RAD Lab
UC Berkeley

Ruby on Rails Short Course
Part 3: Basic Rails

Armando Fox
UC Berkeley RAD Lab

Outline of the day

1. Web apps, MVC, SQL, Hello World
2. Just enough Ruby
3. Basic Rails

Lunch break

4. Advanced model relations
5. AJAX & intro to testing
6. Configure & deploy

Informal discussion: RoR and pedagogy

Outline of Session 3

- Overview of ActiveRecord
  - accessors and attributes, constructors, finders
  - validations, model lifecycle & callbacks
  - after lunch: ActiveRecord *associations*—coolness
- Overview of ActionView
  - RHTML, RXML, RJS, HAML
  - Forms and model objects, tag helpers
  - Preview: AJAX
- Overview of ActionController
  - connections between controller & view
  - sessions: the hash & the flash
  - stupid filter tricks

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Quick review: hashes and function call notation

- Immediate hash (any object can be a key, any object can be an attribute)

  `my_hsh = {:foo => 1, "x" => nil, 3 => ['a',4]}`

  `my_hsh[:nonexistent_key]` returns nil
- Parens can be omitted from function calls if parsing is unambiguous

  `x = foo(3, "no")` ⇔ `x = foo 3, "no"`
- Braces can be omitted from hash if parsing is unambiguous

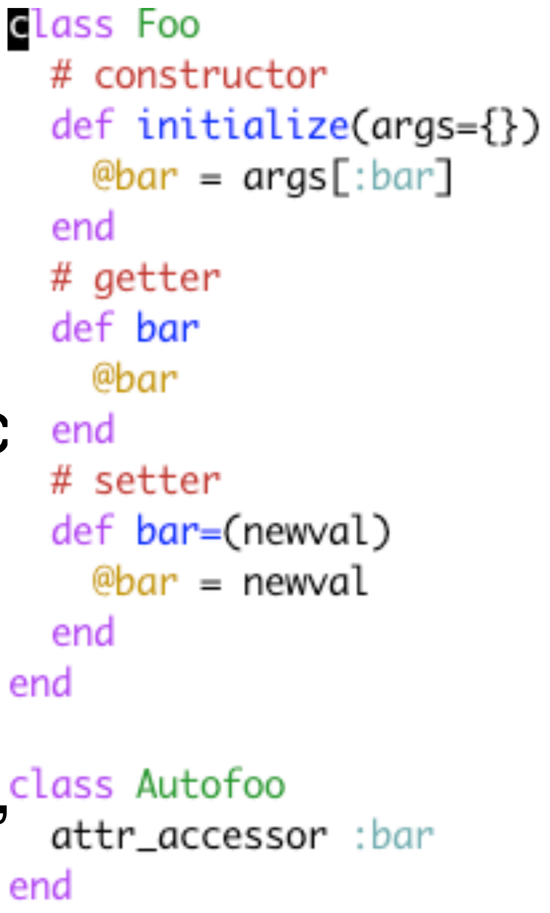
  `x = foo( {:a=>1,:b=>2})` ⇔ `x = foo(:a=>1,:b=>2)`
  - easy way to do keyword arguments
  - Caveat: passing immediates to a function that accepts multiple hashes as its arguments

Active Record: what is it?

- A class library that provides an object-relational model over a plain old RDBMS
- Deal with objects & attributes rather than rows & columns
  - query result rows ⇔ enumerable collection
  - object hierarchy ⇔ join query

Review: the Student Example

- object attributes are "just" instance methods
- ActiveRecord accessors/mutators...
  - default `attr_accessor` for eac table column
  - perform type-casting as needed
  - can be overridden, virtualized, etc.



```
class Foo
  # constructor
  def initialize(args={})
    @bar = args[:bar]
  end
  # getter
  def bar
    @bar
  end
  # setter
  def bar=(newval)
    @bar = newval
  end
end

class Autofoo
  attr_accessor :bar
end
```

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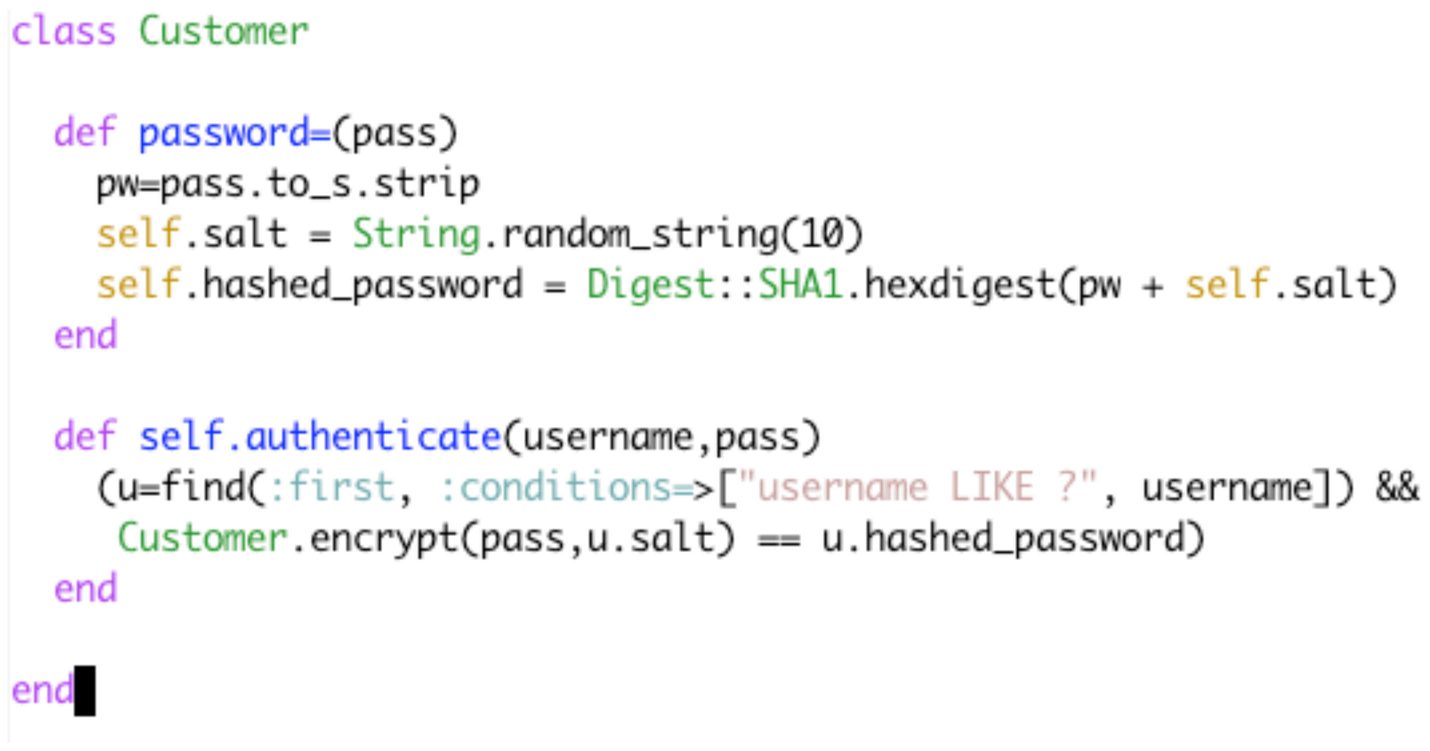
Example: open up Student class...

```
class Student

  def youngster?
    self.degree_expected > Date.parse("June 15, 2008")
  end

  def days_till_graduation_as_string
    graduation = self.degree_expected
    now = Date.today
    if graduation.nil?
      "This person will never graduate."
    elsif  graduation < now
      "Graduated #{now-graduation} days ago"
    else
      "Will graduate in #{graduation-now} days"
    end
  end

end
```

Virtual attributes example: simple authentication

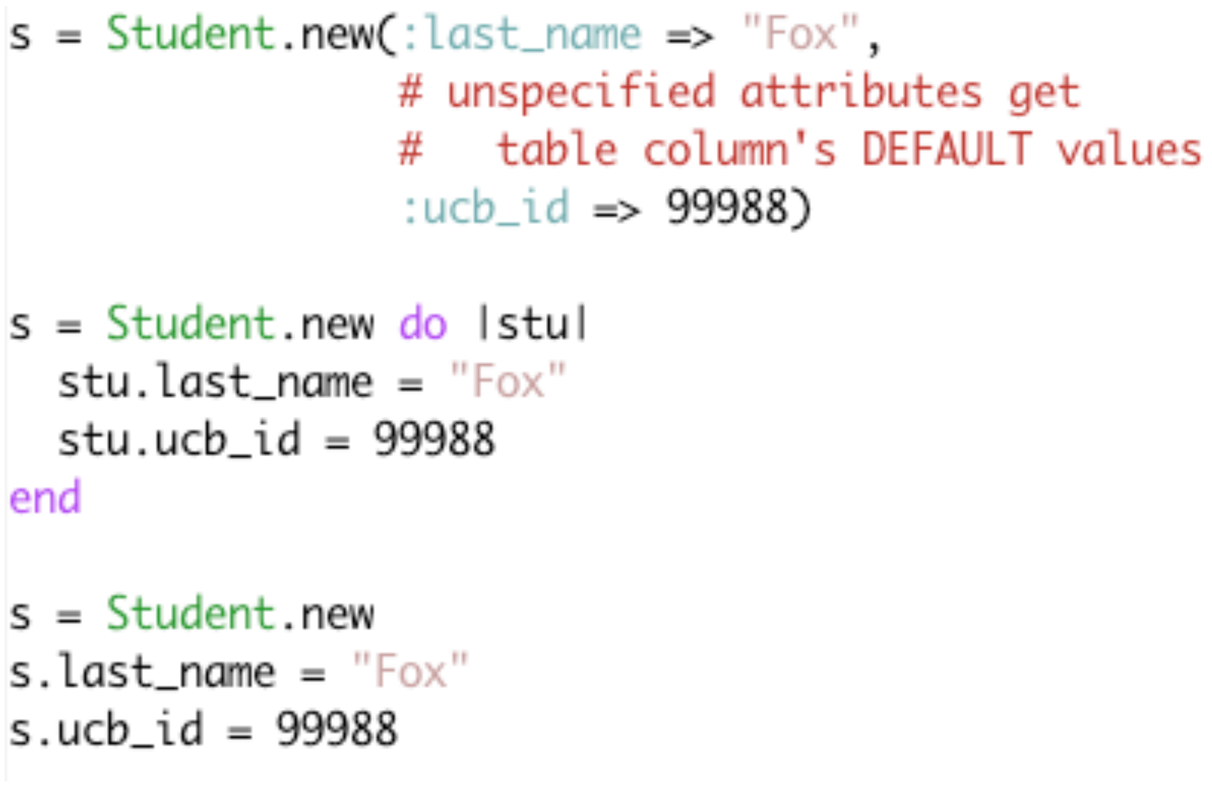
- Only salt & hashed password are stored



```
class Customer

  def password=(pass)
    pw=pass.to_s.strip
    self.salt = String.random_string(10)
    self.hashed_password = Digest::SHA1.hexdigest(pw + self.salt)
  end

  def self.authenticate(username,pass)
    (u=find(:first, :conditions=>["username LIKE ?", username]) &&
     Customer.encrypt(pass,u.salt) == u.hashed_password)
  end

end
```

Constructors

- Initializer knows if it's been handed a block (predicate method `Kernel#block_given?`)

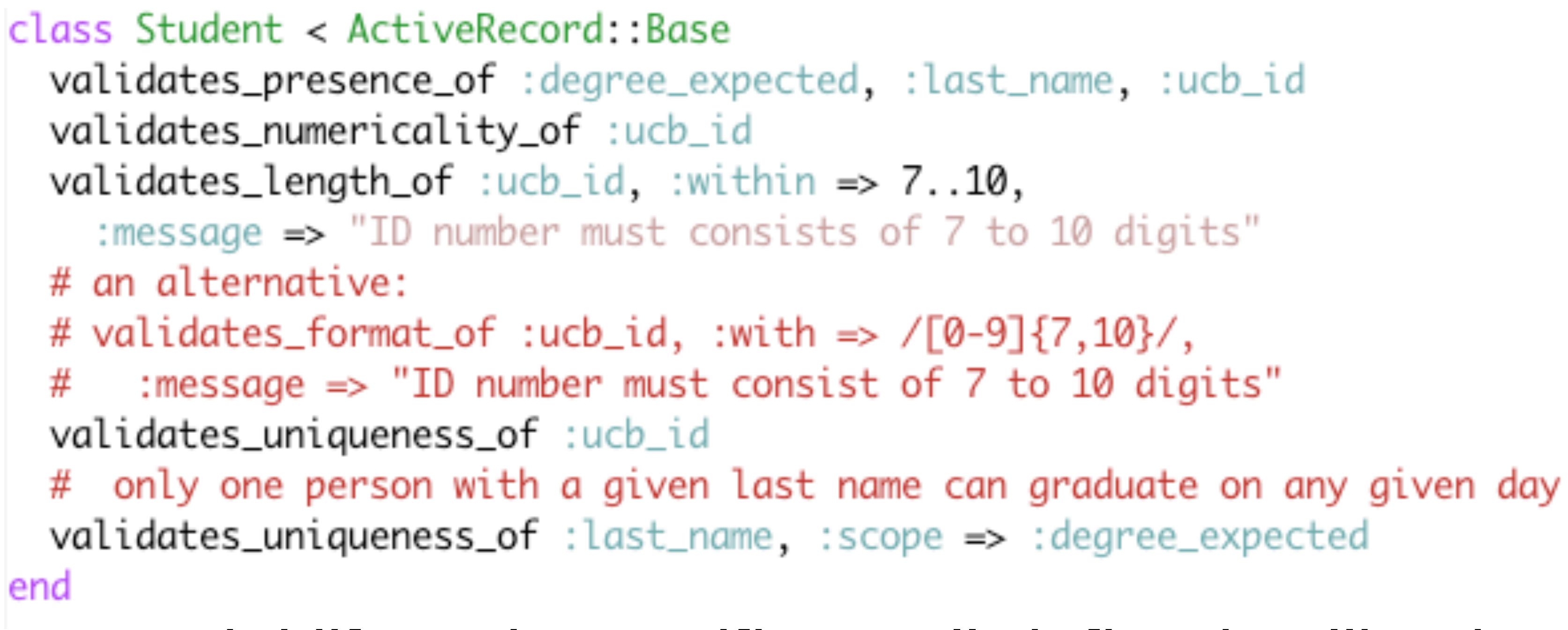


```
s = Student.new(:last_name => "Fox",
                # unspecified attributes get
                #   table column's DEFAULT values
                :ucb_id => 99988)

s = Student.new do |stu|
  stu.last_name = "Fox"
  stu.ucb_id = 99988
end

s = Student.new
s.last_name = "Fox"
s.ucb_id = 99988
```

New != Create

- Call `s.save` to write the object to the database
  - `s.create(args) ≈ s.new(args); s.save`
  - `s.update_attributes(hash)` can be used to update attributes in place
  - `s.new_record?` is true iff no underlying database row corresponds to `s`
- `save` does right thing (INSERT or UPDATE)
- Convention over configuration:
  - if `id` column present, assumes primary key
  - `updated_at/created_at` (resp. *`_on`) automatically set if present to update/creatiion date (resp. time)

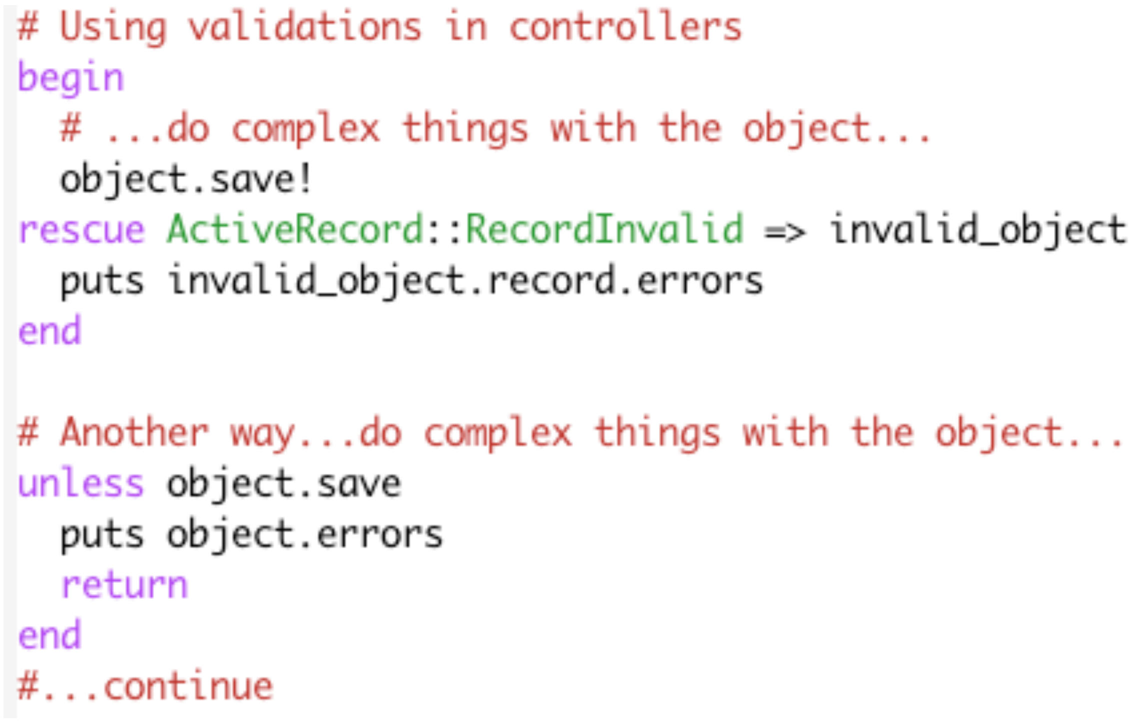
But!...validations



```
class Student < ActiveRecord::Base
  validates_presence_of :degree_expected, :last_name, :ucb_id
  validates_numericality_of :ucb_id
  validates_length_of :ucb_id, :within => 7..10,
    :message => "ID number must consists of 7 to 10 digits"
  # an alternative:
  # validates_format_of :ucb_id, :with => /[0-9]{7,10}/,
  #    :message => "ID number must consist of 7 to 10 digits"
  validates_uniqueness_of :ucb_id
  #  only one person with a given last name can graduate on any given day
  validates_uniqueness_of :last_name, :scope => :degree_expected
end
```

- *model lifecycle* specifies well-defined callbacks for ActiveRecord manipulation
  - allows keeping validation semantics with the model
  - allows keeping validation code separate from mainline
- are those macros, language keywords, or what?

How would you use these?

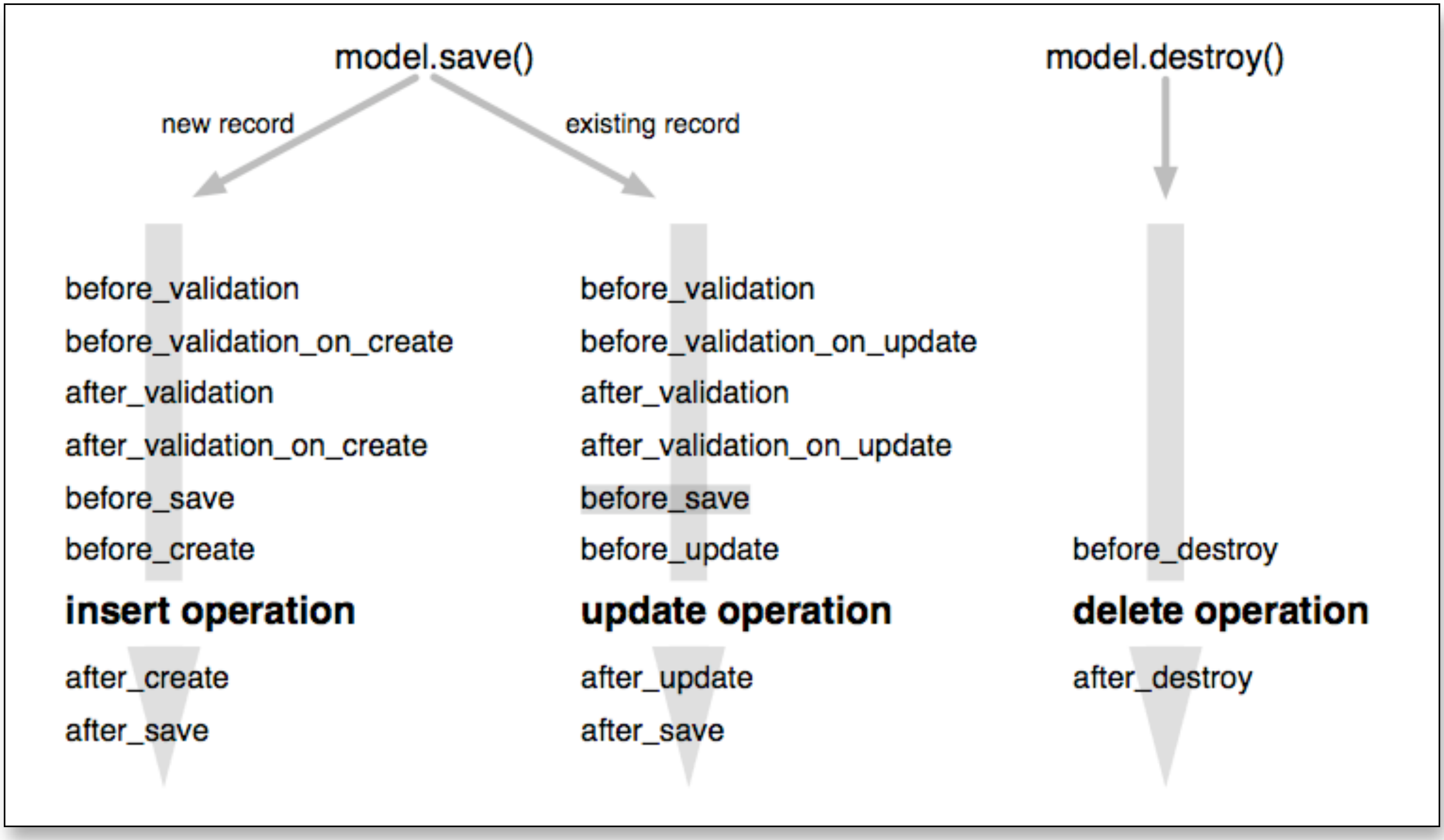


```
# Using validations in controllers
begin
  # ...do complex things with the object...
  object.save!
rescue ActiveRecord::RecordInvalid => invalid_object
  puts invalid_object.record.errors
end

# Another way...do complex things with the object...
unless object.save
  puts object.errors
  return
end
#...continue
```

- Note convention: `save!` vs. `save` (also `create, update,` ...)
- Scaffolding provides a default use via a view helper method `errors_for`

Callbacks: the Return (get it?) of Aspect-Oriented Programming

Allows Pre and Post Operations



Another way to do passwords

Encrypt a password before saving the record

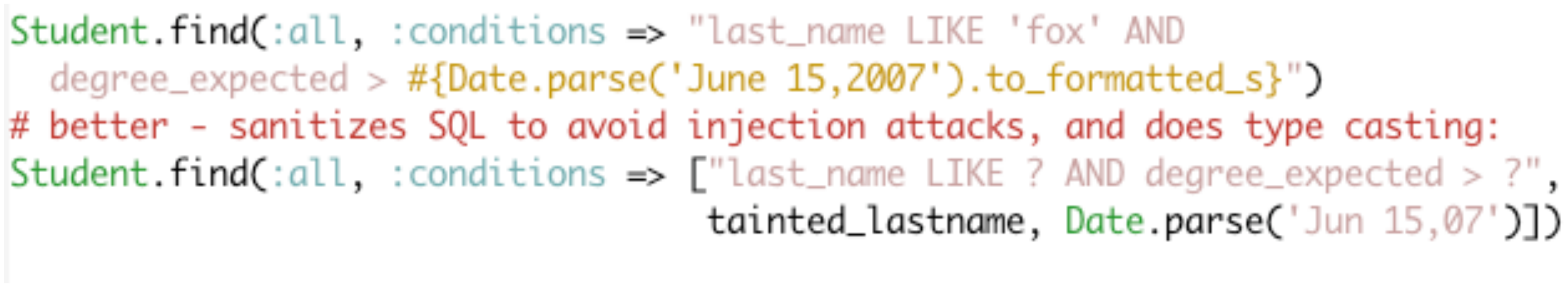
```
# Encrypts some data with the salt.
def self.encrypt(password, salt)
  Digest::SHA1.hexdigest("--#{salt}--#{password}--")
end

def before_save
  return if password.blank?
  self.salt = Digest::SHA1.hexdigest("--#{Time.now.to_s}--
   #{login}--") if new_record?
  self.crypted_password = encrypt(password)
end
```

find() ≈ SQL SELECT

```
# To find an arbitrary single record:
s = Student.find(:first)
# To find all records:
students = Student.find(:all)

# find by 'id' primary key (Note! throws RecordNotFound)
book = Book.find(1235)
# Find a whole bunch of things
ids_array = get_list_of_ids_from_somewhere()
students = Student.find(ids_array)

# To find by column values:
armando = Student.find_by_last_name('Fox')
a_local_grad =
   Student.find_by_city_and_degree_expected('Berkeley',
   Date.parse('June 15,2007')

# To find only a few, and sort by an attribute
many_localgrads =
   Student.find_all_by_city_and_degree_expected('Berkeley',
   Date.parse('June 15,2007'),:limit=>30,:order=>:last_name)
```

Find by conditions

Use ? for values from parameters. Rails will sanitize the SQL and prevent any SQL injection



```
Student.find(:all, :conditions => "last_name LIKE 'fox' AND
  degree_expected > #{Date.parse('June 15,2007').to_formatted_s}")
# better - sanitizes SQL to avoid injection attacks, and does type casting:
Student.find(:all, :conditions => ["last_name LIKE ? AND degree_expected > ?",
                                   tainted_lastname, Date.parse('Jun 15,07')])
```

You can also specify ordering and use arbitrary SQL operators (caveat emptor: database portability may be jeopardized)

```
# Using SQL conditions
books = Book.find(:all,
   :conditions => ['pub_date between ? and ?',
   params[:start_date], params[:end_date]],
   :order => 'pub_date DESC')
```

Advanced Find

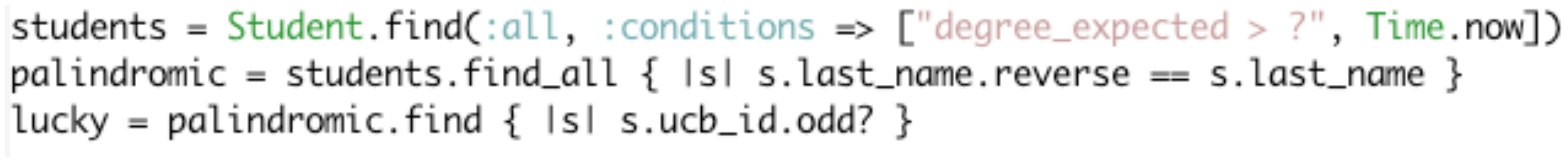
You can also specify limits and offsets, and oh so much more

```
books = Book.find(:all,
   :conditions => [‘pub_date between ? and ?’,
       params[:start_date], params[:end_date]],
    :limit => 10, :offset => params[:page].to_i * 10)
```

- `:lock` - Holds lock on the records (default: share lock)
- `:select` - Specifies columns for SELECT (default *)
- `:group` - (used with select) to group
- `:readonly` - load as read-only (object can’t be saved)
- `:include` - Prefetches joined tables (try :include first; more about this in Section 4)
- Note: use SQL-specific features at your own risk....

Caveat!

- The result of a find-all operation *mixes in* `Enumerable`
- `Enumerable` defines methods `find` and `find_all`
- Not to be confused with `ActiveRecord::Base#find`!



```
students = Student.find(:all, :conditions => ["degree_expected > ?", Time.now])
palindromic = students.find_all { |s| s.last_name.reverse == s.last_name }
lucky = palindromic.find { |s| s.ucb_id.odd? }
```

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Action View

- A template for rendering views of the model that allows some code embedding
  - commonly RHTML; also RXML, HAML, RJS
  - note...too much code breaks MVC separation
  - convention: views for model *foo* are in `app/views/`foo/
- "Helper methods" for interacting with models
  - model values→HTML elements (e.g. menus)
  - HTML form input→assignment to model objects
- DRY (Don't Repeat Yourself) support
  - *Layouts* capture common page content at application level, model level, etc. (`app/views/layouts/`)
  - *Partials* capture reusable/parameterizable view patterns

Helper Methods for Input & Output

- Review: we saw a simple view already...
  - Anatomy: `<%` *code* `%>`   `<%=` *output* `%>`
- But these form tags are generic...what about model-specific form tags?
- In the RHTML template:

```
<%= text_field 'student', 'last_name'  %>
```

- In HTML delivered to browser:

```
<input id="student_last_name"
  name="student[last_name]" size="30"
  type="text" value="Fox" />
```

- What happened? For that we have to look at *partial.*

Partials

- Reusable chunk of a view
  - e.g., one line of a Student table
  - e.g., form to display/capture Student info that can be used as part of Edit, Show, Create,...
  - file naming convention: the partial *foo* for model *bar* is in `app/views/`bar/_foo.`rhtml`
- default partial *form* generated by scaffolding
  - so *edit.rhtml* (the *edit view*) is really trivial, and differs minimally from *new.rhtml*
  - but both of them set the instance variable *student*
- So what's the point of model-specific form fields? We'll revisit shortly when we discuss controllers.

What about a collection?

- Common idiom:

```
@students.each do |student|
  render :partial => 'student'
```

- Captured by:

```
render :partial => :student, :collection =>
  @students
```

  – other options allow passing local variables to partial & specifying “divider” template

Validation error reporting in views: CSS+HTML+Rails

- `form` partial sets ID, class of specific elements
  - `text_field` helper conditionally wraps HTML element in `<div class="fieldWithErrors">`
  - `error_messages_for` (in 'form' partial) wraps `@student.errors` (set by ActiveRecord validation callbacks) with `<div id="errorExplanation">`
- Default layout for class (`app/views/layouts/students.rhtml`)
  - generated by `script/generate scaffold student`
  - pulls in stylesheet `scaffold.css` (generic scaffolding styles) that define visual appearance for element ID `errorExplanation` and class `fieldWithErrors`

Yow!

Note what does *not* happen

- No explicit conditional code in views
- No conflation of logical structure with visual appearance (CSS used wisely)
  - `error_messages_for` returns generic HTML tagged with (user-specified) id's and classes
- No needless repetition: use templates to DRY out code
  - 'form' partial
  - 'student' layout: elements common to all Student-related views, e.g. page title
  - (not in this example) reuse of top-level formatting via `application.rhtml` template
- Another way of looking at it: the world's going declarative

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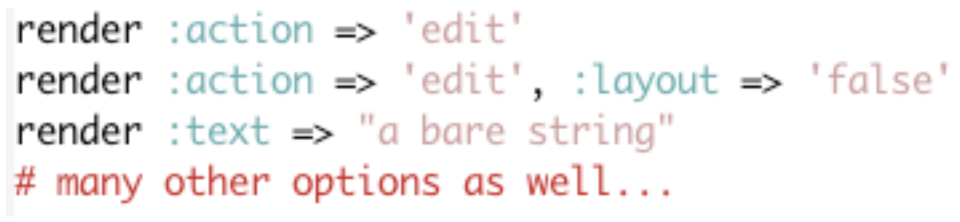
Action Controller

- Each incoming request instantiates a new Controller object with its own instance variables
  - Routing (Sec. 4) determines which method to call
  - Parameter unmarshaling (from URL or form sub.) into `params[]` hash

  ...well, not really a hash...but responds to `[]`, `[]=`
- Controller methods set up instance variables
  - these will be visible to the view
  - controller has access to model's class methods; idiomatically, often begins with `Model.find(...)`
- Let's see some examples...

Then we render...

- Once logic is done, render the view



```
render :action => 'edit'
render :action => 'edit', :layout => 'false'
render :text => "a bare string"
# many other options as well...
```

  - exactly one *render* permitted from controller method (1 HTTP request ⇔ 1 response)
  - Convention over configuration: implicit *render* looks for template matching controller method name and renders with default layouts (model, app)
  - language geek side note: use of CLU-inspired `yield` in content rendering

What about those model-specific form elements?

- Recall:
  ```
  <input type="text" id="student_last_name"
  name="student[last_name]"/>
  ```
- Related form elements for student attributes will be named `student[`*attr*`]`
  - marshalled into params as `params[:student][:last_name]`, `params[:student][:degree_expected]`, etc.
  - i.e, `params[:student]` is a hash :last_name=>string, :degree_expected=>date, etc.
  - and can be assigned directly to model object instance
  - helpers for dates and other “complex” types...magic

What else can happen?

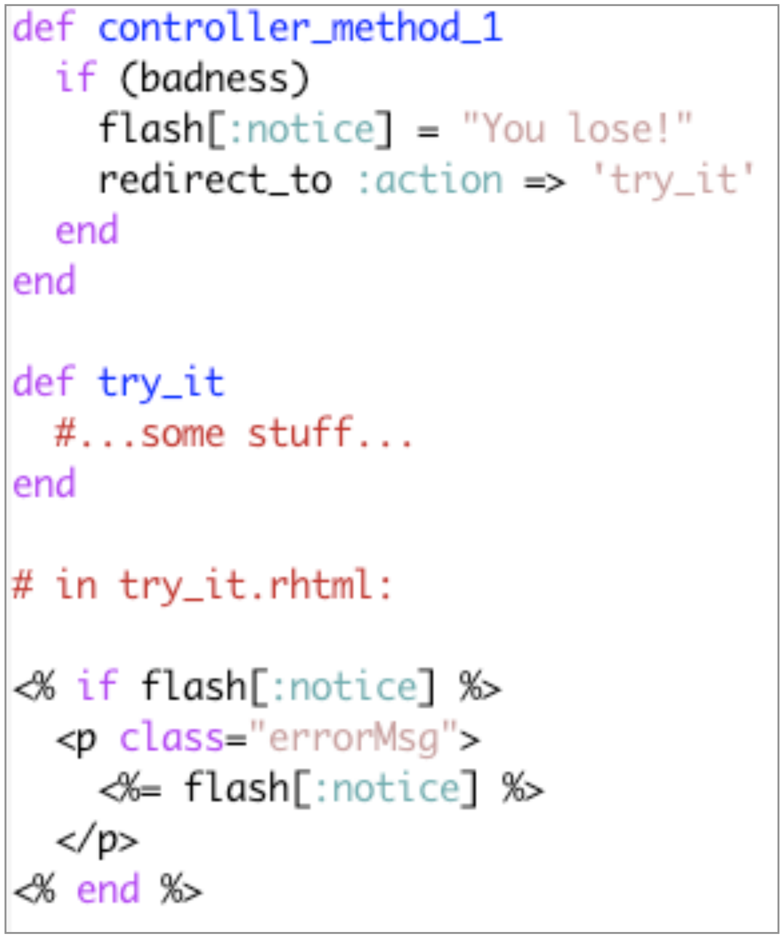
- `redirect_to` allows falling through to different action *without* first rendering
  - fallthrough action will call render instead
  - works using HTTP 302 Found mechanism, i.e. separate browser roundtrip
- example: create method
  - success: redirect to `list` action
  - fail: *render* the `new` action (without redirect)...why?

The Session Hash

- Problem: HTTP is stateless (every request totally independent). How to synthesize a *session* (sequence of related actions) by one user?
- Rails answer: `session[]` is a magic persistent hash available to controller
  - Actually, it's not really a hash, but it quacks like one
  - Managed at dispatch level using cookies
  - You can keep full-blown objects there, or just id's (primary keys) of database records
  - Deploy-time flag lets sessions be stored in filesystem, DB table, or distributed in-memory hash table

The Flash

- Problem: I'm about to `redirect_to` somewhere, but want to display a notice to the user
- yet that will be a different controller instance with all new instance variables
- Rails answer: `flash[]`
  - contents are passed to the *next* action, then cleared
  - to this action: `flash.now[:notice]`
  - visible to views as well as controller
- Strictly speaking, could use session & clear it out yourself



```
def controller_method_1
  if (badness)
    flash[:notice] = "You lose!"
    redirect_to :action => 'try_it'
  end
end

def try_it
  #...some stuff...
end

# in try_it.rhtml:

<% if flash[:notice] %>
  <p class="errorMsg">
    <%= flash[:notice] %>
  </p>
<% end %>
```

Controller predicates: `verify`

- A declarative way to assert various preconditions on calling controller methods
- You can check selectively (`:only, :except`) for...
  - HTTP request type (GET, POST, Ajax XHR)
  - Presence of a key in the flash or the session
  - Presence of a key in `params[]`
- And if the check fails, you can...
  - `redirect_to` somewhere else
  - `add_to_flash` a helpful message
- A simple example in our simple controller

More General Filters

- Code blocks that can go before, after or around controller actions; return Boolean

```
before_filter :filter_method_name
before_filter { |controller| ... }
before_filter ClassName
```

  - options include `:only,:except`, etc.
  - multiple filters allowed; calls provided to prepend or append to filter chain
  - subclasses inherit filters but can use `skip_filter` methods to selectively disable them
- If any before-filter returns false, chain halted & controller action method won't be invoked
  - so filter should redirect_to, render, or otherwise deal with the request
- Simple example: authentication

Summary

- ActiveRecord provides (somewhat-)database-independent object model over RDBMS
  - made *much* more powerful through use of associations
- ActionView supports display & input of model objects
  - facilitates reuse of templates via layouts & partials
- ActionController dispatches user actions, manipulates models, sets up variables for views
  - declarative specifications capture common patterns for checking predicates before executing handlers
- Pervasive use of CSS and HTML class/ID attributes separates appearance from structure, avoids need for explicit conditional code in views

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Questions