CS: Objects in Python

Introduction to Objects

Lab - Introduction to Objects

Introduction to Objects Lab 1

Lab 1

The previous coding examples for objects have revolved around the `Actor` object. Using a real-world example makes the concept of classes a little easier to understand. But the `Actor` class does not accurately reflect how objects are used in programming. The following pages show how object could be used by a social network like Instagram. Imagine there exists a social network called Photogram that allows you to share, like, and comment on photos. Your feed is comprised of a series of posts containing information like the username, media(image or video), a message, likes, and a list of comments. We are going to create a `Post` object to reflect this.

▾ **Is this how Instagram really works?**
No. Data for Instagram is stored as JSON, which stands for Javascript Object Notation. While “object” is a part of JSON, Python objects and JSON objects are different in an important way. JSON objects do not have methods, which will be covered in the next unit. However, using Python objects to represent posts in a social media feed is not far from reality.

Components of a Post

It is always a good idea to think about all the various pieces of information

that need to be stored in an object. It is also important to think about how that information should be represented. Let's say you have 100 followers. You could represent that as a string, `"100"`. But storing the follower count as an int is a better idea. If you gain a follower, you cannot say `"100" + 1`. You would have to typecast `"100"` as an int, add the new follower, and then typecast the new follower count back to a string. Storing this information as an int is much easier. Here are the elements that make up a post for Photogram:
* Username - The user who creates the post should be stored as a string.
* Id - Some social networks let you change your username. To avoid confusion about usernames, an unique id number is used to refer to each user on a social network. This should be stored as an int.
* Media - Each post has an image or video to display. Media files are often stored elsewhere on a server. The object should store the path to the media file so it can be retrieved and shown to the public. This information should be stored as a string.
* Avatar - The user's avatar should appear next to their post. The object should store the path to an avatar as a string.
* Comment Button - Each post has a button so viewers can add their comment. The object should store the path to this button as a string. **Note**, this will not be a working button.
* Caption - The caption that accompanies the media file should be stored as a string.
* Likes - The number of times people have liked a post should be stored as an int.
* Comments - Comments should be stored as a string. However, each post can have a multitude of comments. So this information should be stored as a list of strings.
* Like Button - Heart-shaped icon views could click to like a post. This will be stored as a string.

Defining the Post Class

Now that you know all of the attributes needed to create a post for Photogram, you can define the `Post` class.

```python
class Post:
    """Create a post object for the fictitious social network Photogra

    def __init__(self, username, user_id, media, avatar, comment_butto

        self.username = username
        self.user_id = user_id
        self.media = media
        self.avatar = avatar
        self.comment_button = comment_button
        self.caption = caption
        self.likes = likes
        self.comments = comments
        self.like_button = like_button
```

Now, declare an instance of the `Post` class with some information. For the sake of readability, each of the parameters will be assigned to a variable. Then, the variables will be passed to the object for instantiation. **Note** there is an actual image file that will be used, so be sure the file path is correct.

```python
username = "Sally_17"
user_id = 112010
media = "student_folder/img/photogram/waterfall.png"
avatar = "student_folder/img/photogram/avatar_icon.png"
comment_button = "student_folder/img/photogram/add_comment.png"
caption = "First time at Yosemite. It has surpassed all of my expectat

likes = 23
comments = ["Beautiful!", "I wish I was there too.", "Is that Nevada F

like_button = "student_folder/img/photogram/likes_icon.png"

post1 = Post(username, user_id, media, avatar, comment_button, caption
```

challenge

Check your work

Print each attribute of `post1` to see that everything is working as expected.

Introduction to Objects Lab 2

Lab 2

Now that you have all of the information needed to make a post, you can turn that into visual output using the `Tkinter` module. `Tkinter` allows you to build simple graphical user interfaces with a minimal amount of code. The next lab is going to be an introduction to `Tkinter` and a few of its features.

▼ **What to learn more about `Tkinter`?**

These labs will only cover a tiny fraction of what can be done with the `Tkinter` module. The full documentation for `Tkinter` can be found here. This documentation is not very user-friendly. A more beginner-friendly way to learn about `Tkinter`code> is with this YouTube playlist.

Main Window

`Tkinter`'s output is a window. There are three steps needed to get a window up and running. First, import the `tkinter` module. Second, create a window. Third, run the `mainloop` for the window. Just like with Turtle graphics, the `import` statement should be at the very top of the program, and the `mainloop` should come at the very end. The rest of your program will go between these two lines of code.

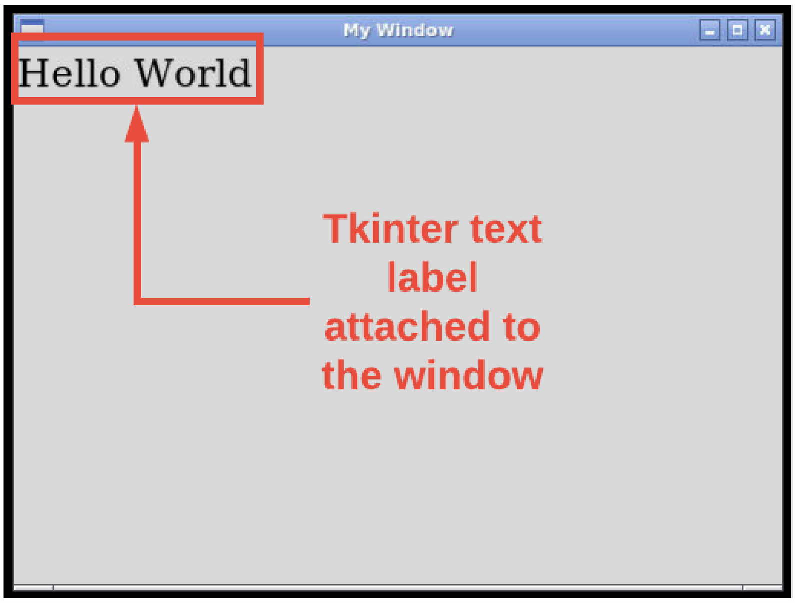
```
import tkinter

window = tkinter.Tk()

window.mainloop() #This is the last line of code in your program
```

That is really all it takes to get a window up and running. You can add a title to the window and set its size with these commands:

```
import tkinter

window = tkinter.Tk()
window.title("My Window")
window.geometry("500x350")

window.mainloop() #This is the last line of code in your program
```

Label Widget - Text

`Tkinter` refers to items added to the the main window as widgets. The `Label` is going to be the building block for these labs.



Label Widget

Create a text label for your window:

```
my_label = tkinter.Label(window, text="Hello World", font="DejaVuSerif
```

Other options for text `Labels`:
* Font - You can set the font family and size with `font` options. The available fonts are DejaVuSerif, DejaVuSansMono, DejaVuSans. You can

also set the font to `bold` as well. An example of the `font` option is: `font="DejaVuSeif 18 bold"`.
* Justify - The `justify` option allows you to align text inside of a `Label`. The options are `"left"`, `"right"`, and `"center"`. An example of the `justify` option is: `justify="left"`.
* Background Color - Use the `bg` option to set the background color. Colors can be done with either CSS or hex colors. An example of the `bg` option is: `bg="blue"`.
* Text Color - Use the `fg` option (foreground) to set the color of the text. An example of the `fg` option is: `fg="red"`.
* Wrap Length - Widgets set their size based on its contents. While this can be helpful, this can also make getting the perfect layout difficult at times. The `wraplength` option tells `Tkinter` when to continue the text on the next line. This keeps the label widget from becoming too wide for your desired layout.

Grid System

Adding widgets to the window is a two-step process. First define the widget, then place it in the window using the grid system. The grid system works by positioning widgets with a row and column number. Rows and columns start counting with 0. The sizes of rows and columns is dependent upon the size of the widget. Here is how to place the `my_label` widget in the top-left corner.

```
my_label.grid(row=0, column=0)
```

The grid system can be a bit difficult to use. For instance, if you want to put a single label in location `row=1, column=1`, the label will appear in the top-left corner. Positioning is relative to other widgets.

Image Label

Using an image in a label is also a two-step process. First create an image object for `Tkinter`, then attach the image to the label by replacing the `text` option with `image`. You still need to use `grid` to place the image in the window.

```
feather_image = tkinter.PhotoImage(file="student_folder/img/feather.pn

image_label = tkinter.Label(window, image=feather_image)
image_label.grid(row=1, column=1)
```

challenge

Explore `Tkinter`

- Try out various fonts and font sizes
- Position labels around the window with the grid system
- Create other image objects (`tkinter.PhotoImage`) and add more images to the window

Introduction to Objects Lab 3

Lab 3

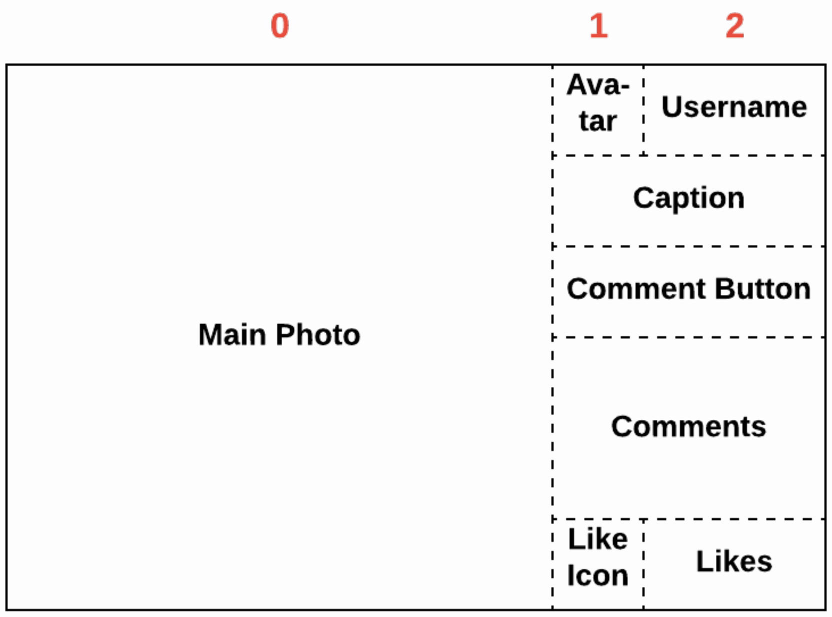
Now that you have had a brief introduction to `Tkinter`, you are going to create a mockup of a post on Photogram using the information stored in the `Post` object created in Lab 1.

Setting up the Window

The first step is to setup the window for the app. Just as in Lab 2, you are going to create a window, give it a title, set the size, and choose a background color.

```
import tkinter

class Post:
    """Create a post object for the fictitious social network Photogra

    ##########
    # The rest of the Post class code goes here
    ##########

window = tkinter.Tk()
window.title("Photogram")
window.geometry("800x500")
window.configure(background="white")

window.mainloop()  # This should be the last line of code in your prog
```

It is important to know in advance what the layout of the app should be. This will influence how the window is created. The image below shows the general layout of Photogram.



Photogram Layout

It is important to note that the window has three columns. Column 0 will be as wide as the image; `Tkinter` does this automatically. We want column 2 to be twice as wide as column 1. This will ensure that the avatar and like icon will be positioned properly. Add the following two lines of code to make column 2 twice as wide as column 1. Running the program will show a large, white rectangle. These lines of code should go before `window.mainloop()`.

```
window.grid_columnconfigure(1, weight=0)
window.grid_columnconfigure(2, weight=1)
```

▼ **Larger viewing area**

Click the blue triangle icon to open the `Tkinter` project in a new tab. You can leave this tab open. Each time you click a `TRY IT` button, the tab will update with the latest version of your project.

Add Photo Variables

Just like in Lab 2, you will need to create a `Tkinter` image object for each image, and then store them in a variable.

```
photo = tkinter.PhotoImage(file=post1.media)
comment_button = tkinter.PhotoImage(file=post1.comment_button)
avatar = tkinter.PhotoImage(file=post1.avatar)
like_button = tkinter.PhotoImage(file=post1.like_button)
```

Add Main Photo

Create the variable `image` to represent the large image on the left. Adding the image is going to be a two-step process: create the label and place the label.

```
# Big photo on the left
image = tkinter.Label(
    window,
    image=photo,
    bg="white")

image.grid(
    row=0,
    column=0,
    rowspan=10,
    stick="W")
```

There are a couple of things that were not covered in Lab 2. First, `rowspan=10` means that the main photo is going to span across ten rows. If you did not do this, row 1 would start below the main photo. In the layout image above, there is nothing below the main photo. `stick="W"` makes the main photo “sticky” to the “west” (left). If the `Tkinter` window were to be resized, the main photo would always remain to the far left.

Introduction to Objects Lab 4

Lab 4

In this lab, you will add the avatar, username, caption, and the comment button to the app. All of these labels will follow the same two-step process as before: create the label and then position the label.

User Avatar

The avatar should be at the top of the window and just to the right of the main photo. So that would be row 0 and column 1. The avatar image is 30 pixels by 30 pixels, which is why the width is set to 30.

```
# Gray user avatar
user_avatar = tkinter.Label(
    window,
    image=avatar,
    width=30,
    bg="white")

user_avatar.grid(
    row=0,
    column=1,
    sticky="W")
```

Add Username

Set the font to DejaVu Sans, and make it bold and size 14 for legibility. Making the text left-justified looks better than other positions.

```python
# Username to the right of the avatar
user_name = tkinter.Label(
    window,
    text=post1.username,
    font="DejaVuSans 14 bold",
    justify="left",
    bg="white")

user_name.grid(
    row=0,
    column=2,
    sticky="W")
```

Add Caption

The font in the caption label will be similar to the font for the username, except it will not be bold. The `wraplength`parameter determines when the word wrap begins. The bigger the number, the more you can write before word wrap happens. The space to the right of the main photo is actually two columns. We want the caption to fill this entire area, so the text needs to span across two columns.

```python
# User caption for the photo
caption = tkinter.Label(
    window,
    text=post1.caption,
    font="DejaVuSans 14",
    wraplength=300,
    justify="left",
    bg="white")

caption.grid(
    row=1,
    column=1,
    columnspan=2,
    sticky="NW")
```

Add Comment Button

The comment button should span across the two columns to the left of the main photo. In addition, the comment button should be centered.

```python
# Add comment icon
comment_icon = tkinter.Label(
    window,
    image=comment_button,
    bg="white",
    justify="center")

comment_icon.grid(
    row=2,
    column=1,
    columnspan=2)
```

Introduction to Objects Lab 5

Lab 5

In this lab, you will finish up the app by adding comments, an icon for likes, and the number of likes the post has received.

Add Comments

The comments are stored in the Python object as a list of strings. The code below will iterate over this list, placing each string into its own label. This label is then attached to the window. Notice that the `grid` settings are "attached to the `Label`. That is because no variable name is used for each comment. Previous labels were stored in a variable, like `user_name`. So you could say `user_name.Label` and list all of the label attributes. Then you could say `user_name.grid` and list the grid attributes. Without a variable name, this is not possible. So the `label` and `grid` attributes are linked together with a `.`.

```
# Loop to add all of the comments
for comment in post1.comments:
    tkinter.Label(
      window,
      text=comment,
      font="DejaVuSans 14",
      wraplength=300,
      justify="left",
      bg="white").grid(
      row=post1.comments.index(comment) + 3,
      column=1,
      columnspan=5,
      sticky="NW")
```

Add Like Icon

This is the final row in our PhotoGram post. Create an image label for the like button. Place it on row 9 and column 1.

```
# Add likes icon
likes = tkinter.Label(
    window,
    image=like_button,
    bg="white",
    justify="center")

likes.grid(
    row=9,
    column=1)
```

Add Likes

The likes count also goes on row 9 and to the right of the like button, so use column 2. The like count should span two columns, but be positioned to the left.

```
# Add likes count
likes_count = tkinter.Label(
    window,
    font="DejaVuSans 14",
    text=post1.likes,
    bg="white",
    justify="left")

likes_count.grid(
    row=9,
    column=2,
    sticky="W",
    columnspan=2)
```

▼ **Final Code**

Here is the code for the Photogram program.

```
import tkinter # Do not erase this line of code

class Post:
  """Create a post object for the fictitious social network Photogra
  def __init__(self, username, user_id, media, avatar, comment_butto

    self.username = username
    self.user_id = user_id
    self.media = media
    self.avatar = avatar
    self.comment_button = comment_button
    self.caption = caption
    self.likes = likes
    self.comments = comments
    self.like_button = like_button

username = "Sally_17"
user_id = 112010
media = "student_folder/img/photogram/waterfall.png"
avatar = "student_folder/img/photogram/avatar_icon.png"
comment_button = "student_folder/img/photogram/add_comment.png"
caption = "First time at Yosemite. It has surpassed all of my expect

likes = 23
comments = ["Beautiful!", "I wish I was there too.", "Is that Nevada

Halfdome pictures", "More pics please"]
like_button = "student_folder/img/photogram/likes_icon.png"

post1 = Post(username, user_id, media, avatar, comment_button, capti


window = tkinter.Tk()
window.title("Photogram")
window.geometry("800x500")
window.configure(background="white")

window.grid_columnconfigure(1, weight=0)
window.grid_columnconfigure(2, weight=1)

photo = tkinter.PhotoImage(file=post1.media)
comment_button = tkinter.PhotoImage(file=post1.comment_button)
avatar = tkinter.PhotoImage(file=post1.avatar)
like_button = tkinter.PhotoImage(file=post1.like_button)
```

```
# Big photo on the left
image = tkinter.Label(
  window,
  image=photo,
  bg="white")

image.grid(
  row=0,
  column=0,
  rowspan=10,
  stick="W")

# Gray user avatar
user_avatar = tkinter.Label(
  window,
  image=avatar,
  width=30,
  bg="white")

user_avatar.grid(
  row=0,
  column=1,
  sticky="W")

# Username to the right of the avatar
user_name = tkinter.Label(
  window,
  text=post1.username,
  font="DejaVuSans 14 bold",
  justify="left",
  bg="white")

user_name.grid(
  row=0,
  column=2,
  sticky="W")

# User caption for the photo
caption = tkinter.Label(
  window,
  text=post1.caption,
  font="DejaVuSans 14",
  wraplength=300,
  justify="left",
  bg="white")

caption.grid(
  row=1,
  column=1,
  columnspan=2,
  sticky="NW")

# Add comment icon
comment_icon = tkinter.Label(
  window,
  image=comment_button,
  bg="white",
  justify="center")

comment_icon.grid(
  row=2,
  column=1,
  columnspan=2)

# Loop to add all of the comments
for comment in post1.comments:
  tkinter.Label(
  window,
  text=comment,
  font="DejaVuSans 14",
  wraplength=300,
  justify="left",
  bg="white").grid(
  row=post1.comments.index(comment) + 3,
  column=1,
  columnspan=5,
  sticky="NW")

# Add likes icon
likes = tkinter.Label(
  window,
  image=like_button,
  bg="white",
  justify="center")

likes.grid(
  row=9,
  column=1)

# Add likes count
likes_count = tkinter.Label(
  window,
  font="DejaVuSans 14",
  text=post1.likes,
  bg="white",
  justify="left")

likes_count.grid(
  row=9,
  column=2,
  sticky="W",
  columnspan=2)

window.mainloop() # This should be the last line of code in your pro
```

Introduction to Objects Lab Challenge

Lab Challenge

Create the variable `dog1`, and instantiate an object of the `Dog` class. This dog’s name is `Marceline` and she is a `German Shepherd`. Create the variable `dog2` and make a **deep copy** of `dog1`. `dog2` should be named `Cajun` and have the breed `Belgian Malinois`. Test your code by printing the `name` and `breed` of each dog to make sure they fulfill the requirements above.