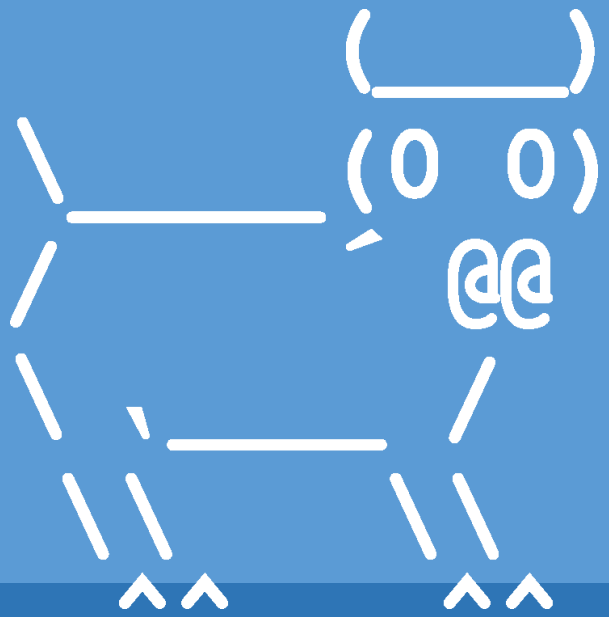
OBJECT-ORIENTED DESIGN

WEEK-AT-A-GLANCE



Introduction to Computer Science

Iris Howley

HAPPENING THIS WEEK

- There's a **quiz** this Friday, April 17
  - Check Glow!

- Homework 5 is due Monday, April 13
  - Homework 6 will be released Wednesday, April 15
- Lab 7 was released Friday, April 10
  - And it's due Thursday, April 16
- Lab 8 will be released Friday, April 17

LECTURES THIS WEEK

- Monday
  - Week Overview
  - Class Attributes
  - Inheritance Example
- Wednesday
  - Inheritance Syntax
  - Super Methods
  - Well-defined Classes
- Friday
  - Type conversion
  - Ciphers
  - Lab Intro

Prior to lecture videos…

Complete:

1. POGIL Activities: Inheritance
   - *available under Glow > Modules*
   - *also posted to the course website under Remote Lectures*

- Best done prior to watching lectures!
- Good for working with a partner (virtually, too!)
  - But will work without a partner, as well

Prior to this week's lessons…

Be able to:

1. Build & instantiate new classes & objects
2. …with attributes and methods

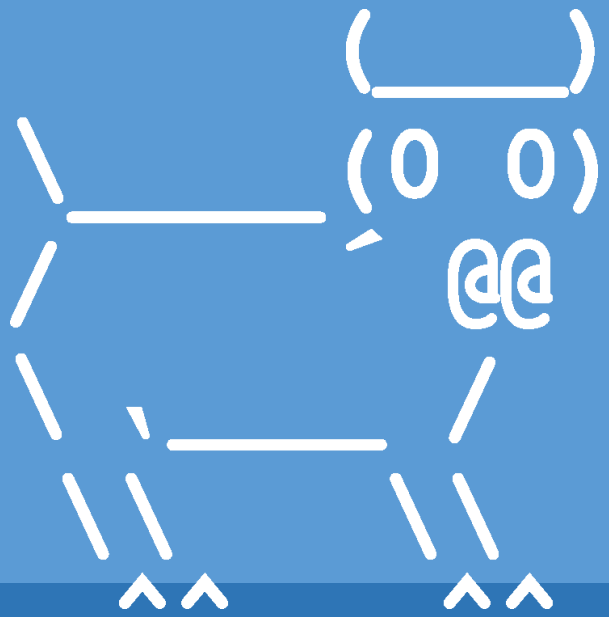
BOOK CHAPTER 18. INHERITANCE

Step through it!!!!

Highly recommended

Please contact me!

Class Attributes



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TODAY'S LESSON

Class Attributes

(Some classes share some attributes across all instances)

Class Attributes Syntax

```
class EvilRobot:
   morality = 'evil'

   __slots__ = ['name']
   def __init__(self, nm):
      self.name = nm
```

Class attribute inside of the class

Restricting the instance attributes

Class methods

```
>>> er1 = EvilRobot('Herbert')
>>> er1.morality
'evil'
>>> er1.name
'Herbert'
```

Accessing the class attribute through the instance

Accessing the instance attribute

Class Attributes Syntax

```
class EvilRobot:
   morality = 'evil'

   __slots__ = ['name']
   def __init__(self, nm):
      self.name = nm

>>> er2 = EvilRobot('Pearl')
>>> er2.morality
'evil'
>>> er2.name
'Pearl'
```

Changing **Class** Attributes' Values

```
class EvilRobot:
   morality = 'evil'

   __slots__ = ['name']
   def __init__(self, nm):
      self.name = nm
```

Uses the CLASS name, not the instance name to re-assign!

```
>>> EvilRobot.morality = 'bad'
>>> er1.morality
'bad'
>>> er2.morality
'bad'
```

Changes the `morality` value for all objects of this type

Changing **Instance** Attributes' Values

```
class EvilRobot:
   morality = 'evil'

   __slots__ = ['name']
   def __init__(self, nm):
      self.name= nm
```

Uses the INSTANCE name, not the class name to re-assign!

```
>>> er1.name = 'Herbert the 2nd'
>>> er1.name
'Herbert the 2nd'
>>> er2.name
'Pearl'
```

Changes the `name` value for the specified instance

Does not change the `name` value for other instances

An Example

Image source: Fine Art America

Playing Cards

- Each card has a suit (one of 4)
  - Diamonds
  - Hearts
  - Clubs
  - Spades

Playing Cards

- Each card has a rank:
  - 2-10
  - Jack (11)
  - Queen (12)
  - King (13)
  - Ace

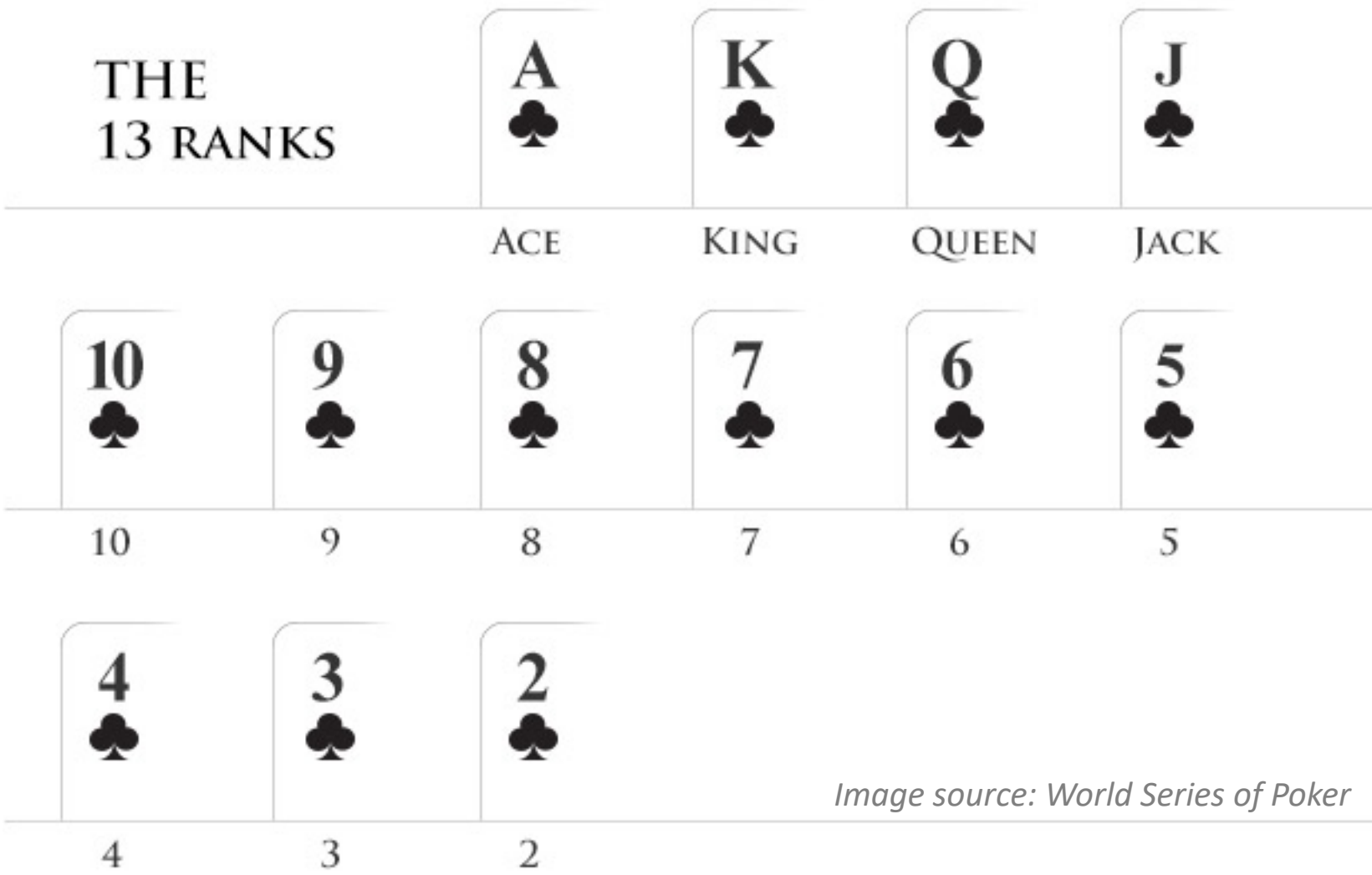


Image source: World Series of Poker

```
class Card:
    """ Represents a standard playing card. """
    # Instance Attributes
    __slots__ = ['suit','rank']

    # Class Attributes
    suit_names = ['Clubs','Diamonds','Hearts','Spades']
    rank_names =
[None,'Ace','2','3','4','5','6','7','8','9','10','Jack','Queen','King']



    def __init__(self, suit=0, rank=2):
        self.suit = suit
        self.rank = rank

    def __str__(self):
        return '{} of {}'.format(Card.rank_names[self.rank],
Card.suit_names[self.suit])
```

```
if __name__ == '__main__':
    # Testing Card
    queenOfDiamonds = Card(1, 12)
    print(queenOfDiamonds) # Queen of Diamonds

    # See how c1.suit_names == c2.suit_names
    # But not c1.suit == c2.suit
    c1 = Card(2,11)
    print(c1)
    print("\tClass Attribute:", c1.suit_names)
    print("\tInstance Attribute:", c1.suit) # 2

    c2 = Card(3,5)
    print(c2)
    print("\tClass Attribute:", c2.suit_names)
    print("\tInstance Attribute:", c2.suit) # 3
```

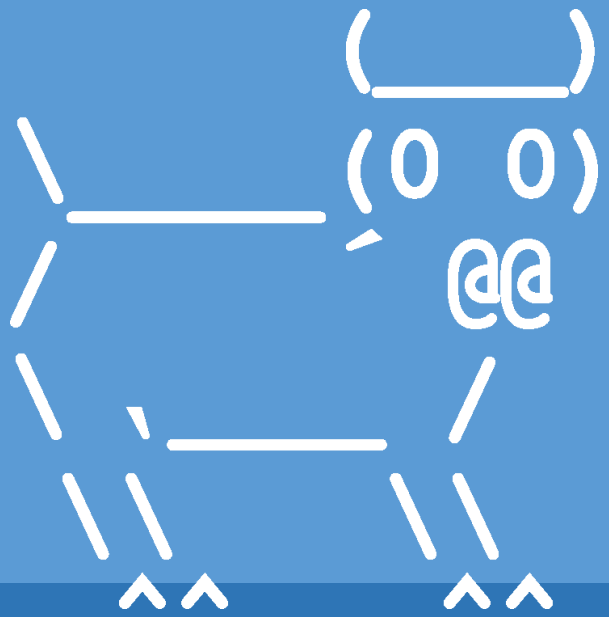
```
print("==", c1.suit_names == c2.suit_names)
# This will print '== True'
```

```
Queen of Diamonds
Jack of Hearts
Class Attribute: ['Clubs', 'Diamonds', 'Hearts', 'Spades']
Instance Attribute: 2
5 of Spades
Class Attribute: ['Clubs', 'Diamonds', 'Hearts', 'Spades']
Instance Attribute: 3
== True
```

```
print("==", c1.suit_names == c2.suit_names)
# This will print '== True'
```

Please contact me!

Inheritance: Example



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TODAY'S LESSON

Inheritance

(A hierarchy of objects for leveraging parents' implementation)

Playing Card `Deck` (Poker)

- 52 cards
  - 13 ranks x 4 suits = 52
  - One of each card, every combination

Image source: Fine Art America

```
class Deck:
    """ Represents a playing card deck. """
    __slots__ = ['cards']

    def __init__(self):
        self.cards = []
        for suit in range(4):
            for rank in range(1,14):
                card = Card(suit, rank)
                self.cards.append(card)
    def __str__(self):
        res = [ str(card) for card in self.cards ]
        #res = []
        #for card in self.cards:
        #    res.append(str(card))
        return '\n'.join(res)
```

```
    def pop_card(self):
        return self.cards.pop()

    def add_card(self, card):
        self.cards.append(card)

    def shuffle(self):
        random.shuffle(self.cards)
```

```
if __name__ == '__main__':
    # Testing Deck
    thedeck = Deck()

    print('\t\t',thedeck, len(thedeck.cards))
```

Prints each card name on 50+ lines

Last line will be: `King of Spades 52`

```
    thedeck.pop_card()

    print('\t\t',thedeck, len(thedeck.cards))
```

Prints each card name on 50+ lines

Last line will be: `Queen of Spades 51`

Playing Card `Hand`

- The cards held by one player
  - Typically empty
  - One card at a time added *from* the Deck

Image source: Fine Art America

```
class Hand(Deck):
    """ Represents a playing hand """
    __slots__ = ['label']

    def __init__(self, label=''):
        self.cards = []
        self.label = label
```

```
if __name__ == '__main__':
    # Testing Hand
    hand = Hand('new hand')  []
    print('cards:',hand.cards)
    print('label:',hand.label)  'new hand'
```

Dealing a `Hand`

- Take one card from the `Deck`
- Add it to the player's `Hand`

Image source: Fine Art America

Dealing a `Hand`

- Take one card from the `Deck`
- Add it to the player's `Hand`

```
>>> deck = Deck()
>>> hand = Hand('player 1')
>>> card = deck.pop_card()
>>> hand.add_card(card)
>>> print(hand)
King of Spades
```

`hand` only contains one card, King of Spaces!

Image source: Fine Art America

Dealing a `Hand`

- Take *many* cards from the `Deck`
- Add them all to the player's `Hand`

Image source: Fine Art America

Dealing a `Hand`

- Take *many* cards from the `Deck`
- Add them all to the player's `Hand`

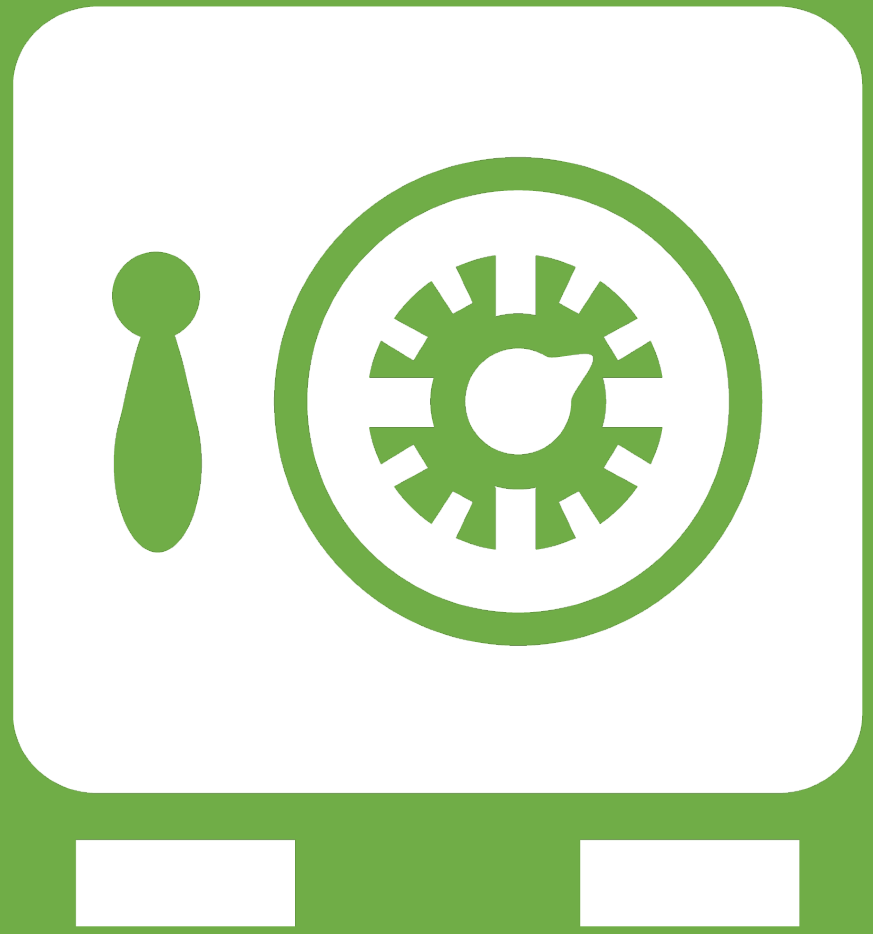
- Add to `Deck`:

```
def move_cards(self, hand, num):
    for i in range(num):
        hand.add_card(self.pop_card())
```

Image source: Fine Art America

```
if __name__ == '__main__':
# Testing Hand/Deck
    p1hand = Hand('player 1')
    newDeck = Deck()
    print("Starter Deck:", len(newDeck.cards)) 52
    print("Starter Hand:", p1hand)
    newDeck.shuffle()
    newDeck.move_cards(p1hand, 5)
    print("Final Deck:", len(newDeck.cards))  47
    print("Final Hand:", p1hand) 2 of Clubs
                                 7 of Spades
                                 9 of Spades
                                 8 of Diamonds
                                 2 of Spades
```

Please contact me!



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