Blackjack

There are 52 cards. Each card has a face and a suit. The suits 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.

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

card = Card()
card.face = "Ace"
card.suit = "Spades"
card.value = 11
```

Methods

We do not really need the `value` attribute, since the value can be computed from the `face` attribute. We add a `value()` method to our `Card` class:

```
class Card(object):
  """A Blackjack card."""
  def value(self):
    if type(self.face) == int:
      return self.face
    elif self.face == "Ace":
      return 11
    else:
      return 10
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`method of Card`

`self` refers to the object itself inside the method.

We can create and use `Card` objects:

```
>>> card = Card()
>>> card.face = "Ace"
>>> card.suit = "Spades"
>>> card_string(card)
'an Ace of Spades'
>>> card.value()
11
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We need nicer syntax to create `Card` objects:
`Card(8, "Clubs")`.

And `card_string` should be a method of `Card`.

Constructors

Objects can have a special method `__init__`, called a constructor. Whenever an object of this type is created, the constructor is called.

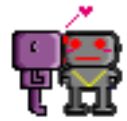
```
FACES = range(2,11) + ['Jack','Queen','King','Ace']
SUITS = [ 'Clubs', 'Diamonds', 'Hearts', 'Spades']

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

  def __init__(self, face, suit):
    assert face in FACES and suit in SUITS
    self.face = face
    self.suit = suit
```

Now creating cards is elegant:

```
hand = [ Card("Ace", "Spades"),
         Card(8, "Diamonds"),
         Card("Jack", "Hurts"),
         Card(10, "Clubs") ]
```



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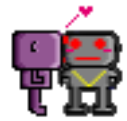
```

Let's change `card_string(card)` into `card.string()`:

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



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for card in hand:
  print card.string(), "has value", card.value()
```

String conversion

We can make conversion to strings even nicer: `str(card)` calls the special method `__str__`:

```
def __str__(self):
  article = "a "
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Now we can write:

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for card in hand:
  print card, "has value", card.value()
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`print` automatically converts its arguments to `str`

More chicken!

Let's improve our `Chicken` object by adding a constructor, `move` and `jump` methods.

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```
class Chicken(object):
  """Graphic representation of a chicken."""
  def __init__(self, hen = False):
    layer = Layer()
    # make all the parts
    self.layer = layer
    self.body = body
    self.wing = wing
    self.eye = eye

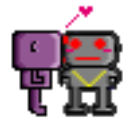
  def move(self, dx, dy):
    self.layer.move(dx, dy)
```

A Deck object

Let's create another object, that represents a shuffled deck of 52 cards. We only need one method: drawing a card from the top of the deck:

```
class Deck(object):
  """A deck of cards."""
  def __init__(self):
    "Create a deck of 52 cards and shuffle them."
    self.cards = []
    for suit in SUITS:
      for face in FACES:
        self.cards.append(Card(face, suit))
    random.shuffle(self.cards)

  def draw(self):
    """Draw the top card from the deck."""
    return self.cards.pop()
```



```
num_players = 3
num_cards = 5
deck = Deck()
hands = []
for j in range(num_players):
  hands.append([])

for i in range(num_cards):
  for j in range(num_players):
    card = deck.draw()
    hands[j].append(card)
    print "Player", j+1, "draws", card

for j in range(num_players):
  print ("Player %d's hand (value %d):" %
         (j+1, hand_value(hands[j])))
  for card in hands[j]:
    print " ", card
```

A list of lists (one for each player)

Blackjack

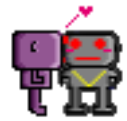
Time to play Blackjack:

```
You are dealt a 6 of Hearts
Dealer is dealt a hidden card
You are dealt a 3 of Spades
Dealer is dealt a 9 of Hearts
Your total is 9
Would you like another card? (y/n) y
You are dealt an Ace of Clubs
Your total is 20
Would you like another card? (y/n) n
The dealer's hidden card was a 10 of Spades
The dealer's total is 19
Your total is 20
The dealer's total is 19
You win!
```

Equality

The comparison operators ==, !=, < etc. do not work automatically for objects:

```
>>> Card(8, "Diamonds") == Card(8, "Diamonds")
False
>>> Card(8, "Diamonds") == Card(9, "Diamonds")
False
```



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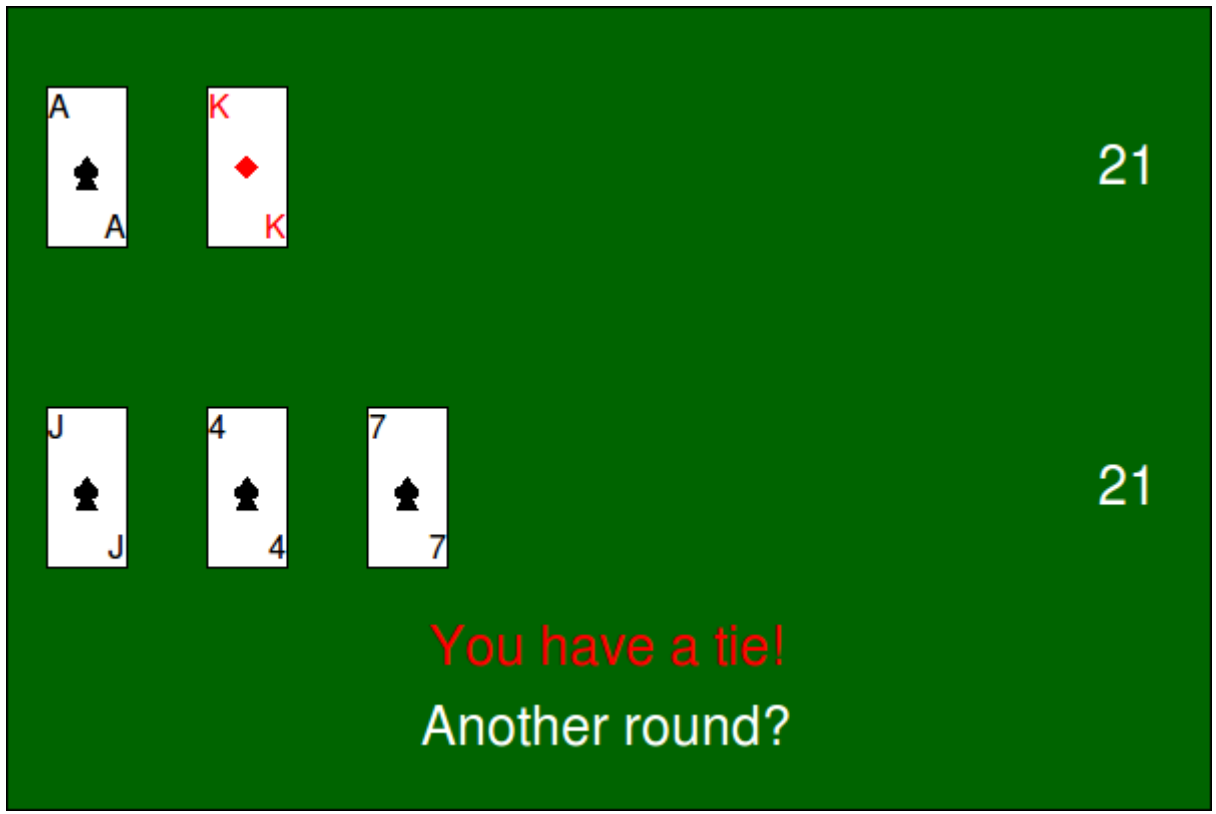
We can define equality through the special method __eq__:

```
  def __eq__(self, rhs):
    return (self.face == rhs.face and
            self.suit == rhs.suit)
  def __ne__(self, rhs):
    return not self == rhs
```

Blackjack with Graphics



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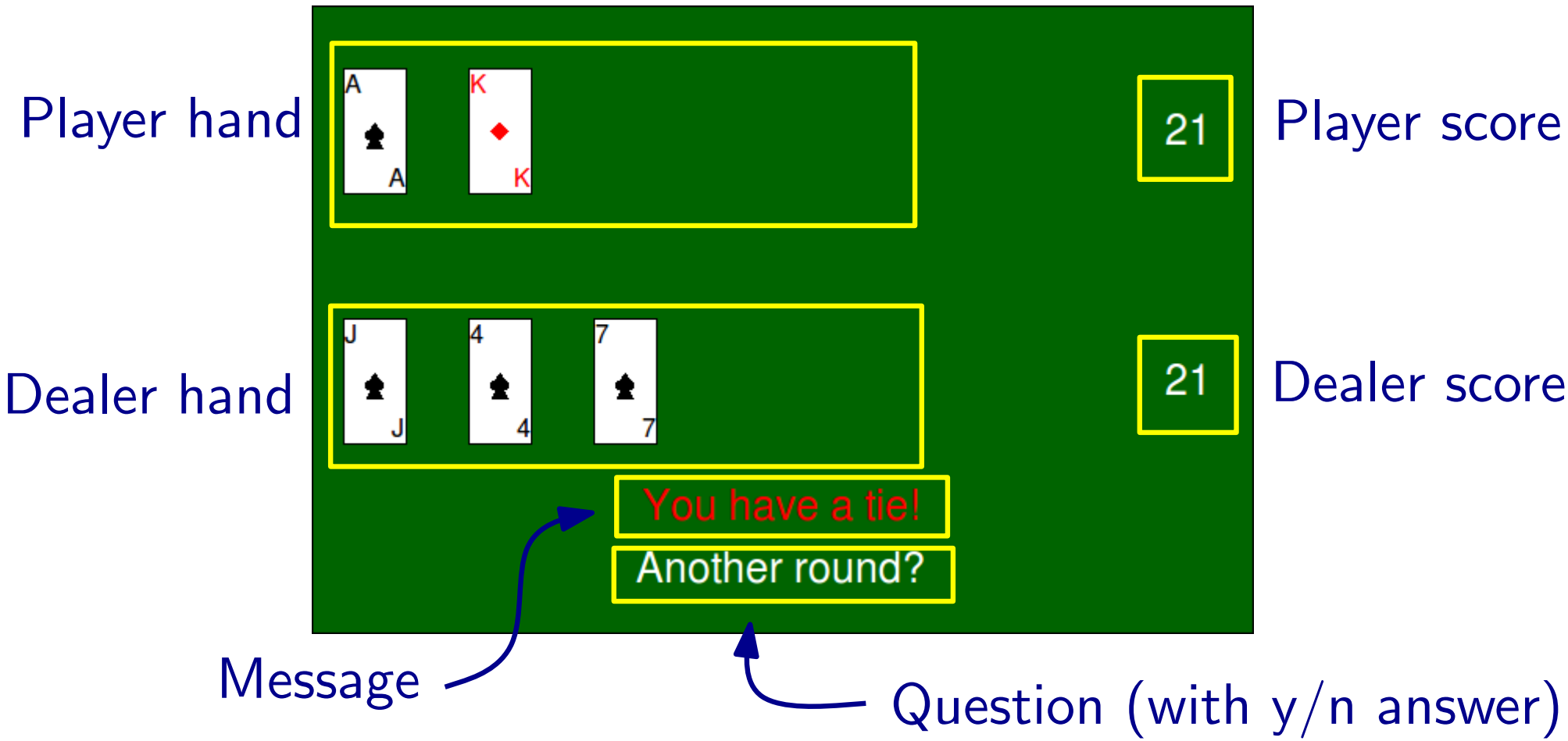

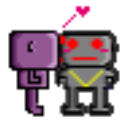

Table object

A `Table` represents the Blackjack table. It provides the following methods:

- `clear()` clear everything
- `close()` close window and end game
- `set_score(which, text)` where `which in [ 0, 1 ]`
- `set_message(text)`
- `ask(prompt)` waits for `y` or `n` and returns `True` or `False`

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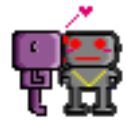
`Table` has two attributes `dealer` and `player`. These are `Hand` objects that represent the hand on the table.



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Methods of `Hand` objects:

- `clear()`
- `add(card, hidden = False)`
- `show()` shows all hidden cards
- `value()` return value of hand

Waiting for user interaction

The `Table.ask(prompt)` method must wait for the user to press a key:

```
def ask(self, prompt):
  self.question.setMessage(prompt)
  while True:
    e = self.canvas.wait()
    d = e.getDescription()
    if d == "canvas close":
      sys.exit(1)
    if d == "keyboard":
      key = e.getKey()
      if key == 'y':
        return True
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e is an event object

User interface programming

Programs with a graphical user interface (GUI) are structured around events. Most of the time, the program just waits for an event to happen.

Events are for instance:

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- window is minimized, maximized, or closed
- mouse is moved
- mouse button is pressed
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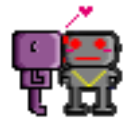

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Event-based programming means that a program doesn't have a sequential flow of control, but consists of functions that are called by events.