CS101, Spring 2015

Objects: Creation and Attributes

Lecture #8

Roadmap

Last week we learned

- Default parameters
- Named parameters
- Formatting
- String methods
- Image processing

This week we will learn

- Objects
  - object creation
  - object attributes

Blackjack

There are 52 cards. Each card has a face and a suit. The suits are clubs, spades, hearts, and diamonds. The faces are 2, 3, . . . , 10, Jack, Queen, King, Ace.

The value of a card is the number for a number card, 11 for an Ace, and 10 for Jack, Queen, and King.

We can represent cards as a triple `(face, suit, value)`.

If `card` is a card, then `card[0]` is the face, `card[1]` is the suit, and `card[2]` is the value.

Cards as triples

Computing the value of a hand:

```
def hand_value(hand):
  total = 0
  for card in hand:
    total += card[2]
  return total
```

Printing a card nicely:

```
def card_string(card):
  article = "a "
  if card[0] in [8, "Ace"]: article = "an "
  return article + str(card[0]) + " of  " + card[1]
```

Easy to make mistakes: What does `card[2]` mean? What if somebody creates a card `("Ace", "Spades", 5)`?

Cards as objects

Let us define a new object type with attributes for face, suit, and value:

```
class Card(object):
  """A Blackjack card."""
  pass

card = Card()              ← create Card object
card.face = "Ace"
card.suit = "Spades"       ← set attributes of card
card.value = 11
```

card has a user-defined type:

```
>>> type(card)
<class '__main__.Card'>
```

Cards as objects

Computing the value of a hand:

```
def hand_value(hand):
  total = 0
  for card in hand:
    total += card.value
  return total
```

Printing a card nicely:

```
def card_string(card):
  article = "a "
  if card.face in [8, "Ace"]: article = "an "
  return (article + str(card.face) +
          " of " + card.suit)
```

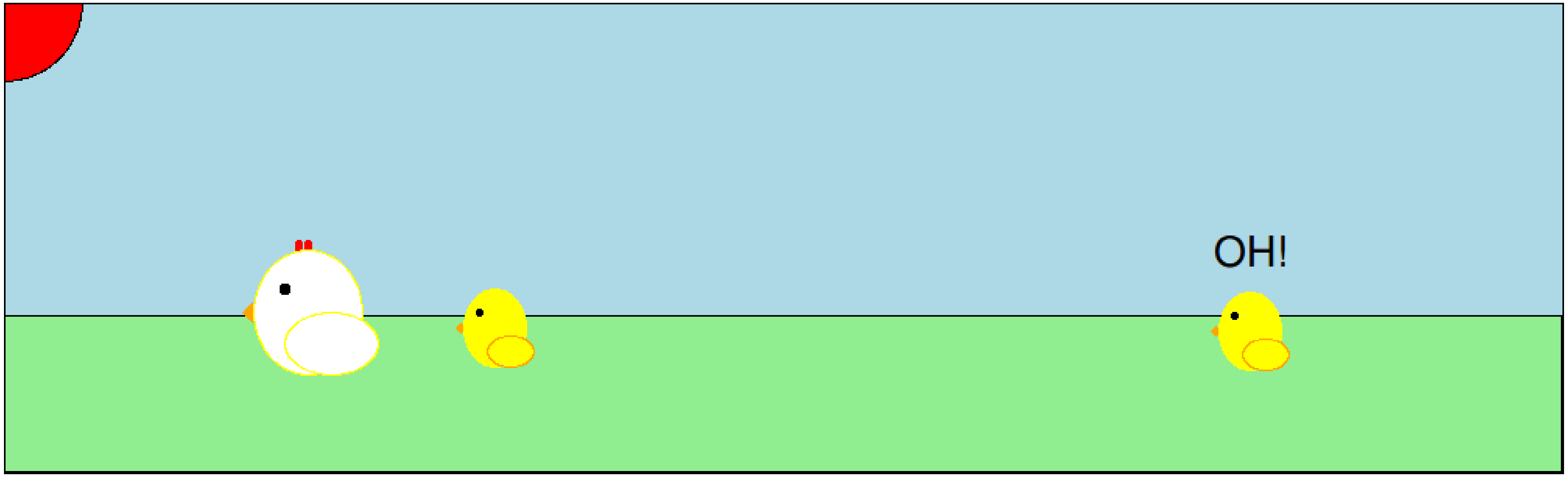
Objects are mutable

There is one big difference between tuples and `Card` objects:
Card objects are mutable:

```
>>> card = Card()
>>> card.face = "Ace"
>>> card.suit = "Spades"
>>> card.value = 11
... and later ...
>>> card.suit = "Hearts"
```

Journey of Chicken

An animation by Jeong-eun Yu and Geum-hyeon Song (2010 Freshmen).



Three `Layer` objects: mother hen, chick1, chick2.
Each chicken has `body`, `wing`, `eye`, and `beak`. Mother hen also has two red dots on the head.

The two chickens are exactly the same. Mother hen is larger and white.

Copy & Paste

The simplest method to make similar objects is to write the code once, and copy & paste it (with the necessary modifications).

Disadvantage: When you find a bug, you have to debug all copies of the code. It is not easy to change the appearance of all the chickens at once.

Let's try to implement the chicken as an object:

```
class Chicken(object):
  """Graphic representation of a chicken."""
  pass
```

Our chicken will have attributes `layer`, `body`, `wing`, `eye`, and `beak`.

Chicken objects

The function make_chicken creates a chicken object, with positioned at $(0, 0)$.

```
def make_chicken(hen = False):
  layer = Layer()
  if hen:
    body = Ellipse(70,80)
    body.setFillColor("white")
  else:
    body = Ellipse(40,50)
    body.setFillColor("yellow")
    body.move(0, 10)
  body.setBorderColor("yellow")
  body.setDepth(20)
  layer.add(body)
  # similar for wing, eye, beak, dots
```

Chicken objects

Finally we create and return the Chicken object:

```
def make_chicken(hen = False):
  # ... see previous page

  ch = Chicken()
  ch.layer = layer
  ch.body = body
  ch.wing = wing
  ch.eye = eye

  # return the Chicken object
  return ch
```

Using chickens

We use Chicken objects by accessing their attributes:

```
hen = make_chicken(True)
chick1 = make_chicken()
chick1.layer.move(120,0)

herd = Layer()
herd.add(hen.layer)
herd.add(chick1.layer)
herd.move(600, 200)

chick2 = make_chicken()
chick2.layer.move(800,200)
```