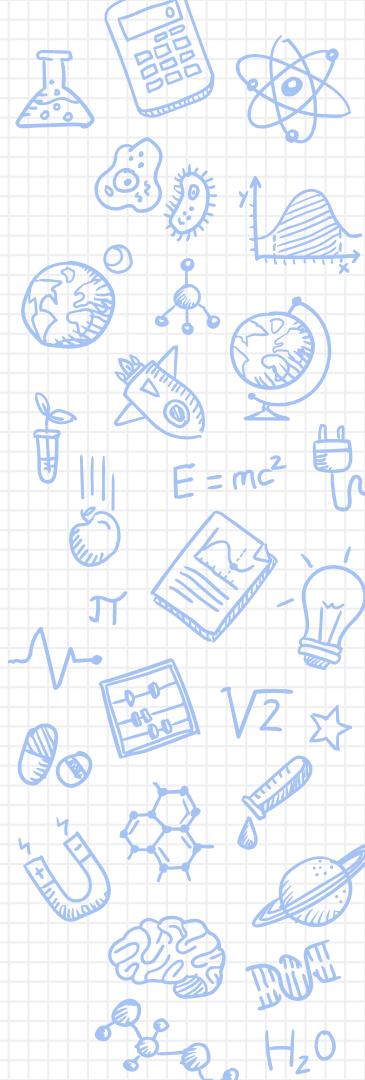
How does H relate to the masks?



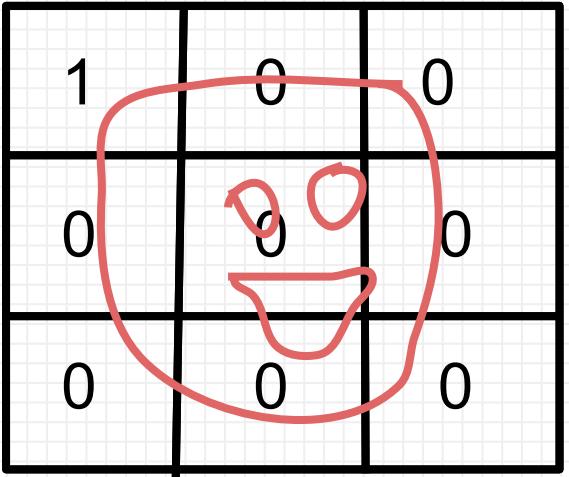
How Scanning Works: iPython



What will the scanning matrix's dimensions be?

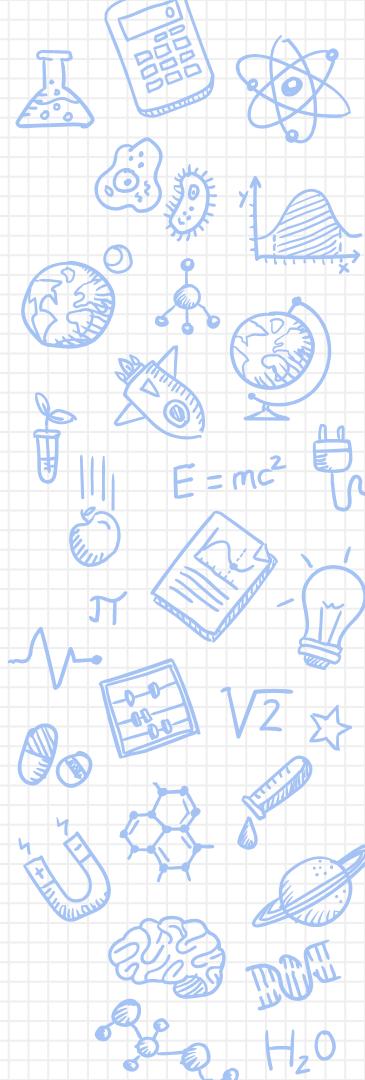


How Scanning Works: iPython



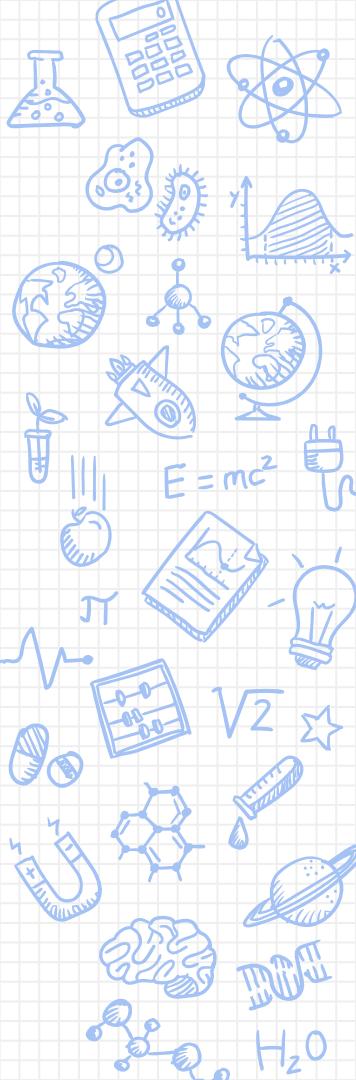
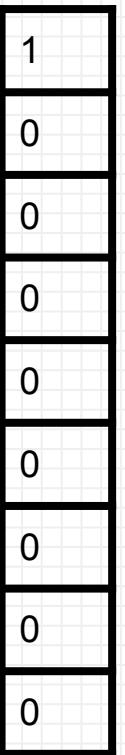
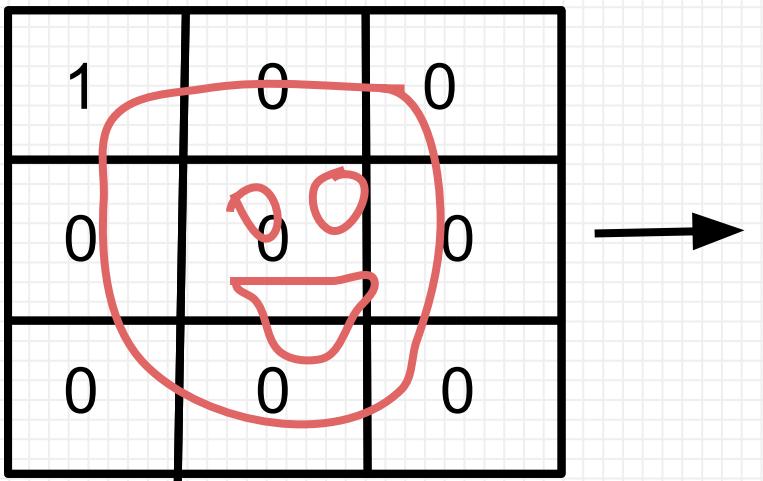
What will the scanning matrix's dimensions be?

How many total pixels are in the picture?



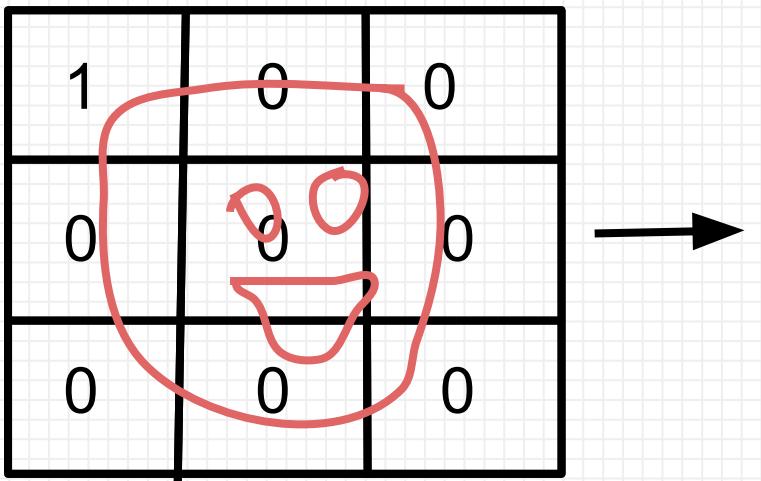
How Scanning Works: iPython

What will the scanning matrix's dimensions be? How many pixels?



How Scanning Works: iPython

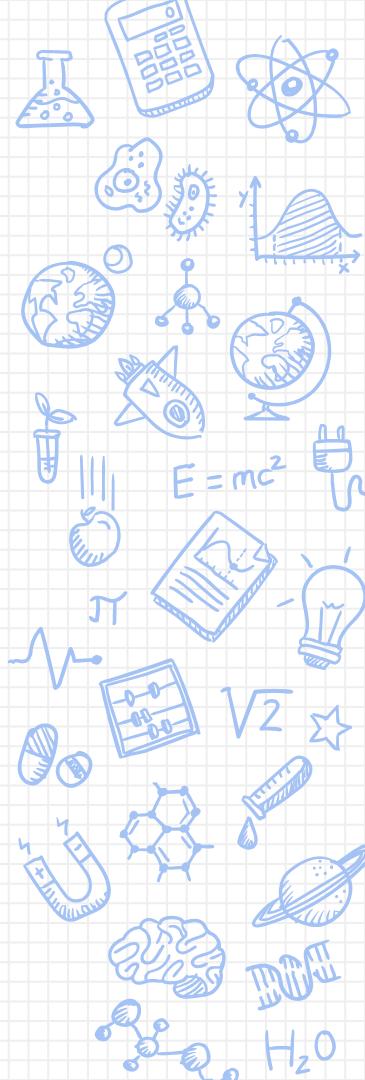
What will the scanning matrix's dimensions be? How many pixels?



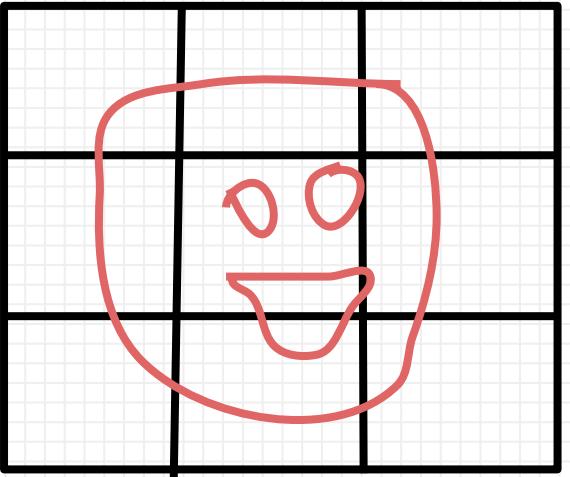
1
0
0
0
0
0
0
0
0
0

9x9

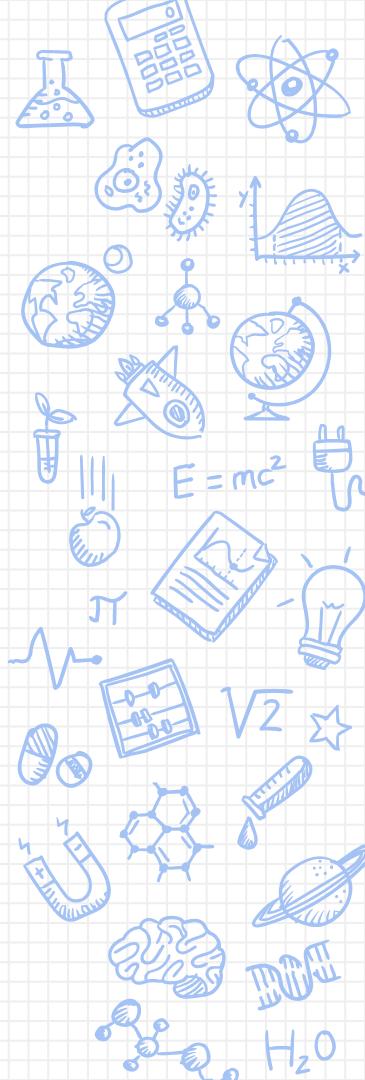
...



How Scanning Works: iPython



What will the scanning matrix's dimensions be?

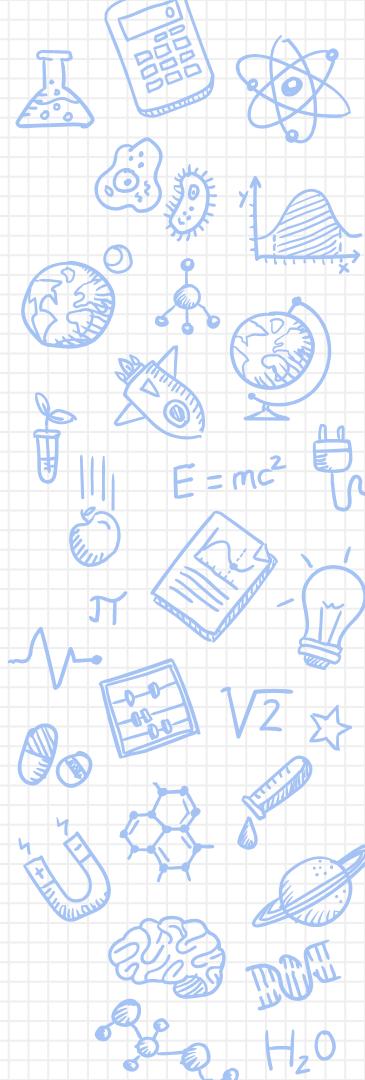


How Scanning Works: iPython

1	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

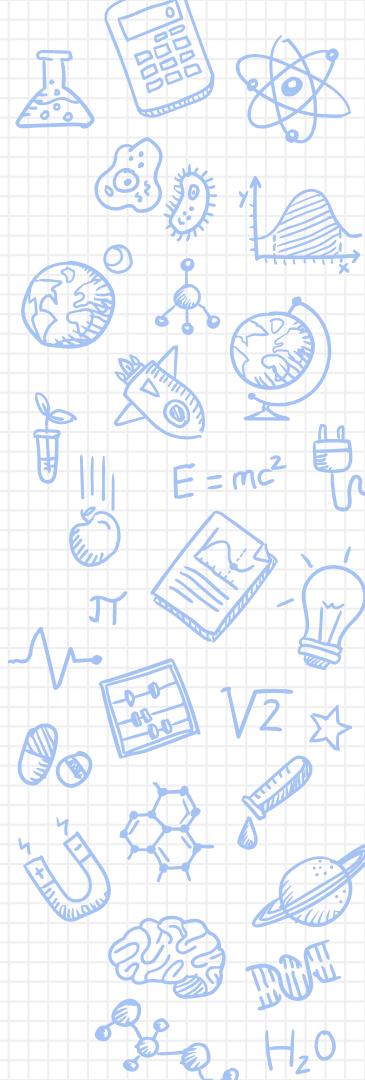
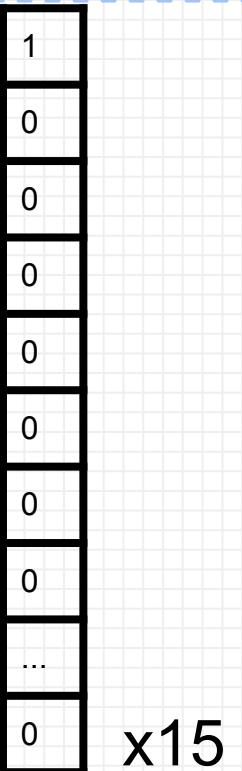
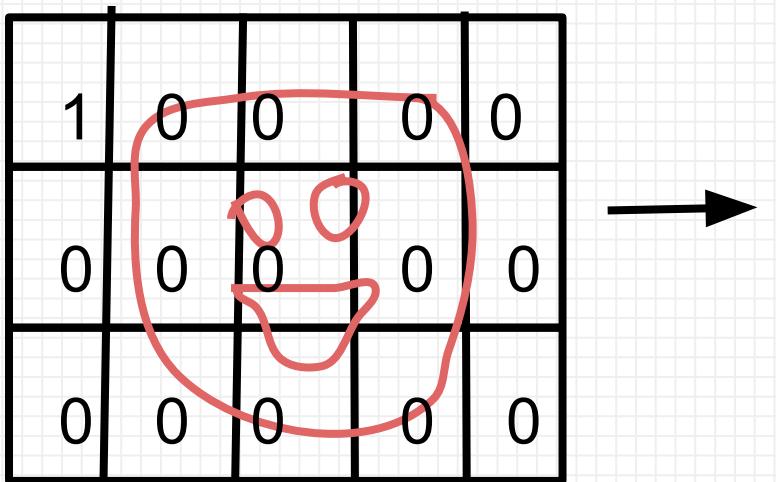
What will the scanning matrix's dimensions be?

How many pixels?



How Scanning Works: iPython

What will the scanning matrix's dimensions be? How many pixels?



How Scanning Works: iPython

What will the scanning matrix's dimensions be? How many pixels?

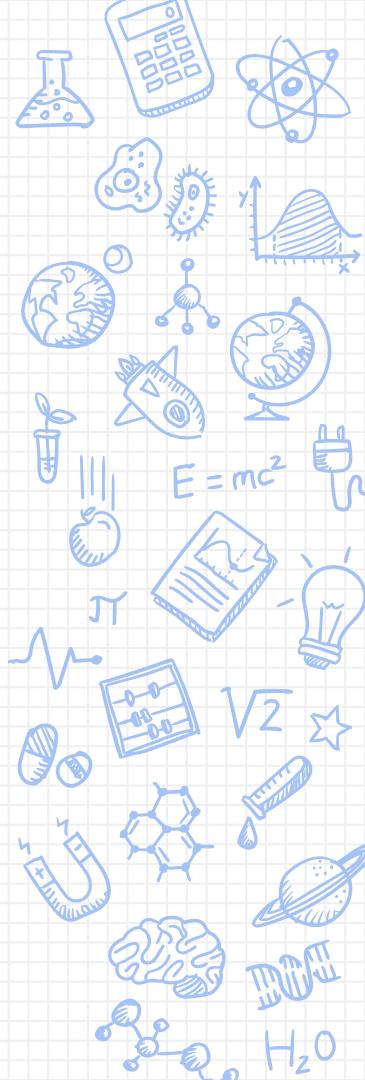
1	0	0	0	0
0	0	0	0	0
0	0	0	0	0



1
0
0
0
0
0
0
0
0
0
0
0
0
0
0

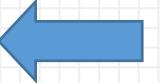
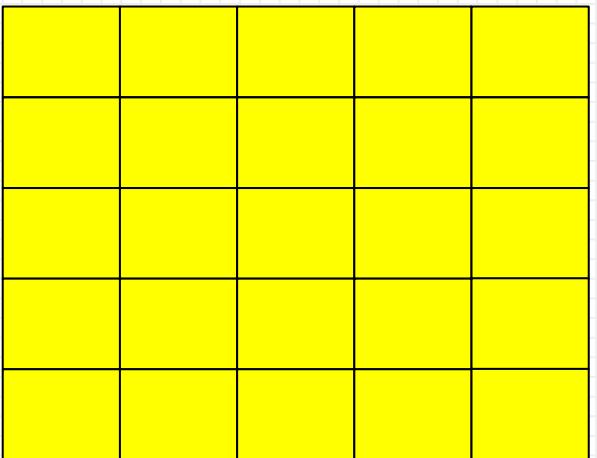
15x15

...

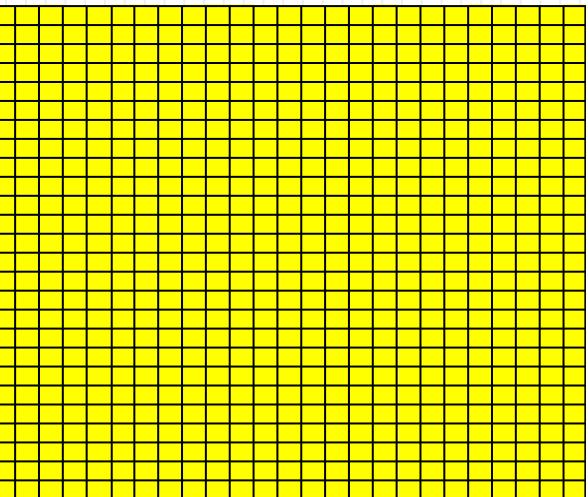


Using H to scan our image!

Mask Projected onto
Real World Object



Masking
Matrix H

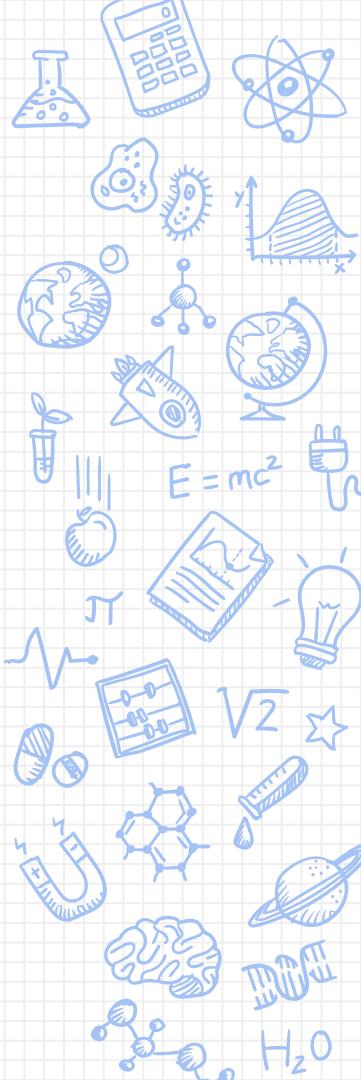


IPython Review:

```
for i in range(0,5):  
    print(i)
```

```
A = np.zeros((5,5))  
counter = 0;  
for i in range(0,5):  
    for j in range(0,5):  
        A[i,j] = counter/24;  
        counter = counter + 1
```

```
A = (np.arange(0,25,1)/24).reshape((5,5))
```

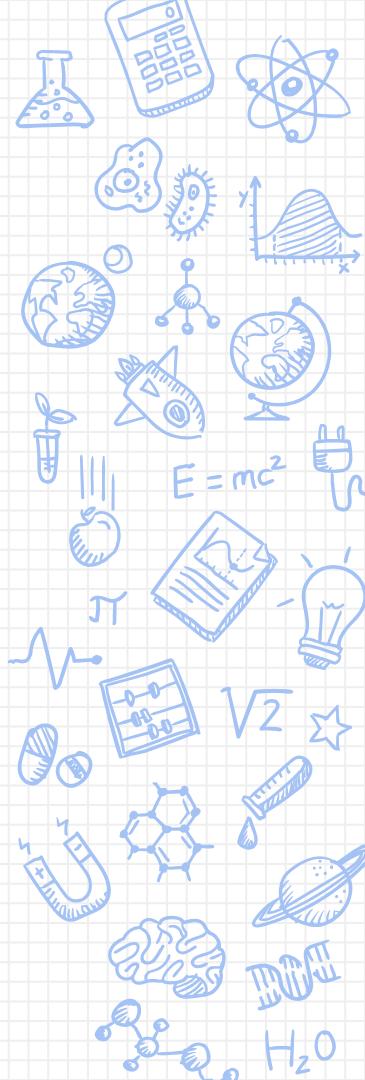


IPython Review:

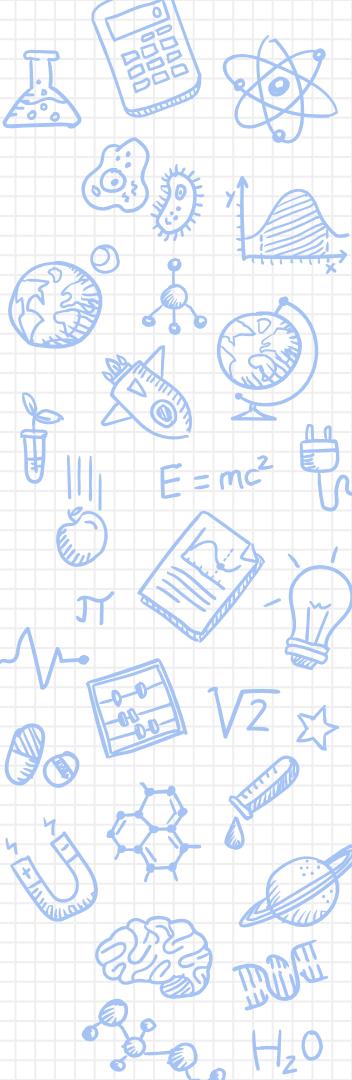
```
>>> import numpy as np  
>>> A = np.array([ [1, 2, 3], [4, 5, 6] ])  
>>> B = np.matrix('12; 34')  
>>> C = np.matrix( [ [1, 2], [3, 4] ] )
```

Some numpy functions:

- A.shape, A.T, np.dot
- A[i , j], A[i , :], A[:, j], A[:, ::-1]
- And many more... **Google is your friend!**

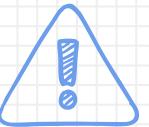


Tips for a Good Image

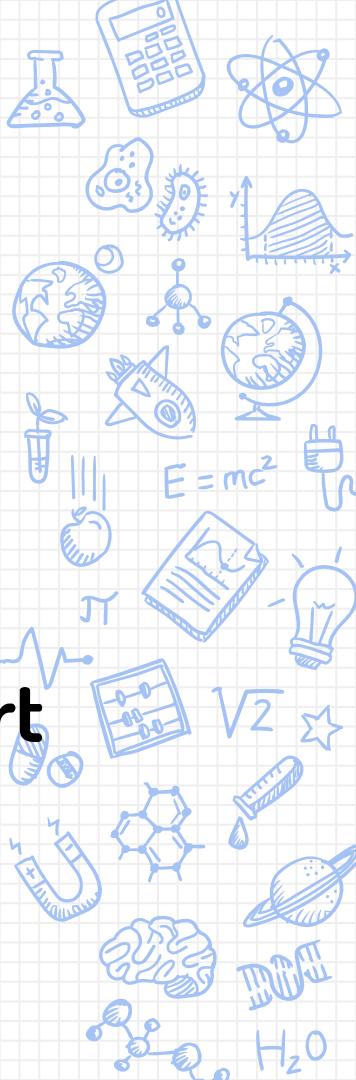


- ✖ Adjust contrast and brightness of projector
 - ✖ Projector's Home Screen → "Setting"
 - ✖ Change Picture Mode from "standard" to "User" by first pushing OK then right bottom X2
 - ✖ Select Contrast and increase to 100
 - ✖ Select Brightness and decrease to 0
 - ✖ Return back to main menu
- ✖ Focus projector using dial on the side
- ✖ Close the box firmly & scan under dark conditions

Important Notes

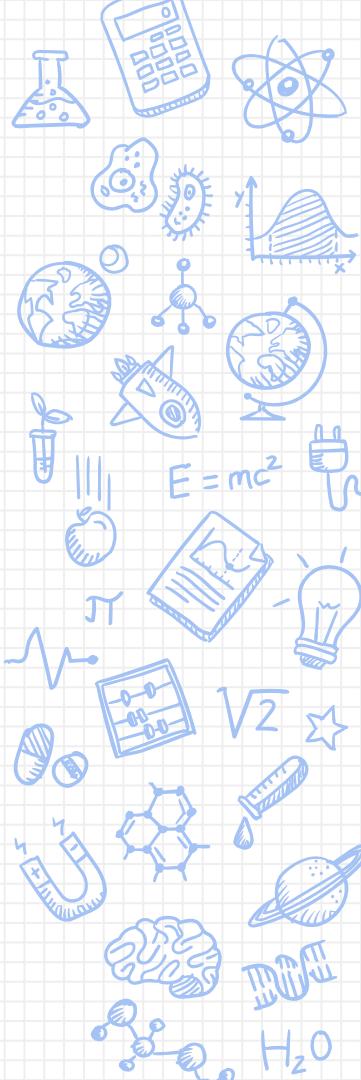


- ✗ You should have your kit from last week
- ✗ Equipment in cardboard box:
 - ✗ Don't break the plastic stand!
 - ✗ Put everything back before you leave!
 - Including Projector's Power
- ✗ Make sure you are using the right com port at all times
 - ✗ Not COM1, and not the debugger



Notes

- ✗ No signal when testing the oscope on their previous circuit
 - ✗ **Unplug P6.0 from MSP and debug if necessary**
- ✗ UART Application Com Port not showing up as an option when scanning
 - ✗ **Close serial monitor!**
- ✗ Do not take sharpies from the desk
- ✗ Limited number of Light Sensors: Share if necessary
- ✗ If something isn't working, close everything and turn it back on (works 9/10 times)



FAQ

- ✗ **SHIFT+RIGHT CLICK** on a window to open in **CMD**
 - ✗ ‘**ipython notebook**’ to open ipython notebook
- ✗ Point ALS at the index card [and not top of box]
 - ✗ Make sure it's not in the way of projection
- ✗ If no pictures show up, copy the URL and open it in Chrome
- ✗ **Check off:**tinyurl.com/lab108-checkoff
- ✗ **Ask Questions:** tinyurl.com/lab108-Q
- ✗ **This Presentation:** tinyurl.com/lab108-img2

