Objectives

- Defining our own classes

Lab 8 Info

- Due tomorrow before lab (2:25)
  - Do not be printing just before lab
  - Professor Levy leading the Quagents lab
- Additional office hours:
  - Today, 2:30-4:40
  - Tomorrow, 11-1

Lab 8 Info

- Name frequencies
  - Size of files
    - Females: 1042
    - Males: 1139
    - Last names: 2181
  - Could process a larger file without changing processing code

Deal or No Deal

- Problem #1 of lab relates to **`printBoard`**, not **`printCasesLeft`**
- **`printCasesLeft`** hint:
  - When do you print a case?
  - What is the difference between the print statements for these and this one?

```
 4   7   9  10
12  13  14  15
…
```

  - How can you distinguish between these cases?

Deal or No Deal Hints

- **`printBoard`** hint

When should you print this value?

When should you print this value?

```
******************************
 The Board:
$       0.01           ----
$       1.00     $    5000.00
```

  - Is that the same condition?

Abstractions

- Provide ways to think about the program and its data
  - Get the jist without the details
- Examples we've seen
  - Functions and methods
    - Used to perform some operation but we don't need to know how they're implemented
  - Dictionaries
    - Know they map keys to values
    - Don't need to know how the keys are organized/stored in the computer's memory
  - Just about everything we do in this class…

Classes and Objects

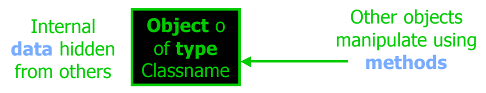
- Provide an abstraction for how to organize and reason about data
- Example: GraphWin class
  - Had attributes (i.e., data or state) background color, width, height, and title
  - Each GraphWin object had these attributes
    - Each GraphWin object had its own values for these attributes
  - Used methods to modify the object's state.

Defining Our Own Classes

- Often, we want to represent data or information that we don't already have a way to represent using built-in types or libraries
- Provide way to *organize* and *manipulate* data
  - Organize: data structures used
    - E.g., ints, lists, dictionaries, other objects, etc.
  - Manipulate: methods

What is a Class?

- Defines a new **data type**
- Defines the class's **attributes** (i.e., data) and **methods**
  - Methods are **functions** *within* a class and are the class's **API**


Internal **data** hidden from others
Object o of **type** Classname
Other objects manipulate using **methods**

Defining a Card Class

- Create a class that represents a playing card
  - How can we represent a playing card?
  - What information do we need to represent a playing card?

Representing a Card object

- Every card has two attributes:
  - Suite (one of "hearts", "diamonds", "clubs", "spades")
  - Rank
    - 2-10: numbered cards
    - 11: Jack
    - 12: Queen
    - 13: King
    - 14: Ace

Defining a New Class

- Syntax:

Typically starts with a capital letter

```
class <class-name>:
      <method definitions>
```

Card Class (Incomplete)

Doc String

Methods

```
class Card:
    """
    A class to represent a standard playing card. The ranks are ints:
    2-10 for numbered cards, 11=Jack, 12=Queen, 13=King, 14=Ace.
    The suits are strings: 'clubs', 'spades', 'hearts', 'diamonds'.
    """
    def __init__(self, rank, suit):
        "Constructor for class Card takes int rank and string suit."
        self.rank = rank
        self.suit = suit

    def getRank(self):
        "Returns the card's rank."
        return self.rank

    def getSuit(self):
        "Returns the card's suit."
        return self.suit
```

card.py

Card Class (Incomplete)

Doc String

Methods

```
class Card:
    """
    A class to represent a standard playing card. The ranks are ints:
    2-10 for numbered cards, 11=Jack, 12=Queen, 13=King, 14=Ace.
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    def getSuit(self):
        "Returns the card's suit."
        return self.suit
```

Methods are functions defined in a class.

card.py

Defining the Constructor

- **__init__** method is the **constructor**
- In constructor, define **instance variables**
  - **Data** contained in every object
  - Also called **attributes** or **fields**
- Constructor does **not** *return* anything

First parameter of *every* method is **self**
- pointer to the object that method acts on

```
def __init__(self, rank, suit):
    "Constructor for class Card takes int rank and string suit."
    self.rank = rank
    self.suit = suit
```

Instance variables

Using the Constructor

- As defined, constructor is called using **`Card(<rank>,<suit>)`**
  - Do not *pass* anything for the **`self`** parameter
  - Python handles underneath, passing the parameter for us automatically
- Example:
  - **`card = Card(2, "hearts")`**
  - Creates a 2 of Hearts card
  - Underneath, Python passes **`card`** as **`self`** for us

Object **card** of type Card

rank = 2
suit = "hearts"

Accessor Methods

- Need to be able to get information about the object

- Have **self** parameter
- Return data

```
def getRank(self):
    "Returns the card's rank."
    return self.rank

def getSuit(self):
    "Returns the card's suit."
    return self.suit
```

- These will get called as **`card.getRank()`** and **`card.getSuit()`**
  - Python plugs **`card`** in for **`self`**

Another Special Method: __str__

- Returns a *string* that describes the object
- Whenever you **`print`** an object, Python checks if you have defined the **__str__** method to see what should be printed
- str(<object>) also calls **__str__** method

```
def __str__(self):
    """Returns a string describing
       the card as 'rank of suit'."""
    result = ""
    if self.rank == 11:
        result += "Jack"
    elif self.rank == 12:
        result += "Queen"
    elif self.rank == 13:
        result += "King"
    elif self.rank == 14:
        result += "Ace"
    else:
        result += str(self.rank)
    result += " of " + self.suit
    return result
```

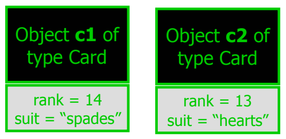
Using the Card Class

Invokes the __str__ method

```
def main():
    c1 = Card(14, "spades")
    print c1
    c2 = Card(13, "hearts")
    print c2
```

Displays:

Ace of spades
King of hearts



Example: Black Jack Value

- Add a method to the Card class called **blackJackValue** that returns the value of the card in the game of black jack.
  - Have Jack, Queen, and King be worth 10
  - Ace is worth 1
  - All the other cards have the value of their rank
- What is the method header?

Example: Rummy Value

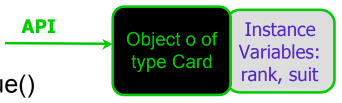
- Add a method to the Card class called **rummyValue** that returns the value of the card in the game of Rummy

Card API

- Based on what we've seen/done so far, what does the Card class's API look like?

Card API

- Card(<rank>, <suit>)
- getRank()
- getSuit()
- blackJackValue()
- rummyValue()
- __str__()



Implementation of methods is hidden

Defining a Card Class

- Create a class that represents a playing card
  - How can we represent a playing card?
  - What information do we need to represent a playing card?
- Do we ***need*** a class to represent a card?
  - Does any built-in data type naturally represent a card?

Using the Card class

- Now that we have the Card class, how can we use it?
- Can make a **Deck** class
  - What data should a Deck contain?
  - How can we represent that data?
- To start: write methods **__init__** and **__str__**
  - What do the method headers look like?

Creating a Deck Class (Partial)

- List of Card objects

```
from card import *

class Deck:
    def __init__(self):
        self.cards = []
        for suit in ["clubs","hearts","diamonds","spades"]:
            for rank in range(2,15):
                self.cards.append(Card(rank, suit))

    def __str__(self):
        result = ""
        for c in self.cards:
            result += c.__str__() + "\n"
        return result
```

Initialize instance variable, self.cards

Creates and returns a string

Displays cards on separate lines

Deck API

- What methods should our Deck class provide?

Adding Deck Functionality

- Functionality:
  - Shuffle the cards
  - Deal one card
  - Number of cards remaining
- What do the method headers look like?
- What should they return?
- How do we implement them?

Deck API

- Deck() ← Constructor
- shuffle()
- deal()
- numRemaining()
- __str__()

Broader Issue

- Facebook knows what you did last summer