Beginner's Python Cheat Sheet - Pygame

What is Pygame?

Pygame is a framework for making games using Python. Making games is fun, and it's a great way to expand your programming skills and knowledge. Pygame takes care of many of the lower-level tasks in building games, which lets you focus on the aspects of your game that make it interesting.

Installing Pygame

Installing Pygame with `pip`

```
$ python -m pip install --user pygame
```

Starting a game

The following code sets up an empty game window, and starts an event loop and a loop that continually refreshes the screen.

An empty game window

```python
import sys
import pygame

class AlienInvasion:
    """Overall class to manage the game."""

    def __init__(self):
        pygame.init()
        self.clock = pygame.time.Clock()
        self.screen = pygame.display.set_mode(
            (1200, 800))
        pygame.display.set_caption(
            "Alien Invasion")

    def run_game(self):
        while True:
            for event in pygame.event.get():
                if event.type == pygame.QUIT:
                    sys.exit()

            pygame.display.flip()
            self.clock.tick(60)

if __name__ == '__main__':
    # Make a game instance, and run the game.
    ai = AlienInvasion()
    ai.run_game()
```

Starting a game (cont.)

Setting a custom window size

The `display.set_mode()` function accepts a tuple that defines the screen size.

```python
screen_dim = (1500, 1000)
self.screen = pygame.display.set_mode(
        screen_dim)
```

Setting a custom background color

Colors are defined as a tuple of red, green, and blue values. Each value ranges from 0-255. The `fill()` method fills the screen with the color you specify, and should be called before you add any other elements to the screen.

```python
def __init__(self):
    --snip--
    self.bg_color = (225, 225, 225)

def run_game(self):
    while True:
        for event in pygame.event.get():
            --snip--

        self.screen.fill(self.bg_color)
        pygame.display.flip()
```

Pygame rect objects

Many objects in a game can be treated as simple rectangles, rather than their actual shape. This simplifies code without noticeably affecting game play. Pygame has a rect object that makes it easy to work with game objects.

Getting the screen rect object

We already have a `screen` object; we can easily access the rect object associated with the screen.

```python
self.screen_rect = self.screen.get_rect()
```

Finding the center of the screen

Rect objects have a `center` attribute which stores the center point.

```python
screen_center = self.screen_rect.center
```

Useful rect attributes

Once you have a rect object, there are a number of attributes that are useful when positioning objects and detecting relative positions of objects. (You can find more attributes in the Pygame documentation. The `self` variable has been left off for clarity.)

```python
# Individual x and y values:
screen_rect.left, screen_rect.right
screen_rect.top, screen_rect.bottom
screen_rect.centerx, screen_rect.centery
screen_rect.width, screen_rect.height

# Tuples
screen_rect.center
screen_rect.size
```

Pygame rect objects (cont.)

Creating a rect object

You can create a rect object from scratch. For example a small rect object that's filled in can represent a bullet in a game. The `Rect()` class takes the coordinates of the upper left corner, and the width and height of the rect. The `draw.rect()` function takes a screen object, a color, and a rect. This function fills the given rect with the given color.

```python
bullet_rect = pygame.Rect(100, 100, 3, 15)
color = (100, 100, 100)

pygame.draw.rect(screen, color, bullet_rect)
```

Working with images

Many objects in a game are images that are moved around the screen. It's easiest to use bitmap (.bmp) image files, but you can also configure your system to work with jpg, png, and gif files as well.

Loading an image

```python
ship = pygame.image.load('images/ship.bmp')
```

Getting the rect object from an image

```python
ship_rect = ship.get_rect()
```

Positioning an image

With rects, it's easy to position an image wherever you want on the screen, or in relation to another object. The following code positions a ship at the bottom center of the screen, by matching the `midbottom` of the ship with the `midbottom` of the screen.

```python
ship_rect.midbottom = screen_rect.midbottom
```

Drawing an image to the screen

Once an image is loaded and positioned, you can draw it to the screen with the `blit()` method. The `blit()` method acts on the screen object, and takes the image object and image rect as arguments.

```python
# Draw ship to screen.
screen.blit(ship, ship_rect)
```
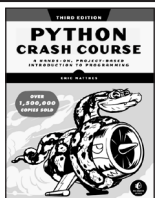
Transforming an image

The `transform` module allows you to make changes to an image such as rotation and scaling.

```python
rotated_image = pygame.transform.rotate(
        ship.image, 45)
```

Python Crash Course

A Hands-on, Project-Based Introduction to Programming

Working with images (cont.)

The `blitme()` method

Game objects such as ships are often written as classes. Then a `blitme()` method is usually defined, which draws the object to the screen.

```python
def blitme(self):
    """Draw ship at current location."""
    self.screen.blit(self.image, self.rect)
```

Responding to keyboard input

Pygame watches for events such as key presses and mouse actions. You can detect any event you care about in the event loop, and respond with any action that's appropriate for your game.

Responding to key presses

Pygame's main event loop registers a KEYDOWN event any time a key is pressed. When this happens, you can check for specific keys.

```python
for event in pygame.event.get():
    if event.type == pygame.KEYDOWN:
        if event.key == pygame.K_RIGHT:
            ship_rect.x += 1
        elif event.key == pygame.K_LEFT:
            ship_rect.x -= 1
        elif event.key == pygame.K_SPACE:
            ship.fire_bullet()
        elif event.key == pygame.K_q:
            sys.exit()
```

Responding to released keys

When the user releases a key, a KEYUP event is triggered.

```python
for event in pygame.event.get():
    if event.type == pygame.KEYUP:
        if event.key == pygame.K_RIGHT:
            ship.moving_right = False
```

The game is an object

In the overall structure shown here (under Starting a Game), the entire game is written as a class. This makes it possible to write programs that play the game automatically, and it also means you can build an arcade with a collection of games.

Pygame documentation

The Pygame documentation is really helpful when building your own games. The home page for the Pygame project is at pygame.org/, and the home page for the documentation is at pygame.org/docs/.

The most useful part of the documentation are the pages about specific parts of Pygame, such as the `Rect()` class and the `sprite` module. You can find a list of these elements at the top of the help pages.

Responding to mouse events

Pygame's event loop registers an event any time the mouse moves, or a mouse button is pressed or released.

Responding to the mouse button

```python
for event in pygame.event.get():
    if event.type == pygame.MOUSEBUTTONDOWN:
        ship.fire_bullet()
```

Finding the mouse position
The mouse position is returned as a tuple.

```python
mouse_pos = pygame.mouse.get_pos()
```

Clicking a button
You might want to know if the cursor is over an object such as a button. The `rect.collidepoint()` method returns True when a point overlaps a rect object.

```python
if button_rect.collidepoint(mouse_pos):
    start_game()
```

Hiding the mouse

```python
pygame.mouse.set_visible(False)
```

Pygame groups

Pygame has a Group class which makes working with a group of similar objects easier. A group is like a list, with some extra functionality that's helpful when building games.

Making and filling a group
An object that will be placed in a group must inherit from Sprite.

```python
from pygame.sprite import Sprite, Group

class Bullet(Sprite):
    ...
    def draw_bullet(self):
        ...
    def update(self):
        ...

bullets = Group()

new_bullet = Bullet()
bullets.add(new_bullet)
```

Looping through the items in a group
The `sprites()` method returns all the members of a group.

```python
for bullet in bullets.sprites():
    bullet.draw_bullet()
```

Calling update() on a group
Calling `update()` on a group automatically calls `update()` on each member of the group.

```python
bullets.update()
```

Pygame groups (cont.)

Removing an item from a group
It's important to delete elements that will never appear again in the game, so you don't waste memory and resources.

```python
bullets.remove(bullet)
```

Detecting collisions

You can detect when a single object collides with any member of a group. You can also detect when any member of one group collides with a member of another group.

Collisions between a single object and a group
The `spritecollideany()` function takes an object and a group, and returns True if the object overlaps with any member of the group.

```python
if pygame.sprite.spritecollideany(ship, aliens):
    ships_left -= 1
```

Collisions between two groups
The `sprite.groupcollide()` function takes two groups, and two booleans. The function returns a dictionary containing information about the members that have collided. The booleans tell Pygame whether to delete the members of either group that have collided.

```python
collisions = pygame.sprite.groupcollide(
        bullets, aliens, True, True)

score += len(collisions) * alien_point_value
```

Rendering text

You can use text for a variety of purposes in a game. For example you can share information with players, and you can display a score.

Displaying a message
The following code defines a message, then a color for the text and the background color for the message. A font is defined using the default system font, with a font size of 48. The `font.render()` function is used to create an image of the message, and we get the rect object associated with the image. We then center the image on the screen and display it.

```python
msg = "Play again?"
msg_color = (100, 100, 100)
bg_color = (230, 230, 230)

f = pygame.font.SysFont(None, 48)
msg_image = f.render(msg, True, msg_color,
        bg_color)
msg_image_rect = msg_image.get_rect()
msg_image_rect.center = screen_rect.center
screen.blit(msg_image, msg_image_rect)
```