Adventures in Coding **2**
Python

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All links to images available in speaker notes

If you are interested…

All class materials are posted to my lab's GitHub page
https://github.com/ou-sbselab/SECS-SummerCamp

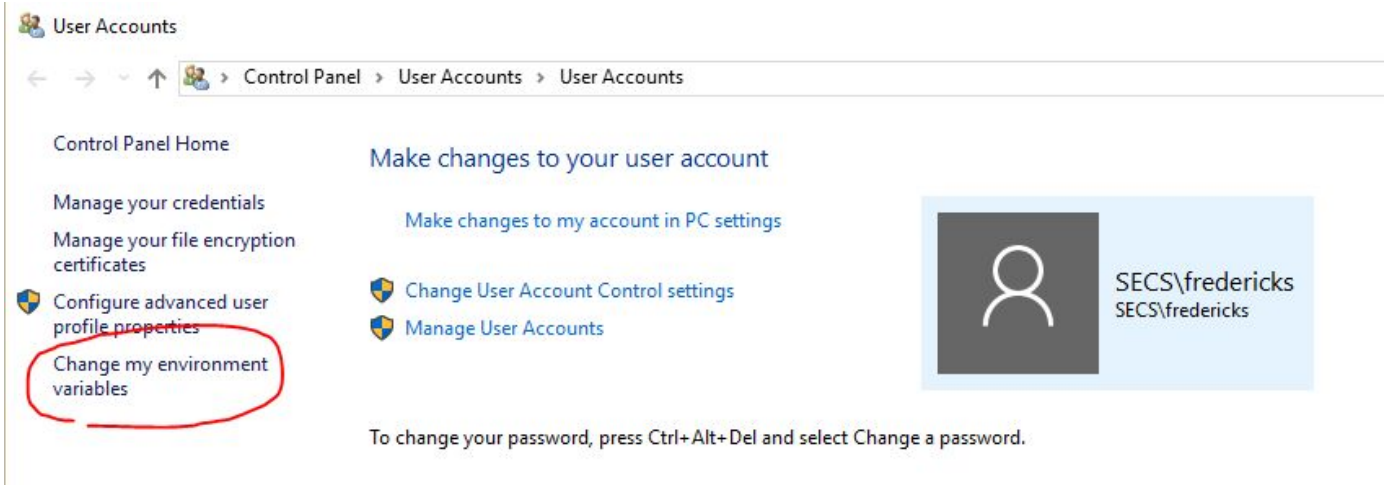
(Your stuff is in adventures-in-coding-2)

Here you can find all the presentations, code, guides, etc.

Python Setup

Python is broken on these machines! Let's fix that.

Search for **User Accounts**, open it, and then click **Change my Environment Variables**



Fixing Python

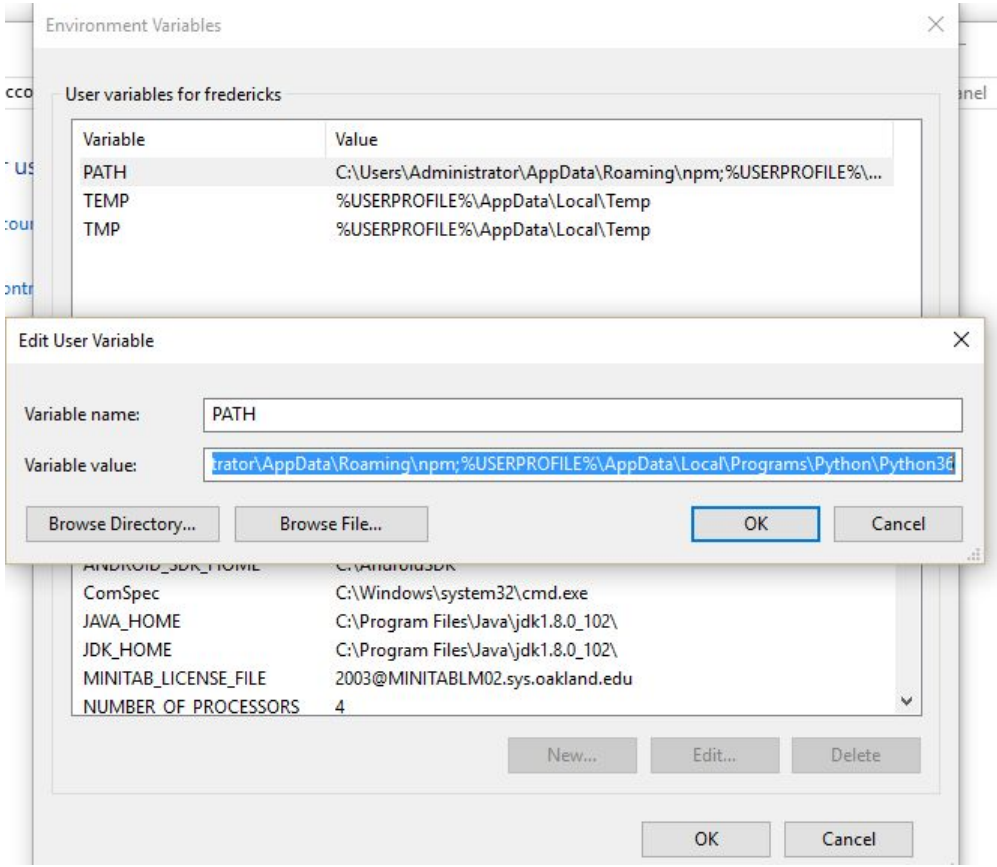
Click **PATH** at the top and then click **Edit..**

After Variable value:

Add **;%USERPROFILE%\AppData\Local\Programs\Python\Python36**

Click OK to save.

THE SEMI-COLON IS IMPORTANT!



Python works!

Run a command prompt. Start → cmd. Type **python and you should see this.**

C:\Windows\System32\cmd.exe - python

```
C:\Windows\system32>python
Python 3.6.2 (v3.6.2:5fd33b5, Jul  8 2017, 04:57:36) [MSC v.1900 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

`exit()` will quit Python

Install pygame (we'll need it later)

In the command prompt, navigate (cd) to
%USERPROFILE%\AppData\Local\Programs\Python\Python36\Scripts

Run:

```
python -m pip install pygame
```

```
C:\Users\fredericks\AppData\Local\Programs\Python\Python36\Scripts>python -m pip install pygame
Collecting pygame
  Downloading https://files.pythonhosted.org/packages/e4/1f/23e1620de98d3eff46cbd470dc9465c5b860c06d37787781d756135b512b
/pygame-1.9.3-cp36-cp36m-win_amd64.whl (4.2MB)
    100% |████████████████████████████████| 4.2MB 319kB/s
Installing collected packages: pygame
Successfully installed pygame-1.9.3
You are using pip version 9.0.1, however version 10.0.1 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.

C:\Users\fredericks\AppData\Local\Programs\Python\Python36\Scripts>
```

Check to make sure it works!

Run python:

```
C:\> python

>>> import pygame
```

Adventures in Coding 2 Topics

Quick Python review

Python classes

Continuation of game design concepts

Wake up!

Launch the Python IDE → IDLE

1) Create a variable that holds **your name**
2) Create another variable that holds **your school**
3) Print out “My name is **your name** and I attend **your school.**”

So if I did this, it would say:

```
My name is Professor Erik, and I attend Oakland University.
```

Python reminder:

```
variable = “string”
print("I am printing out the %s" % (variable))
```

Functions

```
def this_function_is_neat(loop):
    for i in range(0,loop):
        print "%d is the best number" % i
```

1) What does **this_function_is_neat** actually do?
2) How would you call it?

`main` in Python

```
# Functions functions functions…
..
..
..
if __name__ == "__main__":
    print('this is the main function')
```


Classes

Classes

C#

```
public class MyClass
{
  public MyClass()
  {
    // Initialize class
    int x    = 1;
    String y = "name";
  }
}

var my_class = MyClass();
```

Python

```
def MyClass(object):
  def __init__(self):
    self.x = 1
    self.y = "name"


my_class = MyClass()
```

HelloWorld Class

```
class HelloWorld(object):
  def __init__(self, in_name):
    print "Hello there!  I am printed whenever you instantiate me"
    self.student_name = in_name


hello = HelloWorld("Prof. Erik")
```

Student class

```
class Student(object):
    # Initialize student information
    def __init__(self, name, sid, age, hobby):
        self.name  = sname
        self.sid   = sid
        self.age   = age
        self.hobby = hobby

    # Print out the student's age
    def printAge(self):
        print("%s is %d years old." % (self.name, self.age))
```

Inheritance!

One common OOP concept is **inheritance**

One class **inherits** from another

```
# Define a class that specifies a Person
class Person(object):
    def __init__(self, name, age):
        self.name = name
        self.age  = age

    def Print(self):
        print("Name [%s], Age [%d]" % (self.name, self.age))
```

Inherit from Person

```
# Create a student → derives from Person
class Student(Person):
    def __init__(self, name, age, student_id):
        Person.__init__(name, age)
        self.student_id = student_id

    def Print(self):
        print("Name [%s], Age [%d], Student ID [%d]" % \
            (self.name, self.age, self.student_id))

p = Person("Your Name", 40)
s = Student("Your Name", 40, 123456789)
```

Other things to remember ➔ DECISIONS and LOOPS

Decisions:

```
something = "do it"
if (something == "do it"):
    print("I did something")
else:
    print("I did something else!")
```

LOOPS (and random and lists)

```
import random

students = []
for i in range(10):
    student_name = "Student %d" % i
    s = Student(student_name, random.randint(10,20), \
                random.randint(1,10000))

    students.append(s)

for student in students:
    student.Print()
```

Questions!

- Why is it Student 0 instead of Student 1?
- How would you **extend the Student class** to include the classes a student is taking?

Extend Student class

```
# Classes is a list!
class Student(object):
    def __init__(self, name, age, student_id, classes):
        …
        self.classes = classes

    # Print a list of classes per student
    def PrintClasses(self):
        for class in classes:
            print class

s = Student("Name", 12, 1234456, ["Math", "Social Studies"])
s.PrintClasses()
```

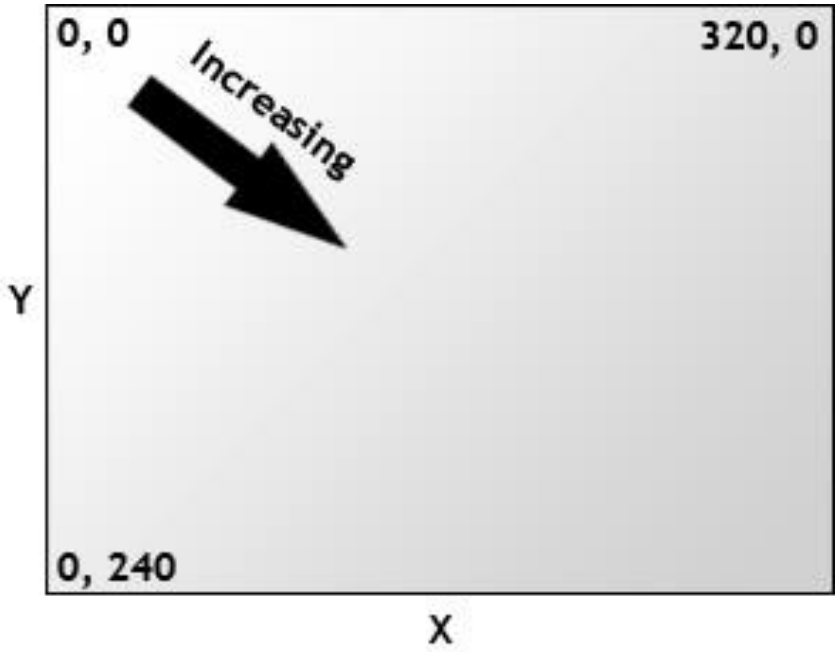
Remember pygame? Let's do that again!

```
import pygame
# Hello world of graphics
pygame.init()
screen = pygame.display.set_mode((640, 480))

done = False
while not done:
  for event in pygame.event.get():
    if event.type == pygame.QUIT:
      done = True

  pygame.draw.rect(screen, (0,128,255), pygame.Rect(30,30,60,60))
  pygame.display.flip()
```

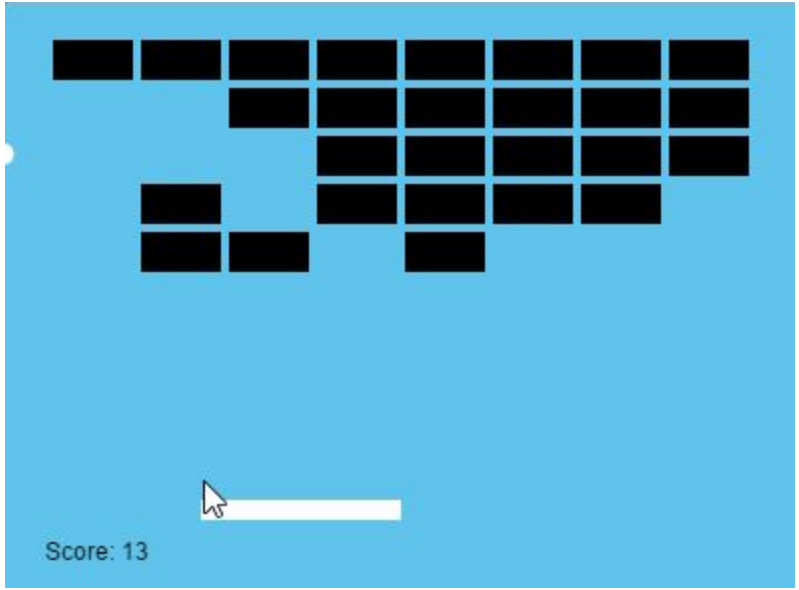
Drawing to the screen

Back to the rectangle...

The monitor ➔



Game for the rest of the day: Breakout



What do we need to make a game?

Imports we'll need

```
import pygame
import sys
import random
```

Constants

```
SCREEN_W = 640
SCREEN_H = 480

BRICK_W  = 60
BRICK_H  = 15

PADDLE_W = 60
PADDLE_H = 12

BALL_DIAMETER = 16
BALL_RADIUS   = int(BALL_DIAMETER / 2)
```

More Constants

```
MAX_PADDLE_X = SCREEN_W - PADDLE_W
MAX_BALL_X   = SCREEN_W - BALL_DIAMETER
MAX_BALL_Y   = SCREEN_H - BALL_DIAMETER

PADDLE_Y     = SCREEN_H - PADDLE_H - 10

BLACK = (0, 0, 0)
GOLD  = (135, 113, 72)
WHITE = (255, 255, 255)
BLUE  = (0, 0, 255)
```

A few more!

```
# State machine
S_BALL_IN_PADDLE = 0
S_PLAYING        = 1
S_WON            = 2
S_GAME_OVER      = 3
```


Add your constants!

Game class

Let's setup a skeleton that we'll fill out throughout the rest of the day.

```
### CONSTANTS
... (from prior slides) → don't type this in.

### GAME CLASS
class OUBreakout(object):
  def __init__(self):
    print 'Init'

### MAIN
if __name__ == '__main__':
  game = OUBreakout()
```

```
(in OUBreakout class)

# Initialize the our main class and pygame
def __init__(self):
    pygame.init()

    self.screen = pygame.display.set_mode((SCREEN_W,SCREEN_H))
    pygame.display.set_caption('OU Breakout')
    self.clock = pygame.time.Clock()

    if pygame.font:
        self.font = pygame.font.Font(None, 30)
    else:
        self.font = None

    self.initialize_game()
```

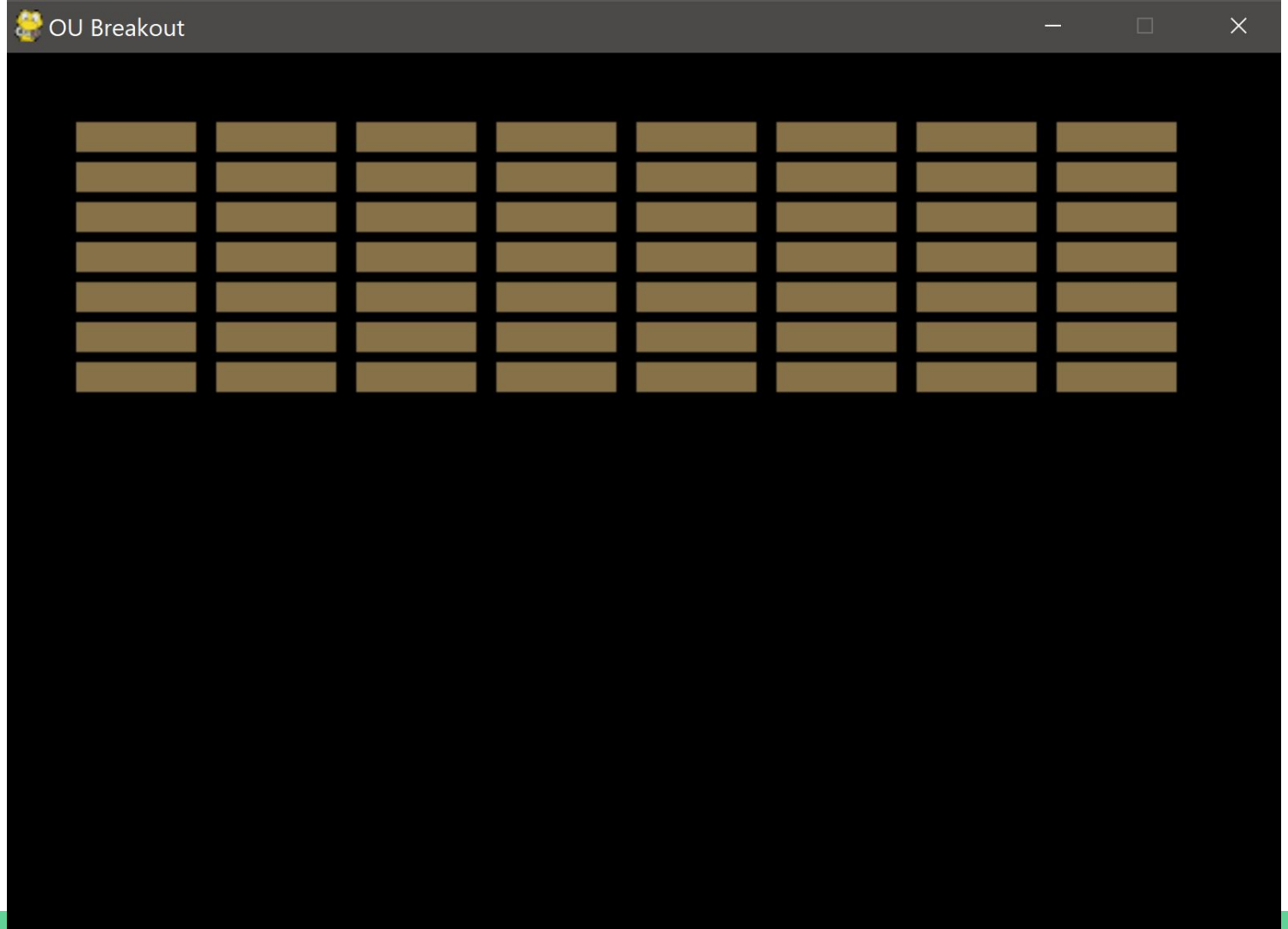
```
def initialize_game(self):
    self.lives = 3
    self.score = 0
    self.state = S_BALL_IN_PADDLE

    self.paddle = pygame.Rect(300, PADDLE_Y, PADDLE_W, PADDLE_H)
    self.ball   = pygame.Rect(300, PADDLE_Y - BALL_DIAMETER \
                              BALL_DIAMETER, BALL_DIAMETER)

    self.ball_velocity = [5, -5]

    self.create_bricks()
```

```
def create_bricks(self):
    y_offset    = 35
    self.bricks = []

    for i in range(7):     # rows
        x_offset = 35
        for j in range(8): # columns

            self.bricks.append( \
                pygame.Rect(x_offset, y_offset, BRICK_W, BRICK_H))
            x_offset += BRICK_W + 10

        y_offset += BRICK_H + 5
```

```
def draw_bricks(self):
    for brick in self.bricks:
        pygame.draw.rect(self.screen, GOLD, brick)
```

```
def run(self):
    while True:  # Main game loop
        for event in pygame.event.get():
            if event.type == pygame.QUIT:
                sys.exit()

        self.clock.tick(60)       # lock to 60 FPS
        self.screen.fill(BLACK)   # Redraw screen

        self.draw_bricks()

        pygame.display.flip()
```


Add
game.run() to
the end!


OU Breakout


Time to
handle user
input

New OUBreakout class function

```
def check_input(self):
    keys = pygame.key.get_pressed()

    if keys[pygame.K_ESCAPE]:
        sys.exit()
```

Inside def run(self):

```
    …

    self.screen.fill(BLACK)
    self.check_input()
    …
```

After calling draw_bricks() inside of def run:

```
    self.draw_bricks()

    # Draw the paddle and the ball
    pygame.draw.rect(self.screen, BLUE, self.paddle)
    pygame.draw.circle(self.screen, WHITE, \
       (self.ball.left + BALL_RADIUS, \
        self.ball.top + BALL_RADIUS), \
        BALL_RADIUS)
    …
```

Inside of check_input():

```
    # Check pygame.K_ESCAPE
    ...

    if keys[pygame.K_LEFT]:
        self.paddle.left -= 5
        if self.paddle.left < 0:
            self.paddle.left = 0

    if keys[pygame.K_RIGHT]:
        self.paddle.left += 5
        if self.paddle.left > MAX_PADDLE_X:
            self.paddle.left = MAX_PADDLE_X
    ...
```

Inside def run above draw_bricks

```
    if self.state == S_BALL_IN_PADDLE:
        self.ball.left = self.paddle.left + self.paddle.width/2
        self.ball.top  = self.paddle.top  - self.ball.height

    self.draw_bricks()
    …
```


And what else?


uhlsport
SIZE 5
INFINITY
SERIES

New class function:

```
def move_ball(self):
    self.ball.left += self.ball_velocity[0]
    self.ball.top  += self.ball_velocity[1]

    if self.ball.left <= 0:
        self.ball.left = 0
        self.ball_velocity[0] = -self.ball_velocity[0]

    if self.ball.left >= MAX_BALL_X:
        self.ball.left = MAX_BALL_X
        self.ball_velocity[0] = -self.ball_velocity[0]

    if self.ball.top < 0:
        self.ball.top = 0
        self.ball_velocity[1] = -self.ball_velocity[1]
```

In def run():

```
    ...
    elif self.state == S_PLAYING:
        self.move_ball()
```

In check_input():

```
    ...
    if keys[K_SPACE] and self.state == S_BALL_IN_PADDLE:
        self.ball_velocity = [5, -5]
        self.state = S_PLAYING
```

New class function:

```
def handle_collisions(self):
    for brick in self.bricks:
        if self.ball.colliderect(brick):
            self.score += 3
            self.ball_velocity[1] = -self.ball_velocity[1]
            self.bricks.remove(brick)
            break

    if len(self.bricks) == 0:
        self.state = S_WON
```

In def run():

```
if self.state == S_PLAYING:
    self.move_ball()
    self.handle_collisions()

elif self.state == S_BALL_IN_PADDLE:
    …
    self.show_message("Press SPACE to begin.")
elif self.state == S_WON:
    self.show_message("You won! Press ENTER to play again.")
elif self.state == S_GAME_OVER:
    self.show_message("You lost! Press ENTER to play again.")
```

New class function: show a message!

```
def show_message(self, message):
    if self.font:
        size = self.font.size(message)
        font_surface = self.font.render(message, False, WHITE)
        x = (SCREEN_W - size[0]) / 2
        y = (SCREEN_H - size[1]) / 2
        self.screen.blit(font_surface, (x, y))
```


Last
things!

Handle paddle and misses → at end of handle_collisions

```
def handle_collisions(self):
    …

    if self.ball.colliderect(self.paddle):
        self.ball.top = PADDLE_Y - BALL_DIAMETER
        self.ball_velocity[1] = -self.ball_velocity[1]

    elif self.ball.top > self.paddle.top:
        self.lives -= 1
        if self.lives > 0:
            self.state = S_BALL_IN_PADDLE
        else:
            self.state = S_GAME_OVER
```

New class function

```
def show_stats(self):
    if self.font:
        font_surface = self.font.render("SCORE: %d LIVES: %d" \
            % (self.score, self.lives), False, WHITE)
        self.screen.blit(font_surface, (205, 5))
```

In self.run():

```
    ...
    self.show_stats()
    pygame.display.flip()
```


Simple
game!

Add in location for hitting paddle!

Add in levels!