Templates and Class-based Views

Chapter 3

Objectives

- In this chapter we'll update our Pages app to have a homepage and an about page.
- We'll learn about Django's class-based views
  - TemplateView, ListView, DetailView
  - FormView, CreateView, UpdateView
- We'll also learn about templates and how to extend them.

Initial Setup

- In the previous chapters, we have completed the following steps:
  - create a new directory for our code
  - install Django in a new virtual environment
  - create a new Django project
  - create a new pages app with corresponding views and URLConfs
  - update settings.py

MTV framework (revisited)

- In Chapter 2, we have talked about Django’s MTV framework, where
  - **M stands for “Model,”**
  - **T stands for “Template,”**
  - **V stands for “View,”**
- In Chapter 2, we have covered the views function (and URL configurations). This chapter will talk about templates.

Templates

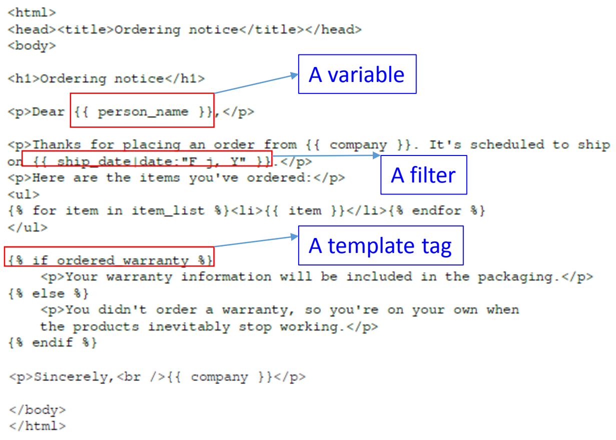
- Django uses templates so that individual HTML files can be served by a view to a web page specified by the URL.
- Templates, Views, and URLs work together closely.
- The URLs control the initial route, the entry point into a page, such as /about.
- The views contain the logic or the "what".
- The template has the HTML.
- For web pages that rely on a database model, it is the view that does much of the work to decide what data is available to the template.

Template system basics

- A Django **template** is a text document, or a normal Python string, that is marked up using the Django template language, with the intention to separate the presentation of a document from its data.
- A template can contain template tags and variables.
- A template defines placeholders and various bits of basic logic (template tags) that regulate how the document should be displayed.
- Usually, templates are used for producing HTML.
- The template system is meant to express presentation, not program logic. The objective is to separate data and presentation.

Template: An example

- This example template describes an HTML page that thanks a person for placing an order with a company. Think of it as a form letter.
- Any text surrounded by a pair of braces, e.g. {{ person_name }} is a *variable*.
- Any text surrounded by curly braces and percent signs e.g., {% if ordered_warranty %} is a *template tag*.
- A *template* tag tells the template system to “*do something*“.
- A *filter* is used to alter the format of a variable and is attached with a pipe character (|), e.g. {{ ship_date|date:"F j, Y" }} where we are passing the ship_date variable to the date filter with the arguments "F j, Y".



```
<html>
<head><title>Ordering notice</title></head>
<body>

<h1>Ordering notice</h1>

<p>Dear {{ person_name }},</p>

<p>Thanks for placing an order from {{ company }}. It's scheduled to ship
on {{ ship_date|date:"F j, Y" }}.</p>
<p>Here are the items you've ordered:</p>
<ul>
{% for item in item_list %}<li>{{ item }}</li>{% endfor %}
</ul>

{% if ordered_warranty %}
    <p>Your warranty information will be included in the packaging.</p>
{% else %}
    <p>You didn't order a warranty, so you're on your own when
    the products inevitably stop working.</p>
{% endif %}

<p>Sincerely,<br />{{ company }}</p>

</body>
</html>
```

Date Template Filter

Format character	Description	Example output
	Day	
d	Day of the month, 2 digits with leading zeros.	01 to 31
j	Day of the month without leading zeros.	1 to 31
S	English ordinal suffix for day of the month, 2 characters.	st, nd, rd or th
	Month	
m	Month, 2 digits with leading zeros.	01 to 12
n	Month without leading zeros.	1 to 12
b	Month, textual, 3 letters, lowercase.	jan
M	Month, textual, 3 letters.	Jan
F	Month, textual, long.	January
	Year	
y	Year, 2 digits.	99
Y	Year, 4 digits.	1999
	Week	
D	Day of the week, textual, 3 letters.	Fri
l	Day of the week, textual, long.	Friday
	Hours	
G	Hour, 24-hour format without leading zeros.	0 to 23
H	Hour, 24-hour format.	00 to 23
g	Hour, 12-hour format without leading zeros.	1 to 12
h	Hour, 12-hour format.	01 to 12
a	a.m. or p.m.	a.m.
A	AM or PM.	AM
	Minutes	
i	Minutes.	00 to 59
	Seconds	
s	Seconds, 2 digits with leading zeros.	00 to 59

Template Filters

- Template filters are simple ways of altering the value of variables before they're displayed. Filters use a pipe character, like this:

  `{{ name|lower }}` -- which converts text to lowercase
- Filters can be chained, e.g., that takes the first element in a list and converts it to uppercase: `{{ my_list|first|upper }}`
- Some filters take arguments. A filter argument comes after a colon and is always in double quotes. E.g.: `{{ bio|truncatewords:"30" }}`

Basic template-tags: if/else

The if tag may take one or several {% elif %} clauses.

```
{% if athlete_list %}
    Number of athletes: {{ athlete_list|length }}
{% elif athlete_in_locker_room_list %}
     <p>Athletes should be out of the locker room soon! </p>
{% elif ...
     ...
{% else %}
     <p>No athletes. </p>
{% endif %}
```

Basic template-tags: for

- The {% for %} tag allows you to loop over each item in a sequence. As in Python's for statement, the syntax is for X in Y, where Y is the sequence to loop over and X is the name of the variable to use for a particular cycle of the loop

```
<ul>
{% for athlete in athlete_list reversed %}
    <li>{{ athlete.name }}</li>
{% endfor %}
</ul>
```

- If you need to access the items in a dictionary,

```
{% for key, value in data.items %}
    {{ key }}: {{ value }}
{% endfor %}
```

Basic template-tags: for – an optional {% empty %} clause

- The for tag supports an optional {% empty %} clause that lets you define what to output if the list is empty

```
{% for athlete in athlete_list %}
    <p>{{ athlete.name }}</p>
{% empty %}
    <p>There are no athletes. Only computer programmers.</p>
{% endfor %}
```

which is equivalent to

```
{% if athlete_list %}

  {% for athlete in athlete_list %}
      <p>{{ athlete.name }}</p>
  {% endfor %}

{% else %}
    <p>There are no athletes. Only computer programmers.</p>
{% endif %}
```

Basic template-tags: for (cont'd)

- There is no support for breaking out of a loop before the loop is finished.
- If you want to accomplish this, change the variable you're looping over so that it includes only the values you want to loop over.
- Similarly, there is no support for a continue statement that would instruct the loop processor to return immediately to the front of the loop.

Basic template-tags: for – a template variable called forloop

- Within each {% for %} loop, you get access to a template variable called forloop.
- This variable has a few attributes that give you information about the progress of the loop.
- The forloop variable is only available within loops. After the template parser has reached {% endfor %}, forloop disappears.
  - forloop.counter is always set to an integer representing the number of times the loop has been entered. This is one-indexed, so the first time through the loop, forloop.counter will be set to 1. Here's an example:

```
{% for item in todo_list %}
    <p>{{ forloop.counter }}: {{ item }}</p>
{% endfor %}
```

  - forloop.counter0 is like forloop.counter, except it's zero-indexed. Its value will be set to 0 the first time through the loop.

Basic template-tags: for – a template variable called forloop

- forloop.revcounter is always set to an integer representing the number of remaining items in the loop. The first time through the loop, forloop.revcounter will be set to the total number of items in the sequence you're traversing. The last time through the loop, forloop.revcounter will be set to 1.
- forloop.revcounter0 is like forloop.revcounter, except it's zero-indexed. The first time through the loop, forloop.revcounter0 will be set to the number of elements in the sequence minus 1. The last time through the loop, it will be set to 0.
- forloop.first is a Boolean value set to True if this is the first time through the loop. This is convenient for special-casing:

```
{% for object in objects %}
    {% if forloop.first %}<li class="first">
    {% else %}<li>{% endif %}
    {{ object }}
    </li>
{% endfor %}
```

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Basic template-tags: for – a template variable called forloop

- forloop.last is a Boolean value set to True if this is the last time through the loop. A common use for this is to put pipe characters between a list of links. Another common use for this is to put a comma between words in a list.

```
{% for link in links %}
    {{ link }}{% if not forloop.last %} | {% endif %}
{% endfor %}
```

- forloop.parentloop is a reference to the forloop object for the parent loop, in case of nested loops. Here's an example:

```
{% for country in countries %}
    <table>
    {% for city in country.city_list %}
        <tr>
        <td>Country #{{ forloop.parentloop.counter }}</td>
        <td>City #{{ forloop.counter }}</td>
        <td>{{ city }}</td>
        </tr>
    {% endfor %}
    </table>
{% endfor %}
```

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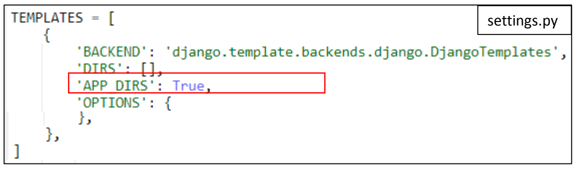
Basic template-tags: comment

- The Django template language allows for comments. To designate a comment, use {#   #}: {# This is a comment #}
- Comments using this syntax cannot span multiple lines.
- If you want to use multi-line comments, use the {% comment %} template tag.

```
{% comment %}
This is a
multi-line comment.
{% endcomment %}
```

Location of Templates

- By default, Django looks within each app for templates. So a home.html template in pages app would be located at mysite/pages/templates/home.html.



settings.py

```
TEMPLATES = [
    {
        'BACKEND': 'django.template.backends.django.DjangoTemplates',
        'DIRS': [],
        'APP_DIRS': True,
        'OPTIONS': {
        },
    },
]
```

- However, we can edit our settings.py file to tell Django to look in a project-level folder for templates.
- Create a project-level folder called templates (mysite/templates) and an HTML file called home.html.
- Next is a one-line change to the setting 'DIRS' under TEMPLATES in settings.py file.
  'DIRS': [os.path.join(BASE_DIR, 'templates')],
- BASE_DIR is a variable that stores the path to the directory in which your project's settings.py module is contained.
- We make use of os.path.join() to mash together the BASE_DIR variable and 'templates'. For example, it would yield <workspace>/mysite/templates/.
- os.path.join is a Python command to create a file path by joining strings together (concatenating).

Class-Based Views: TemplateView

- We will update our pages/views.py file to use the class-based view instead of a function, and it inherits from the built-in generic TemplateView to display our template.

```
# pages/views.py
from django.views.generic import TemplateView
class HomePageView(TemplateView):
    template_name = 'home.html'
```

Remember to pay attention to proper indentation.

- Note that we've capitalized our view since it's now a Python class. Classes, unlike functions, should always be capitalized.
- The TemplateView already contains all the logic needed to display our template, we just need to specify the template's name.
- Then we can add a simple headline to our home.html file.
  `<h1>Homepage.</h1>`

Class-Based Views vs function-based views

```
# pages/views.py
from django.views.generic import TemplateView
class HomePageView(TemplateView):
    template_name = 'home.html'
```

Class-based view (capitalized) of this chapter

```
# pages/views.py
from django.http import HttpResponse
def homePageView(request):
    return HttpResponse('Hello, World!')
```

function-based view of previous chapter

Remember to pay attention to proper indentation.

URLs – project-level urls.py

- The last step is to update our URLConfs.
- Recall from Chapter 2 that we have updated the project-level urls.py file to point at our pages app.

```
# pages_project/urls.py
from django.contrib import admin
from django.urls import path, include
urlpatterns = [
    path('admin/', admin.site.urls),
    path('', include('pages.urls')),
]
```

- No changes are needed for the project-level urls.py. However, we will need to update the application-level urls.py

URLs – Edit application-level urls.py

- Edit our application-level urls.py file (within the pages app) to use the Class-Based view with the following code:

```
# pages/urls.py
from django.urls import path
from . import views
urlpatterns = [
  path('', views.HomePageView.as_view(), name='home'),
]
```

The period reference the current directory, which is our pages app containing both views.py and urls.py.

- If the user requests the homepage, represented by the empty string '', then use the view called HomePageView.
- When using Class-Based Views, you always add as_view() at the end of the view name.

- Refresh your browser to see the new homepage.

Summary on Templates

- Django uses templates to generate HTML files so that individual HTML files can be served by a view to a web page specified by the URL.
- Note that Templates, Views, URLs, such pattern will hold true for every Django web page you make.
- The order in which you create them doesn't much matter since all 3 are required and work closely together.
  - The URLs control the initial route, the entry point into a page, such as /about,
  - the views contain the logic or the "what", and
  - the template has the HTML.
- Take some repetition to internalize this concept since you'll see it over and over again in Django development.

Add an About page

- The process for adding an about page is similar to what we just did.
  - We'll create a new template file, a new view, and a new url route.
- Create a new template called about.html in the project-level template folder with <h1>About page.</h1> as content.
- Update the pages/views.py file by adding the following:

```
class AboutPageView(TemplateView):
    template_name = 'about.html'
```

Remember to pay attention to proper indentation.

- And then connect it to a url at about/. This is done by adding the following line to the app-level urls.py file (i.e. pages/urls.py) .

```
path('about/', views.AboutPageView.as_view(), name='about'),
```

- Refresh your browser to see the new "About page".

Class-based ListView

Below is an example of ListView.

```
from django.views.generic import ListView
from .models import Post
class HomePageView(ListView):
    model = Post
    template_name = 'home.html'
```

```
<!-- templates/home.html -->
<h1>Message board homepage</h1>
<ul>
  {% for post in object_list %}
    <li>{{ post }}</li>
  {% endfor %}
</ul>
```

Remember to pay attention to proper indentation.

- First, import ListView
- In the second line we define which model we're using.
- In the view, we subclass the generic ListView, specify the model name and template reference.
- Internally, ListView returns an object called object_list, that contains all the post objects that we want to display in our template.
- Django is able to populate the context using the lowercased version of the model class' name,in addition to the default object_list entry, i.e. post_list
- The idea is similar to executing the SQL statement "SELECT * FROM Post".

Class-based DetailView

- DetailView **should be used** when you want to present detail of a single model instance.
- By default, DetailView provides a context object we can use in our template called either object or **the lowercased name of our model**.
- **Also, DetailView expects a primary key passed to it as the identifier,** via the URL. An example will be covered in Lab 5, which is similar to executing the SQL statement "SELECT * FROM Table WHERE condition".
- You can explicitly set the name of the context object in our view, for instance, to call it anything_you_want and then use anything_you_want.title in the template.

```
# blog/views.py
from django.views.generic import DetailView
from .models import Post
class BlogDetailView (DetailView):
    model = Post
    template_name = 'post_detail.html'
    context_object_name = 'anything_you_want'
```

Remember to pay attention to proper indentation.

More on DetailView

- DetailView **shouldn’t be used** when your page has forms and does creation or update of objects.
- FormView, CreateView, UpdateView, DeleteView are more suitable for working with forms, creation, update and delete of objects. Details to be discussed in Chapter 5 Forms.

Extending Templates

- Most web sites contain content that is repeated on every page (header, footer, etc).
- It will be nice if there is one place for our header code that would be inherited by all other templates.
- Let’s create a base.html file containing a header with links to our two pages, the homepage and the about page, as written in the pages/urls.py file.
- Before we start, let’s talk about template tags.

The {% url %} template tag

- To add URL links in our project, we can use the built-in url template tag which takes the URL pattern name as an argument.
- Remember how we added optional URL names to our url routers?

```
path('about/', views.AboutPageView.as_view(), name='about'),
```

  The url tag uses these names to automatically create links for us.
- The URL route for our about page is called ‘about’, therefore to configure a link to it we would use {% url ‘about' %}.

Content of base.html

- The content of base.html is as follows:

```
<!-- templates/base.html -->

<header>

  <a href="{% url 'home' %}">Home</a> | <a href="{% url 'about' %}">About</a>

</header>
 {% block content %}

 {% endblock %}
```

Note that code between {% block content %} and {% endblock %} is to be filled by other templates.

- At the bottom we’ve added a block tag named content.
- Blocks are identified by their name.
- Blocks can be **overwritten** by child templates via inheritance.

Extending the base.html

- Let’s update our home.html and about.html to extend the base.html template.
- That means we can reuse the same code from one template in another template.
- The Django templating language comes with an extends method that we can use for this.

```
<!-- templates/home.html -->
{% extends 'base.html' %}
{% block content %}
<h1>Homepage.</h1>
{% endblock %}
```

```
<!-- templates/about.html -->
{% extends 'base.html' %}
{% block content %}
<h1>About page.</h1>
{% endblock %}
```

When the template engine sees the {% extends %} tag, noting that this template is a child template. The engine immediately loads the parent template – in this case, base.html. At that point, the template engine replaces the {% block %} tags in base.html with the contents of the child template.

- Refresh your browser to see the home page and the “About page”. You’ll see the header is magically included in both locations.

Should user-submitted data be trusted blindly?

- When generating HTML from templates, there's always a risk that a variable will include characters that affect the resulting HTML. For example, consider this template fragment: Hello, {{ name }}.
- If the user entered his name as this: <script>alert('hello')</script>
  the template would be rendered as:
  Hello, <script>alert('hello')</script>
  which means the browser would pop-up a JavaScript alert box!
- Similarly, what if the name contained a '<' symbol, like <b>username
- That would result in: Hello, <b>username
  which, in turn, would result in the remainder of the Web page being bolded!
- User-submitted data shouldn't be trusted blindly and inserted directly into your Web pages.

Automatic HTML escaping

- To avoid this problem, take advantage of Django's automatic HTML escaping.
- By default in Django, every template automatically escapes the output of every variable tag. Specifically, these five characters are escaped:
  - < is converted to &lt;
  - > is converted to &gt;
  - ' (single quote) is converted to &#39;
  - " (double quote) is converted to &quot;
  - & is converted to &amp;

How to turn off auto-escaped

- Sometimes, template variables contain data that you intend to be rendered as raw HTML, in which case you don't want their contents to be escaped.
- To disable auto-escaping for an individual variable, use the safe filter, e.g. `{{ data|safe }}`
- To control auto-escaping for a template, use the autoescape tag, e.g.

```
{% autoescape off %}
Hello {{ name }}
{% endautoescape %}
```

auto-escaping tag

- The auto-escaping tag passes its effect on to templates that extend the current one as well as templates included via the include tag, just like all block tags.

```
# base.html

{% autoescape off %}
<h1>{% block title %}{% endblock %}</h1>
{% block content %}
{% endblock %}
{% endautoescape %}

# child.html

{% extends "base.html" %}
{% block title %}This & that{% endblock %}
{% block content %}{{ greeting }}{% endblock %}
```

Because auto-escaping is turned off in the base template, it will also be turned off in the child template, resulting in the following rendered HTML when the greeting variable contains the string <b>Hello!</b>:

```
<h1>This & that</h1>
<b>Hello!</b>
```

Summary: what have you learnt?

- Django’s class-based views and templates
- Edit settings.py file to tell Django to look in a project-level folder for templates
- Extend templates