PyGame Sprites

- an excellent turorial exists for PyGame sprites here ⟨`http://kai.vm.bytemark.co.uk/~piman/writing/sprite-tutorial.shtml`⟩.

- these notes are derived from this tutorial and the examples extended
  - initially without object orientation and later to include orientation with the previous lecture on PyGame and the bouncing ball example

PyGame Sprites

- sprites are quite complicated
  - in my experience this is due to their close association with object orientation
  - you can use sprites without OO
  - for a small number of sprites this is easy enough and the code is smaller than its OO counterpart (and much simpler)
  - for any reasonable number of sprites >= 3 then should use OO as the reduction in code probably offsets the OO complication

When to use Sprites in PyGame

- when you have:
  - many instances of an object on the screen at a time
  - some objects that you need to track closely (e.g. collision detection)
    - Sprites have a self.rect attribute, which can be passed to the function colliderect
  - objects that need to *update themselves* rather than waiting for events to happen passively
  - a Sprite's `update()` method, with a time argument, makes it easy to deal with a dynamic environment

When to use Sprites in PyGame

- if you absolutely, positively need speed, and know exactly what you're doing
  - sprites and sprite groups are fast, but if you're careful, you can be faster

- do consider this until you have profiled your existing code
  - and have removed the more obvious time sinks

When not to use Sprites

- when your:
  - objects don't share much (if any) code
    - and if you rarely have more than one copy of each instantiated at a time
  - loop is event-based, and things never move *by themselves*
- simple user interfaces are often easier to do with surfaces than with sprites

Creating a simple sprite

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

width  = 320
height = 240
size   = [width, height]
pygame.init()
screen = pygame.display.set_mode(size)
background = pygame.Surface(screen.get_size())

b = pygame.sprite.Sprite() # create sprite
b.image = pygame.image.load("ball.png").convert() # load
b.rect = b.image.get_rect() # use image extent values
b.rect.topleft = [0, 0] # put the ball in the top left co
screen.blit(b.image, b.rect)

pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
    pygame.time.delay(100)
```


Sprite in PyGame

- is an object that contains both:
  - an image (a Surface)
  - and a location at which to draw that image (a Rect)
- term *sprite* is actually a holdover from older display systems that did such manipulations directly in hardware
  - Commodore 64, Commodore Amiga used this technique in early 1980s to early 1990s
  - other manufactures did exactly the same, Atari etc

Sprite in PyGame

- Sprites work well in object-oriented languages like Python
  - you have a standard sprite interface `pygame.sprite.Sprite`, and extend those classes as specific sprites
- see the `BallSprite` class in the example later on

Sprite in PyGame

- Sprites have two important instance variables
  - `self.image`and `self.rect`
  - `self.image` is a Surface, which is the current image that will be displayed. self.rect is the location at which this image will be displayed when the sprite is drawn to the screen
- Sprites also have one important instance method, `self.update`.

Creating a simple sprite using an extra Class

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

class BallSprite(pygame.sprite.Sprite):
    image = None

    def __init__(self, location):
        pygame.sprite.Sprite.__init__(self)

        if BallSprite.image is None:
            # This is the first time this class has been
            # instantiated. So, load the image for this a
            # all subsequence instances.
            BallSprite.image = pygame.image.load("ball.pn
        self.image = BallSprite.image

        # Make our top-left corner the passed-in location
        self.rect = self.image.get_rect()
        self.rect.topleft = location
```


Creating a simple sprite using an extra Class

```
pygame.init()
screen = pygame.display.set_mode([320, 320])
b = BallSprite([0, 0]) # put the ball in the top left cor
screen.blit(b.image, b.rect)
pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
    pygame.time.delay(10)
```


Bouncing ball using sprites and no user defined classes

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

width  = 320
height = 240
size   = [width, height]
ydir = 1
xdir = 1
xpos = 0
ypos = 0
pygame.init()
screen = pygame.display.set_mode(size)
background = pygame.Surface(screen.get_size())

b = pygame.sprite.Sprite() # create sprite
b.image = pygame.image.load("ball.png").convert()  # load
b.rect = b.image.get_rect() # use image extent values
b.rect.topleft = [xpos, ypos] # put the ball in the top l
screen.blit(b.image, b.rect)
slow = 0
```

Bouncing ball using sprites and no user defined classes

```
def gravity(y):
    global height
    return 0
    return (((height+height/20) * 3) / y)

pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
    pygame.time.delay(gravity(ypos))
    # If we're at the top or bottom of the screen,
    # switch directions.

    if b.rect.bottom>=height:
        ydir = -1
    elif ypos == 0:
        ydir = 1
    if xpos == 0:
        xdir = 1
    elif b.rect.right>=width:
        xdir = -1
```


Bouncing ball using sprites and no user defined classes

```
    if slow:
        screen.fill([0, 0, 0]) # blank the screen
    else:
        rectlist = [screen.blit(background, b.rect)]

    # Move our position up or down by one pixel
    xpos += xdir
    ypos += ydir
    b.rect.topleft = [xpos, ypos]

    if slow:
        screen.blit(b.image, b.rect)
        pygame.display.update()
    else:
        rectlist += [screen.blit(b.image, b.rect)]
        pygame.display.update(rectlist)
```


Bouncing ball using sprites and no user defined classes

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

class BallSprite(pygame.sprite.Sprite):
    image = None

    def __init__(self, initial_position):
        pygame.sprite.Sprite.__init__(self)
        if BallSprite.image is None:
            BallSprite.image = pygame.image.load("ball.pn
        self.image = BallSprite.image

        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position
        self.going_down = True # Start going downwards
        self.next_update_time = 0 # update() hasn't been
```


Bouncing ball using sprites and no user defined classes

```
    def update(self, current_time, bottom):
        # Update every 10 milliseconds = 1/100th of a sec
        if self.next_update_time < current_time:

            # If we're at the top or bottom of the screen
            if self.rect.bottom == bottom - 1: self.going_
            elif self.rect.top == 0: self.going_down = Tr

            # Move our position up or down by one pixel
            if self.going_down: self.rect.top += 1
            else: self.rect.top -= 1

            self.next_update_time = current_time + 10
```

Bouncing ball using sprites and no user defined classes

```
pygame.init()
boxes = []
for location in [[0, 0],
                 [60, 60],
                 [120, 120]]:
    boxes.append(BallSprite(location))

screen = pygame.display.set_mode([150, 150])
while pygame.event.poll().type != KEYDOWN:
    screen.fill([0, 0, 0]) # blank the screen.

    time = pygame.time.get_ticks()
    for b in boxes:
        b.update(time, 150)
        screen.blit(b.image, b.rect)
    pygame.display.update()
```


Bouncing ball using sprites and no user defined classes

- it is worth noting that the OO solution uses processor resources efficiently

Tutorial

- modify the last example so that the balls also move on the x axis as well
- now add the gravity effect