# Chapter 1.1 – Introduction to Python

## Python Basics

- Topics
  - Introduction
  - Data Types
  - Arithmetic/Logic Operations

## Notable Features

- Many basic data types : numbers (floating point, complex, and unlimited-length long integers), strings, lists, and dictionaries.
- Supports object-oriented programming: with classes and multiple inheritance.
- Supports raising and catching exceptions: cleaner error handling.
- Strongly and dynamically typed data types: mixing incompatible types (e.g. attempting to add a string and a number) causes an exception, errors caught sooner.
- Automatic memory management: frees you from having to manually allocate and free memory in your code.

## Notable Feautures

- Elegant syntax: programs easier to read.
- Easy-to-use language: ideal for prototype development.
- Large standard library: supports many common programming tasks e.g. connecting to web servers, regular expressions, file I/O.
- A bundled development environment called IDLE.
- Runs on different computers and operating systems: Windows, MacOS, many brands of Unix, OS/2, ...
- Free software: Free to download or use Python - the language is copyrighted it's available under an open source license.

## Indentation

- Python does not use brackets to structure code, instead it uses whitespaces
  - Tabs are not permitted.
    - Four spaces are required to create a new block,
  - To end a block simply move the cursor four positions left.
  - An example:

```
1. def bar(x):
2.     if x == 0:
3.         foo()
4.     else:
5.         foobar(x)
```


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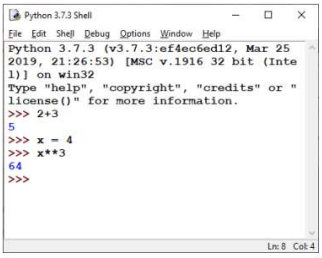
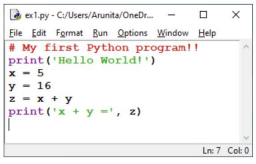
5.         foobar(x)
```

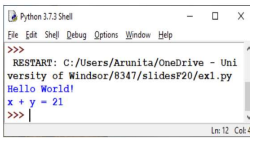

IDLE EXAMPLE

## IDLE

- IDLE: Basic IDE that comes with Python
  - Should be available from Start Menu under Python program group.
  - Main "Interpreter" window.
    - Allows us to enter commands directly into Python
    - As soon as we enter in a command Python will execute it display the result.
    - '>>>' signs act as a prompt.




## Numeric Data Types

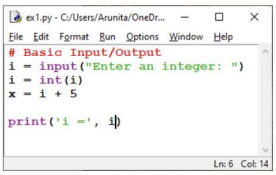
- *int*: represents positive and negative whole numbers.
  - Written without a decimal point
  - e.g. 5, 258964785663
- *float*: written with a decimal point
  - e.g. 3.0, 5.8421, 0.0, -32.5 etc

## Arithmetic Operators

- Basic arithmetic operators: + (addition), - (subtraction), * (multiplication), / (division)
  - / (division) produces floating point value — 15/3 → 5.0
  - // (integer division) truncates any fractional part — 25//3 → 8
  - % (remainder) gives the remainder after integer division. — 25%3 → 1
  - Augmented assignment operators: +=, -=, *=, /=

## Basic Input/Output

- Built-in input() function accepts input from user.
  - takes optional string argument to print on console
  - waits for user to type response and hit Enter
  - If no text, user just hits enter: return empty string
  - otherwise, return string containing entered text
  - Example: i = input("Enter an integer: ")
- Built-in print() function for output
  - Example: print("int = ", i)





## Summary

- Python intro
- Numeric data types
- Input/Output

***Chapter 1.2 – Introduction to Python (Part 2)***

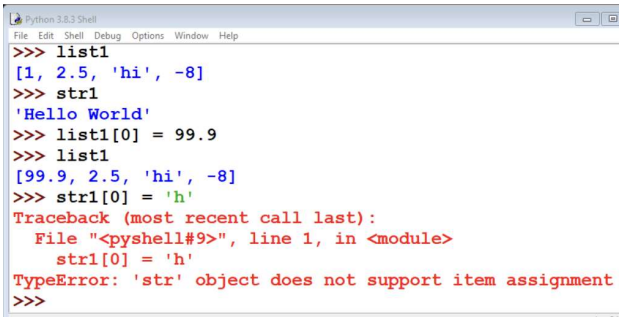
## Python Basics

- Topics
  - Introduction
  - Collection Data Types
    - Strings
    - Lists
    - Dicts
  - Comparison/Logic Operations

## Collection Data Types

- Holds a collection of items, which may or may not be of the same type.
- May be *mutable* (e.g. list, set, dict) or *immutable* (e.g. tuple, str)
- *sequence*: a type that supports membership(in), size function (len()), slices ([]) and is iterable. e.g. list, str, tuple
  - https://docs.python.org/3/tutorial/datastructures.html

## Mutable vs Immutable

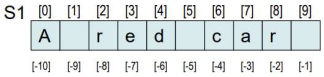



## Strings

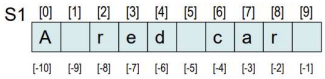
- A collection data type that is ***ordered*** and ***unchangeable*** (***immutable***).
  - e.g. [1], [3, 'hi', 4.5, [1,2,3]], []
- The string type in Python is called **str**
- String literals delimited by single or double quotes; e.g. 'hello' or "hello"
- Access individual items using the index number and enclosing in square brackets, e.g. str1[0]
- The first element always has index 0

## Strings

- Use index([]) and 'slice' similar to lists
  - S1 = "A red car "
  - >>> S1[4]
    - **'d'**
  - >>> S1[:7]
    - **'A red c'**
  - >>> S1[2:-6]
    - **'re'**
  - >>> S1[1] = '*'
    - **TypeError: 'str' object does not support item assignment**
  - >>> S1 = 'something else'
    - # This is ok



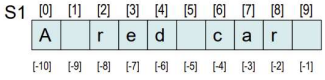
## String Methods




- S1.count('r')
- **2**
- S1.split()
- **['A', 'red', 'car']**
- S1.replace('r', '*')
- **"A *ed ca* "**
- S1.upper()
- **"A RED CAR "**

NOTE: This is not an exhaustive list

## String Methods




- S1.index('r')
- 2
- S1.index('x')
- ValueError
- S1.find('r')
- 2
- S1.find('x')
- -1
- S1.startswith('A red')
- True

NOTE: This is not an exhaustive list

## Lists

- A collection data type that is ordered and changeable (mutable).
  - e.g. [1], [3, 'hi', 4.5, [1,2,3]], []
- Use [] to index items; similar to strings
- Can have multiple indices, e.g. list1[2][0], list1[-2][-1][-3]

## Lists (Examples)

```
Python 3.8.3 Shell
File Edit Shell Debug Options Window Help
>>> list1 = [1, 2.5, 'hello class', [2, 18, 12, 'house'], -8]
>>> list1[1]
2.5
>>> list1[2][0]
'h'
>>> list1[-2][-1][0:3]
'hou'
>>> list1[15]
Traceback (most recent call last):
  File "<pyshell#14>", line 1, in <module>
    list1[15]
IndexError: list index out of range
>>> list1[2:15]
['hello class', [2, 18, 12, 'house'], -8]
>>>
```

## Your Turn …

- L1 = [1], [3, 'hi', 4.5, [1,2,3]]
  - >>> L1[1]
  - >>> len(L1)
  - >>> L1[3][0]
  - >>> L1[6]
  - >>> L1[-1]

## range(n)

- *range(n)*: produces sequence 0, 1, 2, … *n*-1
- range([*i*, ]*stop*[, *k*]): sequence starts at *i* (instead of 0) and incremented by *k* (instead of 1)
- range(5) → produces sequence 0, 1, 2, 3, 4
- range(3, 20, 4) → produces 3, 7, 11, 15, 19
- >>> L = [1, 5, 7, 2, 8]
- >>> for i in range(len(L)):
  L[i] = L[i]+10
- >>> L
  - [11, 15, 17, 12, 18]

## List Methods

- L = [1,2,3,[4,5,'a','b'], 'hello', '6', 7]
  - L.append([8,9])
  - **[[1, 2, 3, [4, 5, 'a', 'b'], 'hello', '6', 7, [8, 9]]**
  - L += [8,9]
  - **[1, 2, 3, [4, 5, 'a', 'b'], 'hello', '6', 7, 8, 9]**
  - L.index(3)
  - **2**

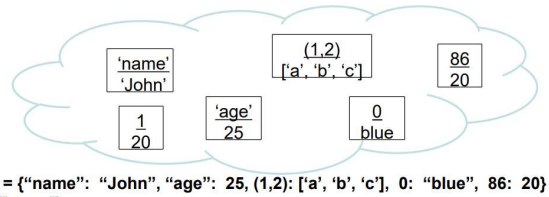
NOTE: This is not an exhaustive list. We are always starting with initial value of L.

## Dictionaries

- *dict*: an ***unordered*** collection of key-value pairs
  - ***mutable***
  - unordered → no notion of index positions
  - keys are unique → a key-value item ***replaces*** existing item with same key
  - duplicate values are fine

- d1 = {"name": "John", "age": 25, (1,2):['a', 'b', 'c'], 0: "blue", 86: 20, 1:20}
- d2 = dict([("name","John"), ("age", 25), ((1,2), ['a', 'b', 'c']), (0, "blue"), (86, 20)])

# Dictionaries




- **d1 = {"name": "John", "age": 25, (1,2): ['a', 'b', 'c'], 0: "blue", 86: 20}**
- d1["name"]
- **"John"**
- d1[(1,2)]
- **['a', 'b', 'c']**
- d1["blue"]
- **KeyError**
- d1["blue"] = 1
- **# adds new key-value pair "blue":1**

# Dictionaries

- **d1 = {'name' : 'John', 'age' : 25, (1,2):['a', 'b', 'c'], 0: 'blue', 86: 20, 1:20, 'blue':1}**
- d1["blue"]
- 1
- del d1['age']
- # deletes key-value pair "age": 25
- d1['name'] = 'Ty"
- # replaces key-value pair "name": "John" with "name": "Ty"
- d1[d1["blue"] ]
- 20

# Membership Operator

- *in*: tests for membership, returns True or False
- *not in*: tests for non-membership, returns True or False
- L = [1, [2,3], "ab", -23] S = "Python is great!"
  - [2,3] in L
  - **True**
  - 2 in L
  - **False**
  - 2 not in L
  - **True**
  - "on is" in S
  - **True**
  - "eat" not in S
  - **False**

# Comparison Operators

- Basic comparison operators: <, <=, ==, !=, >=, >
  - a = 4, b=12
  - a < b → True
  - a == b → False
  - a >= b, a != b, a <= b → (False, True, True)
- Can be chained
  - 2 <= a < b <= 20 → True

# Logical Operators

- 3 logical operators: and, or, not
  - and and or use short circuit logic → return operand that determined result, rather than a Boolean value (unless operands are Boolean)
  - Rules for expressions with non-Boolean types
    - int: 0 → False; All other values → True
    - float: 0.0 → False; All other values → True
    - list: [] (i.e. empty list) → False; All other values → True
    - str: '' (i.e. empty string) → False; All other values → True
  - 5 and 2
  - **2**
  - 0 and 2
  - **0**

# Your Turn …

- Use short circuit evaluation to determine the results:
  - 5 and 2
  -
  - 0 and 2
  -
  - 0 or 7 or 8
  -
  - 6 or 6 or 9
  -
  - not 6
  -
  - not 0
  -
  - not '0'
  -

# Summary

- Collection data types
  - Range() function
- Boolean operators
  - Membership
  - Comparison
  - Logical

# Chapter 1.3 – Python Programming(Part – 3)

## Python Basics

- Topics
  - If statements
  - Loops
  - Exception handling
  - Functions
  - File Input/Output
  - Modules

## Control Flow

- Conditional branching
  - IF statement
- Looping
  - While
  - For … in
- Exception handling
- Function or method call

## IF Statement

- *suite*: a block of code, i.e. a sequence of one or more statements
- Syntax:

```
if bool_expression1:
   suite1
elif bool_expression2:
    suite2
…
elif bool_expressionN:
    suiteN
else:
    else_suite
```

- No parenthesis or braces
- **:** used whenever a suite is to follow
- Use *indentation* for block structure

```
if a < 10:
    print("few")
elif a < 25:
    print("some")
else:
    print("many")
```

## While Statement

- Used to execute a suite 0 or more times
  - number of times depends on while loop's Boolean expression.
  - Syntax:

```
while bool_expression:
        suite
```

  - Example:

```
x, sum = 0,0
while x < 10:
        sum += x
        x += 2
print(sum, x)   #What is final value of sum and x
```

Answer: sum=20, x=10

## For … in Statement

- Syntax:

```
for variable in iterable:
        suite
```

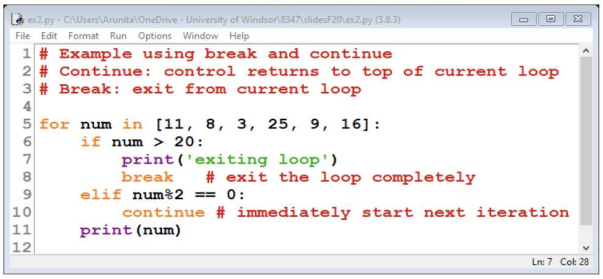
- Example: fruits = ['apple', 'pear', 'plum', 'peach']

```
for item in fruits:
        print(item)
```

- Alternatively

```
for i in range(len(fruits)):
        print(fruits[i])
```

## Break and Continue



```
# Example using break and continue
# Continue: control returns to top of current loop
# Break: exit from current loop

for num in [11, 8, 3, 25, 9, 16]:
    if num > 20:
        print('exiting loop')
        break   # exit the loop completely
    elif num%2 == 0:
        continue # immediately start next iteration
    print(num)
```

| Iter# | num | num>20? | Num%2==0? | print(num) |
|---|---|---|---|---|
| 0 | 11 | n | n | 11 |
| 1 | 8 | n | y | |
| 2 | 3 | n | n | 3 |
| 3 | 25 | y | | |

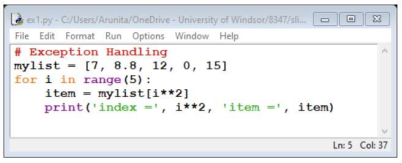
## Exception Handling

- Functions or methods indicate errors or other important events by ***raising exceptions***.
- Syntax (simplified):

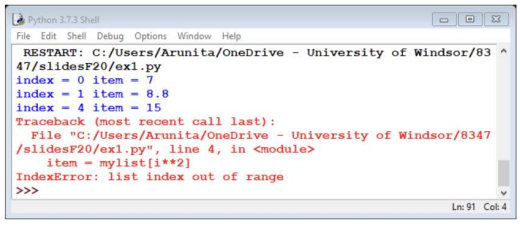
```
try:
    try_suite
except exception1 as variable1:
    exception_suite1
…
except exceptionN as variableN
finally:
    # cleanup
```

- variable part is optional

## Exception Handling – Example 1

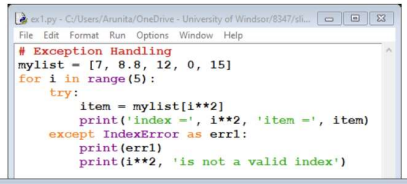


```
# Exception Handling
mylist = [7, 8.8, 12, 0, 15]
for i in range(5):
    item = mylist[i**2]
    print('index =', i**2, 'item =', item)
```

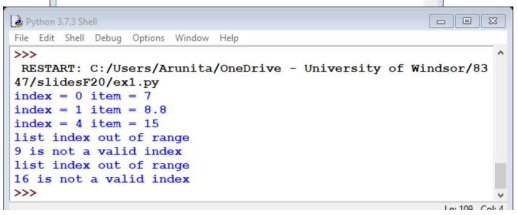


```
RESTART: C:/Users/Arunita/OneDrive - University of Windsor/8347/slidesF20/ex1.py
index = 0 item = 7
index = 1 item = 8.8
index = 4 item = 15
Traceback (most recent call last):
  File "C:/Users/Arunita/OneDrive - University of Windsor/8347/slidesF20/ex1.py", line 4, in <module>
    item = mylist[i**2]
IndexError: list index out of range
>>>
```

## Exception Handling – Example 1



```
# Exception Handling
mylist = [7, 8.8, 12, 0, 15]
for i in range(5):
    try:
        item = mylist[i**2]
        print('index =', i**2, 'item =', item)
    except IndexError as err1:
        print(err1)
        print(i**2, 'is not a valid index')
```



```
>>>
RESTART: C:/Users/Arunita/OneDrive - University of Windsor/8347/slidesF20/ex1.py
index = 0 item = 7
index = 1 item = 8.8
index = 4 item = 15
list index out of range
9 is not a valid index
list index out of range
16 is not a valid index
>>>
```

## Exception Handling – Example 2

Example:

```
s = input('Enter number: ')
try:
    n = float(s)
    print(n, ' is valid. ')
except ValueError as err:
    print(err)
```

- If user enters '8.6' output is: 8.6 is valid
- If user enters 'abc', output is:
  ValueError: could not convert string to float: 'abc'

## Functions

- Syntax:
  *def functionName(arguments):*
    *suite*
- Parameters are optional. Written as:
  - *positional arguments*: a sequence of comma separated identifiers
  - *keyword argurments*: a sequence of identifier=value pairs
- Every function returns a value
  - either a single value or tuple of values
  - return values can be ignored
  - can leave function at any point using *return* statement
  - no *return* statement or no argument for *return* → returns **None**

## Functions

- Function definition:

```
def trianglePerimeter(s1, s2, s3):
    perimeter= s1 + s2 + s3
    return perimeter
```

- **Sample function call: sides = [5, 8, 2]**
  - **result = trianglePerimeter(sides[0], sides[1], sides[2])**
  - **result = trianglePerimeter(*sides)  # use sequence unpacking operator (*)**
- **General function for any n-sided polygon:**

```
def perimeter(* sides):
    result = 0
    for s in sides:
        result += s
    return result
```

## File Input/Output

- f = open(filename, mode)
  - mode is optional; possible values:
    - 'w' = write
    - 'r' = read (default)
    - 'a' = append
    - 'rb'('wb') = read (write) in binary
  - Example:
    - f1 = open("infile.txt")
    - f2 = open("outfile.txt", "w")
  - f is iterable:

```
for x in f:
    print(x)
```

## File Methods

- *f.close()*: closes file object f
- *f.peek(n)*: returns n bytes without moving file pointer position
- *f.read(n)*: read at most n bytes from f
- *f.read()*: read every byte starting from current position
- *f.readline()*: read next line
- *f.readlines()*: read all the lines to the end of file and return them as a list
- *f.write(s)*: write byte/bytearray object s to f in binary mode str object s in text mode.
- *f.writelines(seq)*: write the sequence of objects (strings or byte strings, depending on mode) to f.

## Modules

- *Modules*: Contains additional functions and custom data types.
  - Usually a .py file containing Python code; can be written in other languages
  - designed to be imported and used by other programs
- *Packages*: Sets of modules that are grouped together.
- Usage examples:
  - import os
  - import math
  - from os import path

## Summary

- Control flow statements
- File I/O
- Modules

# Dynamic Web Sites

- Topics
  - Introduction
  - Communication
    - HTTP, URL
  - Presentation
    - HTML/CSS, templates
  - Overall Structure (MVC)
    - First look at Django

# Client Server Model

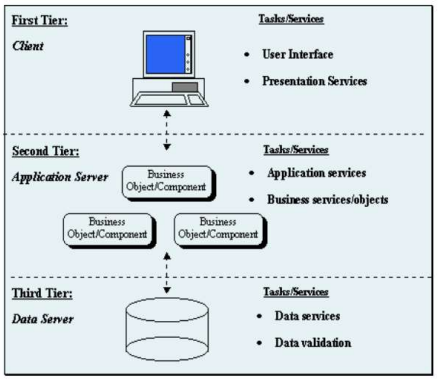



*Fig. taken from [1]

- User requests document from the Web server.
- Web server fetches and/or generates the necessary document.
- The result is returned to the user's browser.
- The browser renders the document.

# Static vs. Dynamic Web Pages

- *Static web page*: requests to the same URL always return the same information.
  - Content consists of HTML text files stored on the server.
  - URL typically does not contain parameters; simply a 'path'
  - Primarily informational
- *Dynamic web page*: Data returned by a given URL can vary significantly.
  - generates content and displays it based on actions the users make on the page
  - Functional and informational

# HTTP

- *HTTP*: Hyper-Text Transfer Protocol
  - Encapsulates the process of serving web pages
  - Protocol for client-server communication
  - Most clients/servers use version 1.1; HTTP 2 gaining popularity.
  - ***A network protocol*: defines rules and conventions for communication between network devices.
- HTTP is stateless
  - Server maintains no information on past client requests.

# URL

- *URL*: Uniform Resource Locator
- General Format: *<scheme> : //<host> :<port> /<path> ;<parameters> ?<query>*
  - Scheme: Protocol being used (e.g. http)
  - Host: host name or IP address
  - Port: TCP port number used by the server (if not specified, defaults to 80 for http)
  - Query passes parameters
  - Example:
    - https://www.google.ca/?gfe_rd=cr&ei=XzYUVceeHayC8QfamoGgDw&gws_rd=ssl#q=http

# HTTP

- Application level protocol
  - Client sends request
  - Server responds with reply
  - Other application level protocols are FTP, SMTP, POP etc.
- Almost always run over TCP
  - Uses 'well known' port 80 (443 secure)
  - Other ports can be used as well
  - Can support multiple request-reply exchanges over a single connection

# HTTP Message

- A start line: can be request or status line
  - **GET /hello.htm HTTP/1.1 (e.g. of request line from client)**
  - **HTTP/1.1 200 OK (e.g. of status line from server)**
- Zero or more header fields followed by CRLF
  - Provide information about the request or response, or about the object sent in the message body
  - Format for message-header = field-name ":" [field-value]
  - Examples:
    - » **Host: www.example.com (Host required for requests in Ver 1.1)**
    - » **Server: Apache**
    - » **Content-Length: 51**
- An empty line indicating the end of the header fields
- Optionally a message-body
  - If present, carries the actual data
    - <html> <body> <h1>Hello, World!</h1> </body> </html>

# HTTP Methods

- GET: Used to retrieve information from the given server using a given URI.
  - should only retrieve data and should have no other effect on the data.
- POST: Used to send data to the server, e.g. customer info, using HTML forms.
- Other methods: PUT, DELETE, TRACE etc

## HTTP Requests

- Request-Line = Method SP Request-URI SP HTTP-Version CRLF
  - Method indicates method to be performed; should always be uppercase.
  - Request-URI identifies the resource on which to apply request [2]

```
GET /hello.htm HTTP/ 1.1
User-Agent: Mozilla/4.0
Host: www.tutorialspoint.com
Accept Language: en-us
Connection: Keep-Alive

POST /cgi-bin/process.cgi HTTP/ 1.1
User-Agent: Mozilla/4.0 compatible; MSIE5.01; Windows NT)
Host: www.tutorialspoint.com
Content-Type: application/x-www-form-urlencoded
Connection: Keep-Alive
```

## HTTP Responses

- Status-Line = HTTP-Version SP Status-Code SP Reason-Phrase CRLF

```
HTTP/1.1 200 OK
Date: Mon, 27 Jul 2009 12:28:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Wed, 22 Jul 2009 19:15:56 GMT
Content-Length: 88
Content-Type: text/html
Connection: Closed

<html>
<body>
<h1>Hello, World!</h1>
</body>
</html>
```

## Status Codes

- **1xx: Informational**: request received and continuing process.
  - 100 Continue
  - 101 Switching protocols
- **2xx: Success**: action was successfully received, understood, and accepted.
  - 200 OK
- **3xx: Redirection**: further action must be taken in order to complete the request.
  - 301 Moved Permanently
  - 307 Temporary redirect

## Status Codes

- **4xx: Client Error**: request contains bad syntax or cannot be fulfilled
  - 400 Bad Request
  - 401 Unauthorized
  - 403 Forbidden
  - 404 Not Found
  - 408 Request Timeout
- **5xx: Server Error**: server failed to fulfill an apparently valid request
  - 500 Internal Server Error
  - 503 Service Unavailable
  - 504 Gateway Timeout
  - 505 HTTP Version Not Supported

## What Is HTML?

- HTML is a markup language used to describe webpages.
  - HTML stands for HyperText Markup Language. When a web browser displays a webpage:
    - it is reading and interpreting a HTML document.
  - Used for structuring and presenting content on the World Wide Web.
  - Some related standards include CSS3

## Basic Structure

- *DOCTYPE*: Tells browsers *how* to read your document.
  - Forces browsers to use 'standard mode'.
  - Using standard mode, most browsers will read your document the same way.
- *<head>*: Contains information about your page.
- *<body>*: The actual content of your page.

```
<!DOCTYPE html>
<html>
  <head>
        <title>My first Webpage</title>
  </head>
  <body>
        <h1>This is a Heading</h1>
<p>Hello World!</p>
  </body>
</html>
```

## Elements

- HTML elements are marked up using start tags and end tags.
  - Tags are delimited using angle brackets with the tag name in between.
    - End tags include a slash before the tag name.
    - Some elements require only a single tag, e.g. <br>, <img>
  - HTML tag names are case insensitive.
    - Recommended: use lowercase.
  - Most elements contain some content
    - e.g. ...
  - Elements may contain attributes
    - Used to set various properties of an element

## Attributes

- Attributes: provide additional information about the specific element
  - Always specified in the opening tag.
  - The pattern for writing attributes: attribute="value".
  - Examples:
    - <a href="http://www.myurl.com">This is tag content</a>
    - <img src="my-pic.jpg" alt="This is a picture ">
    - ... .
    - <a href="http://www.myurl.com">This is a link</a>

## Links

- *Link*: Some text or image you can click to jump to another document or a specific part of the current document.
  - *<a>*: element for links (internal and external).
  - *href*: A required attribute that specifies the destination address
  - *Link text*: The visible part.
    - Click on link text sends you to the specified address.

    <a href="http://www.mypage.com">Link text</a>
  - You can also use an image as a link.

```
<a href="default.html">
<img src="smiley.gif" alt="HTML tutorial"
        style="width:42px;height:42px;border:0">
</a>
```

## HTML Forms

- HTML forms are used to collect user input.
  - The **<form>** tag is used to create an HTML form.
  - HTML forms contain **form elements**.
  - The **<input>** element is the most important **form element**.
    - has many variations, depending on the **type** attribute.
  - *Text* Defines normal text input
    - Default width is 20 characters.
  - *Radio* Defines radio button input (for selecting one of many choices)
  - *Submit* Defines a submit button (for submitting the form)

```
<form action="/url_for_processing/" method="post" >
Username: <input type="text" name="username"><br>
<input type="radio" name="gender" value="male" >Male<br>
<input type="radio" name="gender" value="female" >Female<br>
  <input type="submit" value="Submit now" >
  </form>
```

- Other elements: Reset button, Textarea, Checkbox. Dropdown list etc

## Web Framework

- *Web framework*: a software framework designed to support development of dynamic websites and services.
  - Alleviate overhead with associated activities
- Frameworks standardize the 'boilerplate' parts.
  - Provide pre-built components so you can focus on unique parts of your project.
  - Repetitive parts handled by framework.
  - Code you use will be well tested, and have less bugs than what you write from scratch.
  - Enforce good development practices.
  - Security features (login, sessions etc) often better implemented in frameworks.
- Limitations:
  - May restrict you in terms of coding paradigms.
  - Steep learning curve.

## Which Framework?

- Many different frameworks are available:
  - ASP.NET using C#, Struts in J2EE, Ruby on Rails, other frameworks using PHP, Perl etc.
- Django is a high-level Python Web framework
  - Encourages rapid development and clean, pragmatic design.
  - Build high-performing, elegant Web applications quickly.
  - Adhere to DRY (Don't Repeat Yourself) principle.

## Django Framework

- Web framework for perfectionists with deadlines
  - Main focus
    - Dynamic and database driven websites
  - Automate repetitive stuff
  - Rapid development
  - Follow best practices
  - Free
  - Easy to learn
  - Powerful
- Powerful object-relational mapper (ORM)
  - Data models defined entirely in Python
- Automatic admin interface
  - Eliminates tedious work of creating interfaces to add and update content.
- Elegant URL design
  - Flexible, cruft-free URLs
- Template system
  - powerful, extensible template language to separate design, content and Python code

## Sites Using Django

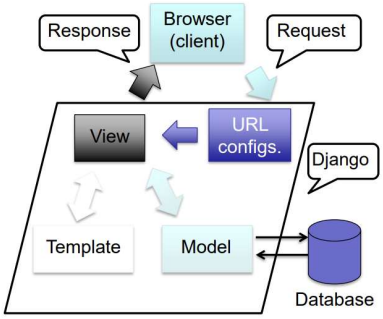
- Disqus
- Instagram
- Mozilla
- NASA
- National Geographic
- OpenStack
- Pinterest

## MVC Paradigm

- MVC (Model-View-Controller) paradigm: The application is separated into 3 main layers.
  - Model: Deals with the data
  - View: Defines how to display data
  - Controller: Mediates between the two, allows user to request and manipulate data.
- Allows code reuse
- Increases flexibility
  - E.g. single set of data can be displayed in multiple formats.

## Django's MTV Architecture

- MVC → MTV
- *Model*:
  - Deals with data representation/access.
- *Template*:
  - Describes **how** data is represented.
  - Same as 'view' in MVC
- *View*:
  - Describes **which** data is presented.
  - Same as 'controller' in MVC.



## MTV Architecture

- Model: Represents the data that will be gathered, stored and presented.
  - Changing the models changes underlying database schema. This can have significant side effects.
- Template: Template language used to render the html
  - Simple logic constructs such as loops
  - HTML most common format, but templates can be used to create any text format, e.g. csv
- View: Describes which data you see.
  - Responsible for much (often most) of the logic.
  - Linked to one or more URLs; return a HTTP response object.
  - Django provides useful shortcuts and helper functions for common tasks.
    - Helps in rapid development.
  - For full flexibility you can write your own custom functions.

## Project Directory

Create a new Django project:

- outer mysite/
  - container for project; can be renamed.
- manage.py
  - command-line utility to interact with your project.
- inner mysite/
  - actual python package for project
- __init.py__
  - empty file, indicates this dir is a package
- settings.py
  - settings/configuration for the project
- urls.py
  - URL declarations for the project
- wsgi.py
  - entry-point for WSGI-compatible web servers to serve your project

```
mysite/
    manage.py
    mysite/
        __init.py__
        settings.py
        urls.py
        wsgi.py
```

## Settings

- Settings.py: Python module with variables for Django settings.
  - update DATABASES 'default' item
  - 'ENGINE' : 'django.db.backends.sqlite3'
    - 'django.db.backends.postgresql_psycopg2',
    - 'django.db.backends.mysql', or
    - 'django.db.backends.oracle'
- By default, following apps are installed
  - django.contrib.admin – The admin site.
  - django.contrib.auth – An authentication system.
  - django.contrib.contenttypes – A framework for content types.
  - django.contrib.sessions – A session framework.
  - django.contrib.messages – A messaging framework.
  - django.contrib.staticfiles – A framework for managing static files.

## Summary

- Dynamic Web
  - Client Server Model
  - HTTP Protocol
  - HTML
    - Forms
- Web Frameworks
  - Django philosophy
    - Don't Repeat Yourself (DRY)
    - Rapid Development
    - MTV Architecture

***Chapter 2.2 – HTML/CSS***

## Topics

- Topics
  - Introduction
  - HTML Basics
    - Tags
    - Syntax
  - HTML Forms
  - CSS

## What Is HTML?

- HTML is a markup language used to describe web pages.
  - HTML stands for HyperText Markup Language. When a web browser displays a webpage:
    - it is reading and interpreting a HTML document.
  - HTML5: The next major revision of the HTML standard.
    - Used for structuring and presenting content on the World Wide Web.
    - Consists of many new features
    - Some related standards include CSS3

## Basic Structure

- *DOCTYPE*: Tells browsers *how* to read your document.
  - Forces browsers to use 'standard mode'.
  - Using standard mode, most browsers will read your document the same way.
- *<head>*: Contains information about your page.
- *<body>*: The actual content of your page.

```
<!DOCTYPE html>
<html>
  <head>
      <title>My first Webpage</title>
  </head>
  <body>
      <h1>This is a Heading</h1>
      <p>Hello World!</p>
  </body>
<html>
```

## Elements

- HTML elements are marked up using start tags and end tags.
  - Tags are delimited using angle brackets with the tag name in between.
    - End tags include a slash before the tag name.
    - Some elements require only a single tag, e.g. <br>, <img>
  - HTML tag names are case insensitive.
    - Recommended: use lowercase.
  - Most elements contain some content
    - e.g. ...
  - Elements may contain attributes
    - Used to set various properties of an element.

## Attributes

- Attributes: provide additional information about the specific element
  - Always specified in the opening tag.
  - The pattern for writing attributes: attribute="value".
  - Examples:
    - <a href="http://www.myurl.com">This is tag content</a>
    - <img src="my-pic.jpg" alt="This is a picture ">
    - ...

## Headings

- Headings are defined with the <h1> to <h6> elements.
  - Web browsers interpret the headings as the structure of your page.
    - Therefore headings should only be used for actual headings and not for making text bold or large.
    - Headings also increase the readability of your pages.

```
<!DOCTYPE html>
<html>
<head>
    <title> My Webpage</title>
</head>
<body>
    <h1>My Main Heading</h1>
        <p> My first paragraph of the page.</p>
    <h2>Secondary heading</h2>
        <p> My second paragraph.</p>
</body>
</html>
```

## Links

- *Link*: Some text or image you can click to jump to another document or a specific part of the current document.
  - *<a>*: element for links (internal and external).
  - *href*: A required attribute that specifies the destination address
  - *Link text*: The visible part.
    - Click on link text sends you to the specified address.

```
<a href="http://www.mypage.com">Link text</a>
```

  - You can also use an image as a link.

```
<a href="default.html">
<img src="smiley.gif" alt="HTML tutorial" ></a>
```

## IDs and Classes

- *ID*: An attribute that assigns a name to your element.
  - The name must be unique and cannot be used anywhere else in your document.
- *Class*: An attribute used to assign some general properties to your element.
  - You can have several elements in your document with the same class-name.
  - You do this, because you want them to behave and look the same way.
- IDs and classes are normally used in combination with CSS

## Local Links

- A local link (link to the same web site) is specified with a relative URL.
  - <a href="html_images.asp">HTML Images</a>
- Link to a specific part of the same doc:
  - Use in conjunction with id or name attribute.
  - # indicates it is a fragment identifier.

```
<p id="para1">This is my first section</p>
<p name="my-para2" >This is another section</p>
<a href="#para1">Go to the first section</a>
<a href="#my-para2">Go to the second section</a>
```

## Lists

- HTML has 2 types of lists:
  - Unordered (bulleted) lists: Use <ul> tags
    - list-style-type attribute used to change appearance of bullets. E.g. <ul style="list-style-type:square">
  - Ordered (numbered) lists: Use <ol> tags
    - type attribute used to define type of marker. <ol type="a">
  - Each item in a list is marked by <li> tag.
  - Lists are useful for menus, navigation etc.

```
<ol type="a">
   <li>Math</li>
   <li>History</li>
   <li>English</li>
</ol>
```

## Block and Inline Elements

- *Block element*: normally start (and end) with a new line, when displayed in a browser.
  - Typically as wide as possible.
  - Example: , <h1>, <p>, <ul>, <table>
  - The width and height of the element can be regulated.
  - May contain inline elements and other block-elements.
- *Inline element*: treated as a part of the document flow. Normally displayed without line breaks.
  - Example: <b>, <td>, <a>, <img>
  - The size should normally not be changed manually.
  - Only inline elements may be contained with inline-elements.

## HTML Style

- Every HTML element has a **default style**
  - e.g. background color is white, text color is black, text-size is 12px ...
- Use style attribute to change the default style of an HTML element.
  - Syntax: style="*property*:*value*"
    - The ***property*** is a CSS property. The ***value*** is a CSS value.
    - <body style="background-color:lightgrey">
  - Each property:value separated by ';'
    - <h1 style="background-color:blue; color:red">This is a heading</h1>

## HTML Style

- Styles can be specified in:
- A separateCSS stylesheet.
  - Link to stylesheet given in <head> portion of html page.
  - Example: <link rel="stylesheet" type="text/css" href="style3.css" />
- Within <style> tags in the <head> portion of html page.
- Directly within the html element itself.
  - Example:
  - <body style="background-color:lightgrey">
  - <h1 style="background-color:blue; color:red">This is a heading</h1>

## Formatting

- You can apply formatting e.g. **bold** or *italic* to words or sentences.
  - Can be used in conjunction with CSS.
  - Common formatting elements:
    - **<b>** Defines bold text
    - **** Defines emphasized text
    - **<i>** Defines italic text
    - **<small>** Defines smaller text
    - **** Defines important text
    - **<sub>(<sup>)** Defines subscripted (superscripted )text
    - **<ins>** Defines inserted text
    - **<del>** Defines deleted text
    - **<mark>** Defines marked/highlighted text

## HTML Layout

- Various techniques can be used to achieve a desired layout.
  - Using <table> tags
    - Not recommended. Use tables to display table data only.
  - Using  tags
  - Using HTML5 semantic elements.

## HTML5 Semantic Elements

- *header* Defines a header for a document or a section
- *nav* Defines a container for navigation links
- *section* Defines a section in a document
- *article* Defines an independent self-contained article
- *aside* Defines content aside from the content (like a sidebar)
- *footer* Defines a footer for a document or a section
- *details* Defines additional details
- *summary* Defines a heading for the details element

## Example

```
<!DOCTYPE html>
<html>

<head>
<style>
header {
   background-color:black;
   color:white;
   text-align:center;
   padding:5px;
}
nav {
   line-height:30px;
   background-color:#eeeeee;
   height:300px;
   width:100px;
```

## Example

```
   float:left;
   padding:5px;
}
section {
   width:350px;
   float:left;
   padding:10px;
}
footer {
   background-color:black;
   color:white;
   clear:both;
   text-align:center;
   padding:5px;
}
</style>
</head>
```

## Example

```
<body>
<header>
   <h1>My Courses</h1>
</header>
<nav>
      Math<br>
      History<br>
      English<br>
</nav>
<section>
     <h1>Math</h1>
     <p>Math lectures are on Mondays.</p>
</section>
<footer>Copyright © W3Schools.com</footer>
</body>
</html>
```

* Example taken from [1]

## HTML Forms

- HTML forms are used to collect user input.
  - The **<form>** tag is used to create an HTML form.

```
<form>
     Form elements
</form>
```

  - HTML forms contain **form elements**.
  - The **<input>** element is the most important **form element**.
    - The <input> element has many variations, depending on the **type** attribute.

## Common <input> Elements

- *text* Defines normal text input
  - Default width is 20 characters.
- *radio* Defines radio button input (for selecting one of many choices)
- *submit* Defines a submit button (for submitting the form)

```
<form>
First name: <input type="text" name="firstname"><br>
Last name: <input type="text" name="lastname"><br>
<input type="submit" value="Submit now" >
</form>
```

## Radio Button

- **<input type="radio">** defines a **radio button**.
  - Radio buttons let a user select ONE of a limited number of choices:

```
<form>
<input type="radio" name="gender" value="male" checked>
Male
<br>
<input type="radio" name="gender" value="female">Female
</form>
```

## Submit Button

- **<input type="submit">** defines a button for **submitting** a form to a **form-handler**.
  - The form-handler is typically a server page with a script for processing input data.
  - The form-handler (url) is specified in the form's **action** attribute.
  - The **method** attribute specifies the HTTP method (**GET** or **POST**) to be used when submitting the forms.

```
<form action="register_page" method="GET">
First name: <input type="text" name="firstname" value="Bob">
<br>
Last name:<input type="text" name="lastname" value="Smith">
<br>
<input type="submit" value="Submit Now">
</form>
```

## Reset Buttons

- *reset button*: is used to clear all inputs by the user
  - Example: <input type="reset" value="Clear All" >

## Textarea Element

- *<textarea>*: Allows user to enter multiple lines of text – not just a few characters.
- Change the size of you textarea using the attributes: rows and cols.

```
<form method="post">
  <textarea cols="25" rows="7"></textarea>
  <br>
  <input type="submit" value="Submit now">
</form>
```

## <label> Tag

- You can associate a label with an element.
  - Label associated with id of the element.
  - Label can be placed before or after the element.

```
<form method="post">
  <label for="comments">Additional Info
  (optional): </label><br>
  <textarea cols="25" rows="7"
  id="comments"></textarea>
  <br>
  <input type="submit" value="Submit now">
</form>
```

# Checkboxes

- Checkbox: Allows users to choose one or more units within a group of choices.
  - The type attribute must have the value "checkbox"
  - Every checkbox within the same group have the same name.
  - The value of the value attribute is the string that will be returned.

```
<form method="post">
    <input type="checkbox" name="animal" value="Cat" />Cats <br />
    <input type="checkbox" name="animal" value="Dog" />Dogs<br />
    <input type="checkbox" name="animal" value="Bird" />Birds<br />


    <input type="submit" value="Submit now" />
</form>
```

# Dropdown Lists

- Dropdown List: Another way to allow users choose just one of a set of choices.
  - Should only be used when the user **must** choose one the specified options.
    - does not allow user to not choose anything (as radio-buttons do).
    - Defined by the <select> element; the values being retuned are defined by the value attribute.

```
<select name="Registration Term">
  <option value="F2015">Fall Term</option>
  <option value="W2016">Winter Term</option>
  <option value="S2016">Summer Term</option>
</select>
```

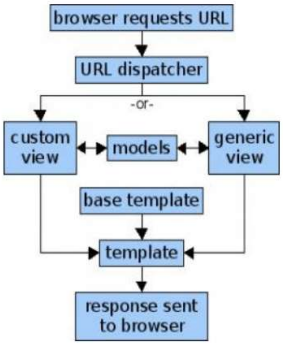
# Chapter 3 - Django Models

## Django Models

- Topics
  - Creating simple models
    - Rich field types
    - Model inheritance
    - Meta inner class
  - Relationships between models
    - ForeignKey
    - ManyToManyField
  - Advanced usage
  - Getting a model's data
    - Querysets

## Review MTV Architecture

- ***Model***
  - Represent data organization; defines a table in a database.
- ***Template***
  - Contain information to be sent to client; help generate final HTML.
- ***View***
  - Actions performed by server to generate data.




## Why Use ORM?

- Django provides rich db access layer
  - bridges underlying relational db with Python's object oriented nature
    - ***Portability***: support multiple database backends
    - ***Safety***: less prone to security issues (e.g. SQL injection attacks) arising from malformed or poorly protected query strings.
    - ***Expressiveness***: higher-level query syntax makes it easier to construct complex queries, e.g. by looping over structures.
    - ***Encapsulation***: Easy integration with programming language; ability to define arbitrary instance methods

## Defining Models

- ***Model*** is an object that inherits from Model class.
  - Model → represented by a table in the db
  - Field → represented by a table column
- Models are defined and stored in the APP's ***models.py*** file.
- *models.py* is automatically created when you start the APP
  - Contains one line from django.db import models
  - This allows you to import the base model from Django.

## Defining Models

- ***Model*** is an object that inherits from Model class.
  - Model → represented by a table in the db
  - Field → represented by a table column
- Models are defined and stored in the APP's ***models.py*** file.
- *models.py* is automatically created when you start the APP
  - Contains one line from django.db import models
  - This allows you to import the base model from Django.

```
File  Edit  Format  Run  Options  Window  Help
from django.db import models

# Create your models here.
class Book(models.Model):
    title = models.CharField(max_length=200)
    length = models.IntegerField()
    website = models.URLField()
    city = models.CharField(max_length=20, blank=True)
    country = models.CharField(max_length=20, default='USA')

    def __str__(self):
        return self.name
```

## Field Types

- Django provides a wide range of built-in field types. Some commonly used field types are given below:
  - *CharField*: character string with a limited number of characters.
    - title = models.CharField(**max_length=**200)
  - *TextField*: character string with unlimited number of characters.
  - *IntegerField*: Integer value.
  - *DateTimeField*: contains date as well as time in hours, minutes, and seconds.

**null**
If **True**, Django will store empty values as **NULL** in the database. Default is **False**.

**blank**
If **True**, the field is allowed to be blank. Default is **False**.

## Field Types

- Django field types (continued):
  - *DateField*: contains the date only.
  - *BooleanField*: stores True or False values.
  - *NullBooleanField*: Similar to above, but allows empty or null value to specify you don't know yet.
  - *FileField*: stores a file path in the db; provides capability to upload a file and store on server.
  - *EmailField*, *URLField*, *IPAddressField*: stored in db like CharField;
    - has extra validation code to ensure value corresponds to valid email, URL, or IP address.

## Primary Keys

- Primary key: A field guaranteed to be unique across the entire table.
  - In ORM terms: unique across the entire model.
  - Using auto-incrementing integers for this field is an effective way of ensuring uniqueness.
  - Useful as reference points for relationships between models.
- By default Django automatically creates this field (of type AutoField)

# Primary Keys

- By default Django automatically creates a primary key field.
  - All models without an explicit primary key field are given an **id** attribute (of type AutoField).
    - id = models.AutoField(**primary_key=**True)
  - Autofield: behaves like normal integers; incremented for each new row in table.
  - To define your own primary key:
    - specify **primary_key = True** for one of your model fields.
    - this field becomes the primary key for the table.
    - it is now your responsibility to ensure this field is unique.

## Example

- Book Model:

```
class Book(models.Model):
  title = models.CharField(max_length=100)
  length = models.IntegerField()
  pub_date = models.DateField()
```

## Example

- Employee Model:

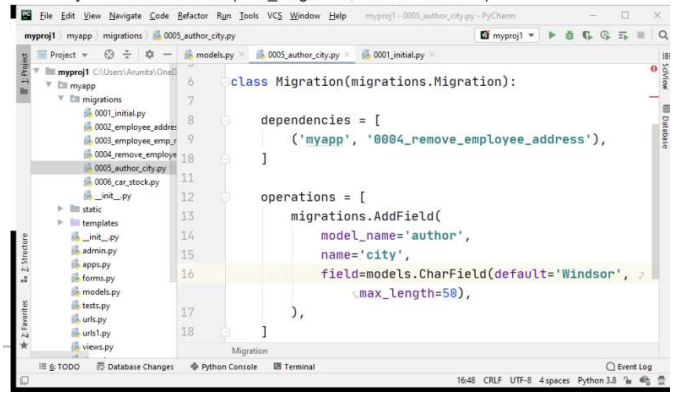
```
class Employee(models.Model):
  emp_no = models.IntegerField(default=999)
  name = models.CharField(max_length=50)
  age = models.IntegerField()
  email = models.EmailField(max_length=100)
  start_date = models.DateField()
```

# Migrations

- **Migrations**: propagate changes to your models (adding a field, deleting a model, etc.) into your database schema.
  - Prior to version 1.7, Django only supported adding new models to the database; could not alter or remove existing models.
  - Used the syncdb command (the predecessor to migrate)

# Example of Migrations

```
class Author(models.Model):
    name = models.CharField(max_length=50)
    city = models.CharField(max_length=50, default='Windsor')
```




# Migration Commands

- ***makemigrations*** : responsible for creating new migrations based on the changes made to your models.
- ***sqlmigrate***: displays the SQL statements for a migration.
- ***migrate***: responsible for applying migrations, as well as unapplying and listing their status.

# Relationships Between Models

- Relationships are elements that join our models.
- Types of relationships:
  - **many-to-one**: multiple 'child' objects can refer to the same 'parent' object; the child gets a single reference to its parent.
  - **many-to-many**: requires a 'many' relationship on both sides.
  - **one-to-one**: both sides of the relationship have only a single-related object.

# Many-To-One Relationship

- Uses the ForeignKey field
  - Requires a positional argument:
  - the class to which the model is related.
- Explicitly defined on only one side of the relationship.
  - The receiving end is able to follow the relationship backward.
- To create recursive relationship –object having many-to-one relationship with itself – use **models.ForeignKey('self').**

## Example

```
class Company(models.Model):
    co_name = models.CharField(max_length=50)

class Car(models.Model):
    type = models.Charfield(max_length=20)
    company = models.ForeignKey(Company,
                on_delete=models.CASCADE)
```

NOTE: The class being referred to must be already defined; otherwise, the variable name would not be available for the Car class.

## Example

Alternatively, use a string
– class name if it is defined in same file, or
– dot notation (e.g. 'myApp.Company') if defined in another file

```
class Car(models.Model):
    type = models.Charfield(max_length=20)
    company = models.ForeignKey('Company',
     on_delete=models.CASCADE)

class Company(models.Model):
    co_name = models.CharField(max_length=50)
```

## Many-to-Many Relationship

- Uses the ManytoManyField.
- Syntax is similar to ForeignKey field.
- Needs to be defined on one side of the relationship only.
  – Django automatically grants necessary methods and attributes to other side.
  – Relationship is symmetrical by default → doesn't matter which side it is defined on.

## Example

```
class Book(models.Model):
    title = models.CharField(max_length=100)
    length = models.IntegerField()
    pub_date = models.DateField()

class Author(models.Model):
    name = models.CharField(max_length=50)
    books = models.ManyToManyField(Book)
```

NOTE: The many-to-many relation is only defined in one model.

## Constraining Relationships

- Both *ForeignKey* and *ManyToManyField* take a limit_choices_to argument.
  – takes a dictionary as its value
  – dictionary key-value pairs are query keywords and values
  – powerful tool for defining the possible values of the relationship being defined.

```
class Employee(models.Model):
...
staff_member = models.ForeignKey(User, on_delete=models.CASCADE,
                                 limit_choices_to={'is_staff': True})
```

## One-To-One Relationship

- Uses the one-to-one field
  – Requires a positional argument:
  – the class to which the model is related.
  – Useful when an object "extends" another object in some way
- Explicitly defined on only one side of the relationship.
  – The receiving end is able to follow the relationship backward.
- Model inheritance involves an implicit one-to-one relation.

## Model Inheritance

- Models can inherit from one another, similar to regular Python classes.
- Previously defined Empolyee class

```
class Employee(models.Model):
    name = models.CharField(max_length=50)
    age = models.IntegerField()
    email = models.EmailField(max_length=100)
    start_date = models. DateField()
```

- Suppose there are 2 types of employees
  – programmers and supervisors

## Model Inheritance

- Option 1: Create 2 different models
  – duplicate all common fields
  – violates DRY principle.
- Option 2: Inherit from **Employee** class

```
class Supervisor(Employee):
    dept = models.CharField(max_length=50)

class Programmer(Employee):
    boss = models. ForeignKey(Supervisor,
                on_delete=models.CASCADE)
```

## Adding Methods to Models

- Since a model is represented as a class, it can have *attributes* and *methods*.
- One useful method is the __str__ method
  – It controls how the object will be displayed.

```
class Book(models.Model):
    title = models.CharField(max_length=100)
    length = models.IntegerField()
    pub_date = models.DateField()

    def __str__(self):
        return self.title
```

## Meta Inner Class

- ***Meta class***: Used to inform Django of various metadata about the model.
  – E.g. display options, ordering, multi-field uniqueness etc.

```
class Employee(models.Model):
    name = models.CharField(max_length=50)
    age = models.IntegerField()
    email = models.EmailField(max_length=100)
    start_date = models.DateField()

    class Meta:
        ordering = ['name', 'start_date']
        unique_together = ['name', 'age']
```

## Query Syntax

- Querying makes use of two similar classes: Manager and QuerySet
- ***Manager***: Interface through which database query operations are provided to Django models
  - At least one Manager exists for every model
  - By default, Django adds a Manager with the name objects to every Django model class.

## Query Examples

```
class Company(models.Model):
    co_name = models.CharField(max_length=50)

class Car(models.Model):
    type = models.Charfield(max_length=20)
    company = models.ForeignKey(Company, on_delete=models.CASCADE)
```

- Get all cars in the db.
  **car_list = Car.objects.all()**
- Get the car of type 'Lexus'.
  **car1 = Car.objects.get(type='Lexus')**
- Get the name of the company that made car1.
  **name = car1.company.co_name**
- Get all the cars made by 'Ford'
  **company = Company.objects.get(co_name='Ford')**
  **cars = company.car_set.all()**

## QuerySet

- **QuerySet**: Can be thought of as a list of model class instances (records/rows)
  - above is a simplification – actually much more powerful
  - QuerySet as nascent db query:
    - List of all books:
      **all_books = Book.objects.all()**
    - List of books with the word "Python" in title:
      **python_books = Book.objects.filter(title__contains="Python")**
    - The book with id == 1:
      **book = Book.objects.get(id=1)**

## QuerySet

- QuerySet as building blocks: QuerySets can be *composed* into complex or nested queries.
- Example 1:

```
python_books = Book.objects.filter(title__contains='Python')
short_python_books = python_books.filter(length__lt=100)
```

- Equivalently:

```
short_python_books =
 Book.objects.filter(title__contains='Python').filter(length__lt=100)
```

## Manager Class

- Manager class has the following methods:
  - ***all***: returns a QuerySet containing all db records for the specified model
  - ***filter***: returns a QuerySet containing model records matching specific criteria
  - ***exclude***: inverse of filter; return records that don't match the criteria
  - ***get***: return a single record (model instance) matching criteria
    - raises error if no match or multiple matches.

## Your Turn…

```
class Book(models.Model):
    title = models.CharField(max_length=100)
    length = models.IntegerField()
    pub_date = models.DateField()

class Author(models.Model):
    name = models.CharField(max_length=50)
    books = models.ManyToManyField(Book)
```

- Get all the books written by 'John Smith'
- Get all authors of the 2nd book in the list.
- Print the name of the first author.

## QuerySet

- **QuerySet** as container: QuerySet implements a partial list interface and can be iterated over, indexed, sliced, and measured.
- Example 1:

```
python_books = Book.objects.filter(title__contains="Python')
for book in python_books:
    print(book.title)
```

- Example 2:

```
all_books = Book.objects.all()
```

How many books in db?

```
num_books = len(all_books) # should use count attribute instead
```

Get the first book:

```
first_book = all_books[0]
```

Get a list of first five books:

```
first_five = all_books[:5]
```

## Summary

- Creating simple models
- Relationships between models
- Setting up database
  - migrate
  - initial data using fixtures
- Retrieving data
  - Managers and QuerySets

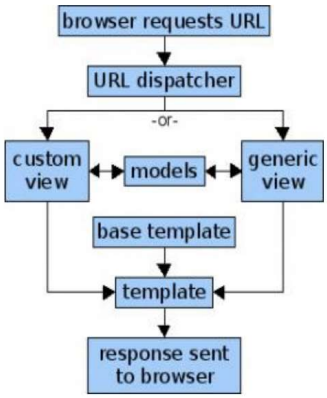
# Chapter 5 – Django Views

## Review MTV Architecture

## Django Views

- Topics
  - URLS
  - HTTP Objects
    - Request
    - Response
  - Views
    - Custom views
    - Generic views (if time permits)

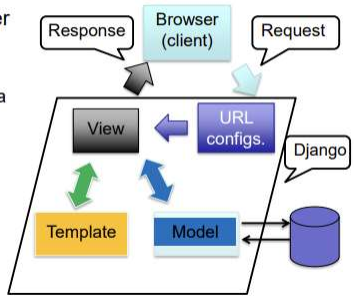
- Represent data organization; defines a table in a database.
- Contain information to be sent to client; help generate final HTML.
- Actions performed by server to generate data.




www.tikalk.com/files/intro-to-**django**.ppt

## Choosing a View (Function)

- Django web pages and other content are delivered by views.
  - Each view is represented by a simple Python function (or method)
- Django chooses a view by examining the requested URL
  - Only looks at the part of URL after the domain name.
  - Chooses view that 'matches' associated URL pattern.




## URLconf

- *URLconf (URL configuration): maps between URL path expressions to Python functions (your views).*
- *urlpatterns*: a sequence of Django **paths**

  Example: **path(r'', views.index, name='index'),**
- URL patterns for your app/project specified in corresponding ***urls.py*** file.

## Sample urls.py

mysite/urls.py

```
from django.urls import include, path
from django.contrib import admin
urlpatterns = [
  path(r'admin/', admin.site.urls),
  path(r'myapp/',
  include('myapp.urls')),
]
```

myapp/urls.py

```
from django.urls import path
from myapp import views

app_name = 'myapp'
urlpatterns = [
  path(r'', views.index, name='index'),
]
```

- include(*module*, *namespace=None*)
  - urlpatterns can "include" other URLconf modules.
  - This "roots" a set of URLs below other ones
  - When Django encounters include():
    - it chops off part of the URL matched up to that point
    - sends the remaining string to the included URLconf for further processing
  - Always use include() when including other URL patterns
    - Only exception in admin.site.urls

## path()

- Syntax:
  - path(route, view, kwargs=None, name=None)
  - ***route***: a string that contains a URL pattern
    - may contain angle brackets (like **<username>**) to capture part of the URL and send it as a keyword argument to the view.
    - angle brackets may include a converter specification (like the int part of <int:section>) which limits the characters matched and may also change the type of the variable passed to the view
    - Django starts at the first **path**, compares requested URL against each route until it finds one that matches.
      - Does not search GET and POST parameters, or domain name

## path()

- Syntax:
  - **path(route, view, kwargs=None, name=None)**
  - ***view***: after finding match, Django calls specified view function, with
    - HttpRequest object as the first argument and
    - any "captured" values from the regular expression as other arguments.
  - ***kwargs*** : can pass additional arguments in a dict, to view function
  - ***name***: lets you refer to URL unambiguously from elsewhere in Django

## path()

- Examples:

```
from django.urls import include, path

urlpatterns = [
  path('index/', views.index, name='main-view'),
  path('bio/<username>/', views.bio, name='bio'),
  path('articles/<slug:title>/', views.article,
        name='article-detail'),
  path('articles/<slug:title>/<int:section>/', views.section,
        name='article-section'),
  path('weblog/', include('blog.urls')),
  ...
]
```

* A **slug** is a short label for something, containing only letters, numbers, underscores or hyphens. They're generally used in URLs.

## re_path()

- Syntax:
  - re_path(route, view, kwargs=None, name=None)

```
urlpatterns = [
    re_path(r'^index/$', views.index, name='index'),
    re_path(r'^bio/(?P<username>\w+)/$', views.bio, name='bio'),
    re_path(r'^weblog/', include('blog.urls')),
    ...
]
```

## URL Matching Examples

```
from django.conf.urls import patterns, path
from myapp import views

urlpatterns = [
# ex: /myapp/

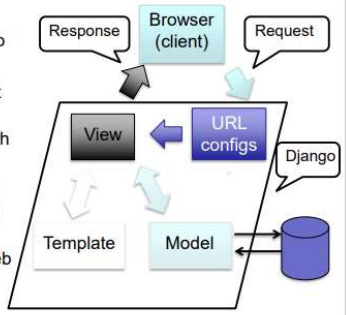
# ex: /myapp/5/

# ex: /myapp/5/results/

]
```

## Web Application Flow

- HTTP request arrives at web server
- Web server passes request to Django
- Django creates a request object
- Django consults URLconf to find right view function
  - Checks url against each regex/path
- View function is called with request object and captured URL arguments
- View creates and returns a response object.
- Django returns response object to web server.
- Web server responds to requesting client.




## Sample urls.py

myapp/urls.py

```
from django.conf.urls import path
from myapp import views
urlpatterns = [
  path(r'', views.index, name='index
  path(r'about/', views.about,
  name='about'),
]
```


```
1  from django.http import HttpResponse
2  from myapp.models import Employee
3
4  # Create your views here.
5  def index(request):
6      employees = Employee.objects.all()
7      response = HttpResponse()
8      ...
9      return response
10
11 def about(request):
12     return HttpResponse('This is a sample APP.')
```

## Views

- ***View function***: A Python function - takes a Web request, returns a Web response.
  - called view for short
  - response can be the HTML contents of a Web page, or a redirect, or a 404 error, or an XML document, or an image . . .
  - provide nearly all the programming logic
    - perform CRUD operations
  - can reside anywhere in your Python path
    - convention is to put views in a file called **views.py**, placed in your project or application directory

## A Simple View

```
from django.http import HttpResponse
import datetime
def current_datetime(request):
  now = datetime.datetime.now()
  html = "<html><body>It is now {0}.</body></html>".format(now)
  return HttpResponse(html)
```

- Import the class HttpResponse and Python's datetime library.
- define a function called current_datetime
  - view function taking HttpRequest object (typically named request) as its first parameter.
  - returns HttpResponse object with generated response
  - view function can have any name. [1]

## Request Objects

- *HttpRequest*: An object with a set of attributes representing raw HTTP request
  - *GET*: An attribute of HttpRequest Object
    - represented as a Python dict subclass QueryDict.
    - GET parameters passed as URL string, but not part of URL itself;do not define a separate resource (view)
    - Example: for the URL /userinfo/ can point to specific user: /userinfo/?name='John Smith'

      **username = request.GET['name']**

## HttpRequest Attributes

  - *POST*: An attribute of HttpRequest Object
    - represented as a QueryDict.
    - POST parameters are not part of URL
    - often generate by and HTML form; when user submits form, URL is called with POST dict containing form fields.
    - Example: if there is a form field 'name' and the user enters 'John'

      **request.POST['name']** will return 'John'
  - *COOKIES*: Another dict attribute; exposes HTTP cookies stored in request.

## Other Attributes

- *path*: portion of URL after domain
- *method*: specifies which request method was used – 'GET' or 'POST'
- *FILES*: contains information about any files uploaded by a file input form field.
- *user*: Django authentication user; only appears if Django's authentication mechanisms activated.
- *sessions*: contains session as read from db based on users session cookie; can be written to also.
  - write saves changes back to db, to be read later.

## Response Objects

- View functions return a HttpResponse object. Important attributes:
  - HttpResponse.status_code : The HTTP status code for the response
  - HttpResponse.content : A bytestring representing the content; usually a large HTML string.
  - can be set when creating a response object
    - response = HttpResponse("<html>Hello World</html")
  - can be set using write method (like a file)
    - response = HttpResponse()
    - response.write("<html>")
    - response.write("Hello World")
    - response.write("</html>")

## Response Objects

- Setting HTTP headers:
  - Treat response object as a dictionary.
  - 'key/value' pairs correspond to different headers and corresponding values.
    - HTTP header fields cannot contain newlines.
  - Example:

```
response = HttpResponse()
response["Content-Type"] = "text/csv"
response["Content-Length"] = 256
```

## View Functions

```
def index(request):
    books = Book.objects.all() [:10]
    response = HttpResponse()
    heading1 = '<p>' + 'List of books: ' + '</p>'
    response.write(heading1)
    for book in books:
        para = '<p>' + str(book.id) + ':  ' + str(book) + '</p>'
        response.write(para)
    return response
```

## View Functions

```
def about(request):
    return HttpResponse('Sample Website')

def detail(request, book_id):
    book = Book.objects.get(id=book_id)
    response = HttpResponse()
    title = '<p>' + book.title+ '</p>'
    author = '<p>' + str(book.author)+ '</p>'
    response.write(title)
    response.write(author)
    return response
```

## HttpResponse Subclasses

- Django provides HttpResponse subclasses for common response types.
  - *HttpResponseForbidden*: uses HTTP 403 status code
  - *HttpResponseServerError*: for HTTP 500 or internal server errors
  - *HttpResponseRedirect*: the path to redirect to (required 1st agrument to the constructor)
  - *HttpResponseBadRequest*: acts like HttpResponse, but uses a 400 status code
  - *HttpResponseNotFound*: acts like HttpResponse, but uses a 404 status code

## Common View Operations

1. ***CRUD***: **C**reate, **R**ead (or Retrieve), **U**pdate and **D**elete
2. Load a template
3. Fill a context
4. Return HttpResponse object
   - with result of the rendered template

## Summary

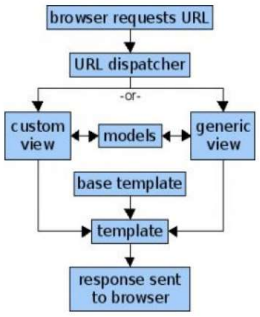
- Choosing a view
  - URLs, patterns
- Request and response objects
  - HttpResponse subclasses
- Views
  - Common operations - CRUD

# Django Templates

- Topics
  - Django Template Language
    - Variables, filters, tags, comments
  - Organizing Templates
    - namespacing
  - Template Inheritance
    - Extends and include
  - Including Static Files in Templates

## Review MTV Architecture

- Represent data organization; defines a table in a database.
- Contain information to be sent to client; help generate final HTML.
- Actions performed by server to generate data.




## Templates

- *Template*: a text document, or a normal Python string, that is marked-up using the Django template language.
  - Contains static content (e.g. HTML) and dynamic mark-up (specifying logic, looping, etc.)
  - Can contain block tags and/or variables
  - Choice of which template to use and data to display is made in view function itself (or through its arguments).

## Shortcut Functions

- *django.shortcuts*: A package that collects helper functions and classes.
  - "span" multiple levels of MVC (MTV).
  - these functions/classes introduce *controlled coupling* for convenience.
- ***render()***: A Django shortcut function
  - Combines a given template with a given context dict and returns an HttpResponse object with that rendered text.

## Render()

- **render(*request*, *template_name*, *context=None*,** *content_type=None*, *status=None*, *using=None*)
  - Required arguments
    - *request*: request obj used to generate the response.
    - *template_name*: The full name of a template to use or sequence of template names.
- *context*: a *dict-like* object used for passing information to a template.
  - Every rendering of a template typically requires a context.
    - Default (i.e. empty dict) – would not be very dynamic.
  - Contains a dictionary of 'key-value' pairs.
- *content_type*: The MIME type to use for the resulting document. Defaults to 'text/html'.
- *status*: The status code for the response. Defaults to 200.
- *using*: The NAME of a template engine to use for loading the template.

## Example

```
from myapp.models import Book
from django.http import
   HttpResponse
def my_view(request):
    # View code here...
    books = Book.objects.all()
    response=HttpResponse()
    for item in books:
        para= '<p>' + item.title+ '</p>'
        response.write(para)
    return response
```

```
from django.shortcuts import
   render
from myapp.models import Book
def my_view(request):
    # View code here...
    books = Book.objects.all()
    return render(request,
      'myapp/index.html', {
      'booklist': books })
```

## Template Language Syntax

- The Django template system is meant to express presentation, not program logic.
  - The language does not try to be (X)HTML compliant.
  - Contains variables and tags.
  - ***Variables***: get replaced with values when the template is evaluated.
    - look like this: **{{ variable }}**.
  - ***Tags***: control the logic of the template.
    - Look like this: **{% tag %} ... tag contents ... {% endtag %}**

## Variables

- When the template engine encounters a variable {{variable}}
  - it evaluates that variable and replaces it with the result.
- *Variable names*: any combination of alphanumeric characters and underscore ("_").
  - Cannot start with underscore
  - cannot have spaces or punctuation characters
  - The dot (".") has a special meaning

## The Dot-lookup Syntax

- When the template system encounters a dot (.) e.g. {{my_var.x}}:
  - Tries the following lookups, in this order:
    - Dictionary lookup
    - Attribute or method lookup
    - Numeric index lookup
  - If resulting value is callable, it is called with no args.
    - The result of the call becomes the template value
  - Example: **<h1>{{ employee.age}}</h1>**
    - Will be replaced with the age attribute of employee object

## Filters

- *Filters*: Allows you to modify context variables for display.
  - Similar to unix pipes (|), e.g. {{ name|lower }}
  - Can be "chained" {{ text|escape|linebreaks }}
    - The output of one filter is applied to the next.
  - Some filters take arguments.
    - {{ story|truncatewords:50 }}: displays 1st 50 words of story variable.
  - arguments that contain spaces must be quoted
    - {{ list|join:", " }}: joins a list with comma and space

## Tags

- Tags {% tag %} can have different functionality.
  - e.g. control flow, loops, logic
  - may require beginning and ending tags
  - some useful tags:
    - for
    - if, elif, else
    - block and extends

## for Tag

- Used to loop over each item in an array
- Example:

```
<ul>
{% for book in booklist %}
    <li>{{ book.title }}</li>
{% endfor %}
</ul>
```

## if, elif, else Tags

- Evaluates a variable
  - if that variable is "true" the contents of the block are displayed.

```
{% if my_list|length > 5 %}
  Number of selected items: {{ my_list|length }}
{% elif my_list %}
  Only a few items were selected
{% else %}
  {{my_list|default: 'Nothing selected.'}}
{% endif %}
```

## url Tag

- *url Tag*: Returns an absolute path reference (a URL without the domain name) matching a given view function.
  - may have optional parameters v1 v2 etc
    - Do not mix both positional and keyword syntax in a single call.
  - All arguments required by the URLconf should be present.
    - **{% url** 'path.to.some_view' v1 v2 **%}**
    - **{% url** 'path.to.some_view' arg1=v1 arg2=v2 **%}**

## Removing Hardcoded URLs

```
urlpatterns = [
  path(r'<int:emp_id>/', views.detail, name='detail'),
]
```

Matching url: **myapp/5/**

A hardcoded link in template file:

- <a href="/myapp/{{ emp.id }}/">{{ emp.name }}</a>
  - hard to change URLs on projects with many templates
  - Solution: use the {% url %} template tag, if name argument is defined in the corresponding ***urls.py***
- <a href="**{% url** 'myapp:detail' emp.id **%}**">{{emp.name }}</a>
  - looks up URL definition from the ***myapp.urls*** module
  - **path(r'<int:emp_id>/', views.detail, name='detail')**
- If you want to change the URL
  - Matching url: **myapp/5/ → myapp/emp_info/5/**
  - **path(r'emp_info/<int:emp_id>/', views.detail, name='detail')**
  - Don't need to change anything in template file

## Namespacing URL Names

- Adding namespaces allows Django to distinguish between views with same names in different APPs.
  - add namespace in app level *urls.py* (after import instructions)
    - app_name = 'myapp'
  - URL definition from the myapp.urls module
    - path(r'<int:emp_no>/', views1.detail, name='detail')
  - In template file, refer to it as
  - <a href="**{% url** 'myapp:detail' emp.id **%}**">{{emp.name}}</a>
  - Assuming emp.id=2, url tag will output string: /myapp/2 /
  - Final HTML string: <a href="/myapp/2 /">{{emp.name}}</a>

```
1  from django.urls import path
2  from myapp import views1
3
4  app_name = 'myapp'
5
6  urlpatterns = [
7      path(r'', views1.index, name='index'),
8      path(r'about/', views1.about,
           name='about'),
9      path(r'<int:emp_no>/',
           views1.detail, name='detail'),
0  ]
```

## Template Inheritance

- *Template inheritance*: allows you to build a base "skeleton" template that contains all the common elements of your site.
  - defines **blocks** that child templates can override
  - *block Tag*: Used in base template to define blocks that can be overridden by child templates.
    - tells template engine that a child template may override those portions of the template
    - <title>**{% block** title **%}**Hello World**{% endblock %}**</title>
  - ***extends Tag***: Used in child template
    - tells the template engine that this template "extends" another template.

## Base&Child Templates

```
<!DOCTYPE html>
<html lang="en">
<head>
    <link rel="stylesheet" href="style.css" />
    <title>{% block title %}My amazing site{%
      endblock %}</title>
</head>
<body>
    {% block sidebar %}
    <ul>
      <li><a href="/">Home</a></li>
      <li><a href="/blog/">Blog</a></li>
    </ul>
    {% endblock %}
    {% block content %}{% endblock %}
</body>
  </html>
```

```
{% extends "base.html" %}

{% block title %}My amazing blog{%
   endblock %}

{% block content %}
{% for entry in blog_entries %}
    <h2>{{ entry.title }}</h2>
    <p>{{ entry.body }}</p>
{% endfor %}
{% endblock %}
```

## Final HTML

```
{% extends "base.html" %}

{% block title %}My amazing blog{%
   endblock %}

{% block content %}
{% for entry in blog_entries %}
    <h2>{{ entry.title }}</h2>
    <p>{{ entry.body }}</p>
{% endfor %}
{% endblock %}
```

```
<!DOCTYPE html>
<html lang="en">
<head>
    <link rel="stylesheet" href="style.css" />
    <title>My amazing blog</title>
</head>
<body>
    <ul>
      <li><a href="/">Home</a></li>
      <li><a href="/blog/">Blog</a></li>
    </ul>
    <h2>Entry one</h2>
    <p>This is my first entry.</p>

    <h2>Entry two</h2>
    <p>This is my second entry.</p>
</body>
  </html>
```

## include Tag

- *include*: Loads a template and renders it with the current context.
  - template name can either be a variable or a hard-coded (quoted) string, in either single or double quotes.
    - **{% include** template_name **%}**
    - **{% include** "welcome.html" **%}**
    - Context: variable person is set to "John", greeting is set to "Hello"
      - {'greeting': 'Hello', 'person': 'John'}
    - welcome.html template: **{{** greeting **}}**, **{{** person **}}**!
    - **{% include** "welcome.html" **%}** → Hello, John!

## load Tag

- *load Tag*: Loads a custom template tag set
  - **{% load** somelibrary package.otherlibrary **%}**
  - e.g. {% load static %} loads the {% static %} template tag from staticfiles template library.
- selectively load individual filters or tags from a library, using the from argument.
  - **{% load** foo bar from somelibrary **%}**
  - {% static %} template tag generates the absolute URL of the static file

## Static Files

- *Static files*: additional files e.g., images, JavaScript, or CSS needed to render the complete web page.
  - static files are placed in a folder under your app
  - e.g. myapp/static/myapp/style.css
  - Add {% load static %} at top of template file

    **{% load** static **%}**

    <link rel="stylesheet" type="text/css" href="**{% static** 'myapp/style.css' **%}**" />

## Shortcut function: redirect()

- *redirect**(to,*args,**kwargs)*** : Returns an HttpResponseRedirect to appropriate URL .
  - Arguments could be:
    - A model: the model's get_absolute_url() function is called.
      - book **=** MyModel**.**objects.get(**...**)
      - **return** redirect(book)
    - An absolute or relative URL: used as-is for redirect location.
      - **return** redirect('/myapp/about/')
    - A view name, possibly with arguments: use urlresolvers.reverse to reverse-resolve the name.
      - **return** redirect('myapp:detail1', item id**=**1)

## Shortcut function: get_object_or_404

- *get_object_or_404**(klass,*args,**kwargs)***: Calls get() on a given model manager.
  - raises Http404 instead of model's DoesNotExist exception.
  - Required arguments:
    - *Klass*: A Model class, a Manager, or a QuerySet instance from which to get the object.
    - ***kwargs*: Lookup parameters, which should be in the format accepted by get() and filter().

## Example

```
from django.http import Http404

def my_view(request):
    try:
        my_object = MyModel.objects.get(pk=1)
    except MyModel.DoesNotExist:
        raise Http404
```

Alternatively,

```
from django.shortcuts import get_object_or_404

def my_view(request):
    my_object = get_object_or_404(MyModel, pk=1)
```

## Summary

- Template system
- Contexts
- Template language syntax
- Template namespacing
- Template inheritance
- Static files in templates


- [1] https://docs.djangoproject.com/en/3.0/topics/templates/

***Chapter 7 – 8 : Forms***

## Review MTV Architecture

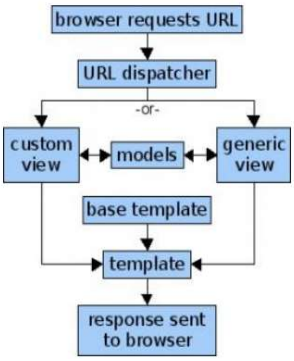
## Django Forms

- Topics
  - Django Forms
    - The Form Class
    - Fields and Widgets
  - Rendering Forms
    - Validating Forms
  - ModelForm

– Represent data organization; defines a table in a database.

– Contain information to be sent to client; help generate final HTML.

– Actions performed by server to generate data.




## HTML Forms

- *Form*: A collection of elements inside <form>...</form>
  - allow user to enter text, select options, manipulate objects etc.
  - send information back to the server.
- In addition to <input> elements, a form must specify:
  - *where*: the URL to which the data corresponding to the user's input should be returned
  - *how*: the HTTP method to be used to return data.
    - **<form action="/your-name/" method="post">**

## GET and POST

- ***GET***: bundles the submitted data into a string, and uses this to compose a URL.
  - The URL contains the address where the data must be sent, as well as the data keys and values.
- ***POST***: Form data is transmitted in body of request, not in URL.
  - Any request that could be used to change the state of the system should use POST method.

## GET and POST

- GET should be used **only** for requests that **do not** affect the state of the system.
  - Not suitable for large quantities of data, or for binary data, such as an image.
  - Unsuitable for a password form, because the password would appear in the URL.
  - GET is suitable for things like a web search form
    - the URLs that represent a GET request can easily be bookmarked, shared, or resubmitted

## Django's Functionality

- Form processing involves many tasks:
  - Example: prepare data for display, render HTML, validate data, and save data
- Django can automate and simplify much of this work. Handles 3 main areas:
  - preparing and restructuring data ready for rendering
  - creating HTML forms for the data
  - receiving and processing submitted forms and data from the client

## Building a Form

- Sample HTML form, to input your name.

```
<form action="/inp/" method="post">
    <label for="your_name">Username: </label>
    <input id="your_name" type="text" name="your_name"
        maxlength="100" >
    <input type="submit" value="OK">
</form>
```

- Components:
  - Data returned to URL /inp/ using POST
  - Text field labeled Username:
  - Button marked "OK"

## Building a Django Form

- Create a Form subclass:

```
from django import forms
class NameForm(forms.Form):
    your_name = forms.CharField(max_length=100)
```

  - This defines a Form class with a single field (your_name).
    - Creates a text input field
    - Associates a label with this field
    - Sets a maximum length of 100 for the input field.
  - When rendered it will create the following HTML

```
<label for="id_your_name">Your name: </label>
<input id="id_your_name" type="text" name="your_name"
    maxlength="100" >
```

- NOTE: It does not include <form> </form> tags or submit button.

## The Form Class

- ***Form class***: describes a form and determines how it works and appears.
  - Similar to how a model describes the logical structure of an object
- ***Form Field***: a form class's fields map to HTML form <input> elements.
  - A form's fields are themselves classes;
  - Fields manage form data and perform validation when a form is submitted.
  - A form field is represented in the browser as a HTML "widget"

# Field Arguments

- ***Field.required***: By default, each Field class assumes the value is required
  - empty value raises a ValidationError exception
- ***Field.label***: Specify the "human-friendly" label for this field.
  name = forms.CharField(label='Your name')
- ***Field.initial***: Specify initial value to use when rendering this Field in an unbound Form.
  name = forms.CharField(initial='John')
- ***Field.widget***: Specify a Widget class to use when rendering this Field.
- ***Field.error_messages***: Override the default messages that the field will raise.
  - Pass in a dictionary with keys matching the error messages you want to override.

  name = forms.CharField(error_messages={'required': 'Please enter your name'})
  …
  ValidationError: [u'Please enter your name']
  - The default error message is: [u'This field is required.']

# Form Fields

```
from django import forms
class NameForm(forms.Form):
    your_name =
        forms.CharField(max_length
        =100)
```

```
<label for="id_your_name">Your name:
</label>
<input id="id_your_name" type="text"
       name="your_name"
       maxlength="100" >
```

- You can access or alter the fields of a Form instance from its fields attribute.
  - Myname = f.fields['your_name']
  - f.fields['your_name'].label = "Username "

```
<label
for="id_your_name">Username:
</label>
<input id="id_your_name"
       type="text"
       name="your_name"
       maxlength="100" >
```

# Widgets

Each form field has associated Widget class
- Corresponds to an HTML input element, such as **<input type="text">.**
- Handles rendering of the HTML
- Handles extraction of data from a GET/POST dictionary
- Each field has a sensible default widget.
- Example: CharField has default TextInput widget → produces an **<input type="text">** in the HTML.
- BooleanField is represented by **<input type="checkbox">**
- You can override the default widget for a field.

- *BooleanField*: Default widget: CheckboxInput; Empty value: False
- *CharField*: Default widget: TextInput; Empty value: ' ' (empty string)
- *ChoiceField*: Default widget: Select; Empty value: ' ' (empty string)
- *EmailField*: Default widget: EmailInput; Empty value: ' ' (empty string).
- *IntegerField*: Default widget: TextInput (typically); Empty value: None
- *MultipleChoiceField*: Default widget: SelectMultiple; Empty value: [] (empty list).

# Create ContactForm Class

- **Create** forms in your app's ***forms.py*** file.
- **Instantiate** the form in your app's ***views.py*** file;
  - In view function corresponding to URL where form to be published
- **Render** the form by passing it as context to a template.
- Consider a form with four fields:
  - **subject, message, sender, cc_myself.**
  - Each field has an associated field type.
    - Example: CharField, EmailField and BooleanField

```
from django import forms
class ContactForm(forms.Form):
  subject = forms.CharField(max_length=100)
  message = forms.CharField(widget=forms.Textarea)
  sender = forms.EmailField()
  cc_myself = forms.BooleanField(required=False)
```

# Bound and Unbound Forms

- A Form instance can be i) **bound** to a set of data, or ii) **unbound**.
  - is_bound() method will tell you whether a form has data bound to it or not.
- An unbound form has no data associated with it.
  - When rendered, it will be empty or contain default values.
  - To create simply instantiate the class. e.g. **f = NameForm()**
- A bound form has submitted data,
  - Can render the form as HTML with the data displayed in the HTML.
  - To bind data to a form: Pass the data as a dictionary as the first parameter to your Form class constructor
    - The keys are the field names, correspond to the attributes in Form class.
    - The values are the data you're trying to validate.

```
data = {'your_name': 'Saja'}
form = NameForm (data)
```

or

```
form = ContactForm(request.POST)
```

# Instantiate and Render a Form

- Steps in rendering an object:
  1. retrieve it from the *database* in the view
  2. pass it to the template ***context***
  3. create HTML using template variables
- Rendering a form is similar, except:
  - It makes sense to render an ***unpopulated*** form
  - When dealing with a form we typically instantiate it in the *view.*
    - process form if needed
  - Render the form:
    - pass it to the template ***context***
    - create HTML using template variables

# The View

- Data sent back typically processed by same view which published the form
  - If form is submitted using POST: populate it with data submitted
  - If arrived at view with GET request: create an empty form instance;

```
from django.shortcuts import render
from django.http import HttpResponseRedirect
from myapp.forms import ContactForm

def contact(request):
  if request.method == 'POST': # if POST process submitted data

  # create a form instance;  populate with data from the request:
        form = ContactForm(request.POST)
        if form.is_valid():   # check whether it's valid:
          # process the data in form
          # ... return render(request, 'response.html', {'myform': form})
  else:
        form = ContactForm()  # if a GET  create a blank form
        return render(request, 'contact.html', {'myform': form})
```

# A Sample Template

- Get your form into a template, using the context.
  - **return** render(request, 'contact.html', {'myform': form})
- If the form is called 'myform' in the context, use {{myform}} in template.
- NOTE: This will **not** render the <form> tags or the submit button
- The form can be rendered manually or using one of the options:
  - **form.as_table, form.as_p** or **form.as_ul**

```
<form action="/your-name/" method="post">
  {% csrf_token %}
  {{ myform }}
  <input type="submit" value="Submit" />
</form>
```

- The form's fields and their attributes will be unpacked into HTML markup from the {{ myform }} form variable.
- The csrf_token template tag provides an easy-to-use protection against Cross Site Request Forgeries

## Rendering Options

```
from django import forms
class ContactForm(forms.Form):
  subject =
  forms.CharField(max_length=100)
  message =
  forms.CharField(widget=forms.Tex
  tarea)
  sender = forms.EmailField()
  cc_myself =
  forms.BooleanField(required=Fals
  e)
```

- The name for each tag is from its attribute name.
  - The text label for each field is generated from the field name by converting all underscores to spaces and upper-casing the first letter. Default suffix is ':'
  - Example: cc_myself → 'Cc myself:'
  - These are defaults; you can also specify labels manually.
- Each text label is surrounded in an HTML <label> tag, which points to a form field via its id.
  - Its id is generated by prepending 'id_' to the field name.
- The id attributes and <label> tags are included in the output by default.
  - To change this, **set auto_id=False**

## Rendering Forms

```
from django import forms
Class ContactForm(forms.Form):
  subject =
  forms.CharField(max_length=1
  00)
  message =
  forms.CharField(widget=forms.
  Textarea)
  sender = forms.EmailField()
  cc_myself =
  forms.BooleanField(required=F
  alse)
```

- Output of {{myform.as_p}}

```
<form action="/myapp/contact/" method="post">
  <p><label for="id_subject">Subject:</label>
     <input id="id_subject" type="text" name="subject"
            maxlength="100" /></p>
  <p><label for="id_message">Message:</label>
     <input type="text" name="message" id=
            "id_message" /></p>
  <p><label for="id_sender">Sender:</label>
     <input type="email" name="sender"
            id="id_sender"/></p>
  <p><label for="id_cc_myself">Cc myself:</label>
     <input type="checkbox" name="cc_myself"
            id="id_cc_myself" /></p>
<input type="submit" value="Enter Contact Info" />
</form>
```

## Form Validation

- ***Form.is_valid()*** : A method used to validate form data.
  - bound form: runs validation and returns a boolean (**True** or **False**) designating whether the data was valid. Generates myform.errors attribute.
  - unbound form: always returns **False**; myform.errors = { }
- The validated form data will be in the myform.cleaned_data dictionary.
  - includes a key-value for ***all*** fields; even if the data didn't include a value for some optional fields.
  - Data converted to appropriate Python types
    - Example: IntegerField and FloatField convert values to Python int and float respectively.

## Validated Field Data

```
>>> data = {'subject': 'hello',
            'message': 'Hi there',
            'sender': 'foo@example.com',
            'cc_myself': True}
>>> myform = ContactForm(data)
>>> myform.is_valid()
True
>>> myform.cleaned_data
{'cc_myself': True,
   'message': u'Hi there',
  'sender': u'foo@example.com',
  'subject': u'hello'}
```

- The values in **cleaned_data** can be assigned to variables and used in the view function.

```
if myform.is_valid():
  subj= myform.cleaned_data['subject']
  msg= myform.cleaned_data['message']
  sender = myform.cleaned_data['sender']
  cc = myform.cleaned_data['cc_myself']

  return HttpResponseRedirect('/thanks/')
```

## Form Validation – if Errors Found

Django automatically displays suitable error messages.

- ***f.errors***: An attribute consisting of a ***dict*** of error messages.

form's data validated first time either you call is_valid() or access errors attribute.

- ***f.non_field_errors()***: A method that returns the list of errors from f.errors not associated with a particular field.
- ***f.name_of_field.errors***: a list of form errors for a specific field, rendered as an unordered list.

E.g. form.sender.errors() → [u'Enter a valid email address.']

## Displaying Errors

- Rendering a *bound* **Form** object automatically runs the form's validation
  - HTML output includes validation errors as a <ul class="errorlist"> near the field.
  - The particular positioning of the error messages depends on the output method.

```
>>> data = {'subject': '', 'message': 'Hi there', 'sender': 'invalid email format',
                           'cc_myself': True}
>>> f = ContactForm(data, auto_id=False)
>>> print(f.as_p ())

<p><ul class="errorlist"><li>This field is required.</li></ul></p>
<p>Subject: <input type="text" name="subject" maxlength="100" /></p>
<p>Message: <input type="text" name="message" value="Hi there" /></p>
 <p><ul class="errorlist"><li>Enter a valid email address.</li></ul></p>
<p>Sender: <input type="email" name="sender" value="invalid email address"
   /></p>
<p>Cc myself: <input checked="checked" type="checkbox" name="cc_myself"
   /></p>
```

## ModelForm

- ***ModelForm***: a helper class to create a **Form** class from a Django **Model**.
  - The generated Form class will have a form field for every model field
    - the order specified in the fields attribute.
  - Each model field has a corresponding default form field.
    - Example: **CharField** on model → **CharField** on form.
  - **ForeignKey** represented by **ModelChoiceField:** a ChoiceField whose choices are a model QuerySet.
  - **ManyToManyField** represented by **ModelMultipleChoiceField:** a MultipleChoiceField whose choices are a model QuerySet.
  - If the model field has blank=True, then required = False .
  - The field's label is set to the verbose_name of the model field, with the first character capitalized.
  - If the model field has choices set, then the form field's widget will be set to Select, with choices coming from the model field's choices.

## ModelForm Example

```
class Book(models.Model):
   title = models.CharField(max_length=100)
   length = models.IntegerField()
   pub_date = models.DateField()

from django.forms import ModelForm
from myapp.models import  Book

# Create the form class.
class BookForm(ModelForm):
      class Meta:
            model = Book
            fields = ['title', 'pub_date', 'length']

# Creating a form to add a book
form = BookForm()

# Create form to change book in db.
book = Book.objects.get(pk=1)
form = BookForm(instance=book)
```

## ModelForm Example

```
from django.db import models
PROV_CHOICES = ( ('ON', 'Ontario.'), ('AB', 'Alberta.'), ('QC', 'Quebec.'), )
class Author(models.Model):
    name = models.CharField(max_length=100)
    prov = models.CharField(max_length=3, choices=PROV_CHOICES)
    birth_date = models.DateField(blank=True, null=True)

class Book(models.Model):
title = models.CharField(max_length=100)
authors =models.ManyToManyField(Author)
```

```
from django.forms import ModelForm
class AuthorForm(ModelForm):
    class Meta:
        model = Author
        fields = ['name', 'prov', 'birth_date']

class BookForm(ModelForm):
    class Meta:
        model = Book
        fields = ['title', 'authors']
```

## Form vs ModelForm Examples

```
from django.forms import ModelForm
class AuthorForm(ModelForm):
    class Meta:
        model = Author
        fields = ['name', 'prov', 'birth_date']

class BookForm(ModelForm):
    class Meta:
        model = Book
        fields = ['title', 'authors']
```

```
from django import forms
class AuthorForm(forms.Form):
    name = forms.CharField(max_length=100)
    prov = forms.CharField(max_length=3, widget=forms.Select(choices=PROV_CHOICES))
    birth_date = forms.DateField(required=False)

class BookForm(forms.Form):
    title = forms.CharField(max_length=100)
    authors = forms.ModelMultipleChoiceField(queryset=Author.objects.all())
```

## save() Method

- ***save() method:*** This method creates and saves a database object from the data bound to the form.
  - can accept an existing model instance as the keyword argument instance.
    - If this is supplied, save() will update that instance.
    - Otherwise, save() will create a new instance of the specified model
  - accepts an optional commit keyword argument (either True or False); commit=True by default.
    - If commit=False, then it will return an object that hasn't yet been saved to the database.
    - In this case, it's up to you to call save() on the resulting model instance.

## ModelForm Validation

- Validation is triggered
  - implicitly when calling is_valid() or accessing the errors attribute
- Calling save() method can trigger validation, by accessing errors attribute
  - A ValueError is raised if form.errors is True.

## Summary

- Django Forms
  - The Form Class
  - Fields and Widgets
- Rendering Forms
  - Validating Forms
  - Error messages
- ModelForm
  - Saving and validating ModelForms


- [1] https://docs.djangoproject.com/en/3.0/topics/forms/

# Chapter 9 – Authentication

## Django Authentication

- Topics
  - Introduction
  - Web Authentication
    - Login/Logout
    - Limiting access
  - Permissions and Authorization
    - Groups
    - Default permissions

## Authentication System

- Django's authentication system consists of:
  - ***User*** objects
  - A configurable password hashing system
  - Forms and view tools for logging in users, or restricting content.
  - **Permissions:** Binary (yes/no) flags designating whether a user may perform a certain task.
  - **Groups**: A generic way of applying labels and permissions to more than one user.

## Installation

- Add these 2 items in INSTALLED_APPS setting:
  - 'django.contrib.auth' : contains the core of the authentication framework, and its default models.
  - 'django.contrib.contenttypes': allows permissions to be associated with models you create.
- Add these 2 items in MIDDLEWARE_CLASSES setting:
  - SessionMiddleware: manages sessions across requests.
  - AuthenticationMiddleware: associates users with requests using sessions.
- By default: already included in settings.py.

## User Objects

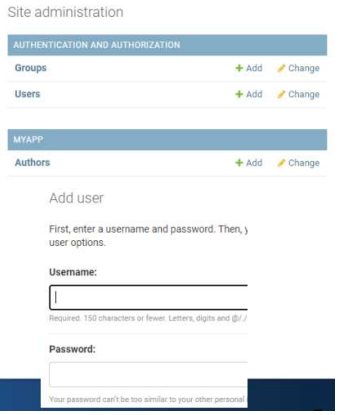
- User objects are the core of the authentication system.
  - Typically represent people interacting with your site.
  - Used to enable things like restricting access, registering user profiles etc.
  - Only one class of user exists in Django's authentication framework
    - Different user types e.g. 'superusers' or admin 'staff' users are just user objects with special attributes set
      - not different classes of user objects.

## User Attributes

- The primary attributes of the default user are:
  - ***Username***: Required. 30 characters or fewer.
    - May contain alphanumeric, _, @, +, . and - characters.
  - *first_name*: Optional. 30 characters or fewer.
  - *last_name*: Optional. 30 characters or fewer.
  - *Email*: Optional. Email address.
  - ***Password***: Required.
    - A hash of, and metadata about, the password.
    - Django doesn't store the raw password. Raw passwords can be arbitrarily long and can contain any character.

## Using Admin Interface

- Admin module can be used to view and manage users, groups, and permissions.
  - Both django.contrib.admin and django.contrib.auth must be installed.
  - The "Add user" admin page requires you to choose a username and password before allowing you to edit the rest of the user's fields.
  - User passwords are **not** displayed in the admin (nor stored in the database).
    - a link to a password change form allows admins to change user passwords






## Creating Users

- Use create_user() helper function:

```
from django.contrib.auth.models import User
user = User.objects.create_user('john',
  'lennon@thebeatles.com', 'johnpassword')
# At this point, user is a User object that has
# already been saved to the database. You can
# continue to change its attributes.
user.last_name = 'Lennon'
 user.save()
```

## Changing Passwords

- Django does not store raw (clear text) passwords on the user model,
  - It only stores a hash.
  - Do **not** manipulate the password attribute of the user directly.
    - **user.password = 'new password' # Don't do this!**
  - Passwords can be changed using **set_password()**

```
from django.contrib.auth.models import User
u = User.objects.get(username='john')
u.set_password('new password')
u.save()
```

## Authenticating Users

- ***authenticate()***: Takes credentials in the form of keyword arguments:
  - For the default configuration this is username and password
    - Returns a User object if the password is valid for the given username.
    - Returns None if password is invalid.

```
from django.contrib.auth import authenticate
 user = authenticate(username='john', password='secret')
 if user is not None: # password verified for the user
     if user.is_active:
        print("User is valid, active and authenticated")
     else:
         print("The password is valid, but the account has been disabled!")
else: # unable to verify the username and password
     print("Username and password did not match.")
```

## Example

```
from django.contrib.auth import authenticate, login

def my_view(request):
    username = request.POST['username']
    password = request.POST['password']
    user = authenticate(username=username, password=password)
    if user is not None:
        if user.is_active:
            login(request, user)
                # Redirect to a success page.
        else:
                # Return a 'disabled account' error message
    else:
        # Return an 'invalid login' error message.
```

## Login_required Decorator

- login_required() does the following:
  - If the user isn't logged in, redirect to settings.LOGIN_URL
    - Passing the current absolute path in the query string. Example: /accounts/login/?next=/polls/3/.
    - By default, the path that the user should be redirected to upon successful authentication is stored in a query string parameter called "next".
  - If the user is logged in, execute the view normally.
    - The view code is free to assume the user is logged in.

```
from django.contrib.auth.decorators import login_required
@login_required
def my_view(request):
    ...
```

## Custom Permissions

- You can create permissions programatically (in views.py or in python django console).

```
from myapp.models import Libuser
from django.contrib.auth.models import Group, Permission
from django.contrib.contenttypes.models import ContentType

content_type = ContentType.objects.get_for_model(Libuser)
perm1 = Permission.objects.create(codename='can_search',
                                  name='Can Search for Libitems',
                                  content_type=content_type)
```

  - Once created, the permission can be assigned to a User via its user_permissions attribute or to a Group via its permissions attribute.
  - The has_perm() method, permission names take the form "<app label>.<permission codename>"
    - e.g. myapp.can_search for a permission on a model in the myapp APP.

## Login

- Each **request** object provides a request.user attribute, which represents the current user.
  - If the current user has not logged in, this attribute will be set to an instance of AnonymousUser; otherwise it will be an instance of User.
  - Use is_authenticated() to differentiate between the two.
  - Example: **if request.user.is_authenticated():**
    **# Do something for authenticated users.**
- ***login()*** *function*: used to attach an *authenticated* user to the current session.
  - It takes an HttpRequest object and a User object.
    - Associates the **user** with the current **request** object
  - Saves the user's ID in the session, using Django's session framework.
  - Any data set during the anonymous session is retained in the session after a user logs in.
  - ***login()*** function can be called from a view.
- To manually log in a user call authenticate() before you call login().

## Logout

- Use django.contrib.auth.logout() within your view.
  - It takes an HttpRequest object and has no return value.
  - logout() doesn't throw any errors if the user wasn't logged in.
  - Cleans out the session data for the current request

```
from django.contrib.auth import logout

def logout_view(request):
    logout(request)
    # Redirect to a success page.
```

## Default Permissions

- 3 default permissions created for each Django model defined in one of your installed apps :
  - *Add*: Access to view the "add" form and add an object
    - limited to users with "add" permission for that type of object.
    - Example: user.has_perm('myapp.add_book')
  - *Change*: Access to view the change list, view the "change" form and change an object
    - limited to users with the "change" permission for that type of object. Example: user.has_perm('myapp.change_book')
  - *Delete*: Access to delete an object
    - limited to users with the "delete" permission for that type of object. Example: user.has_perm('myapp.delete_book')
  - Permissions can be set not only per type of object, but also per specific object instance.

## Check and Change User Permissions

- User objects have many-to-many field: **user_permissions**

```
myuser = User.objects.get(pk=1)
myuser.user_permissions.set([permission_list])
myuser.user_permissions.add(perm1, perm2, …)
myuser.user_permissions.remove(perm1, perm2, ...)
myuser.user_permissions.clear()
```

## Groups

- Groups allow you to apply permissions to a group of users.
  - A user in a group automatically has the permissions granted to that group.
  - Also a convenient way to categorize users to give them some label, or extended functionality.
- User objects have many-to-many field: **groups**

```
myuser = User.objects.get(pk=1)
myuser.groups.set([group_list])
myuser.groups.add(group1, group,2 ...)
myuser.groups.remove(group1, group2, ...)
myuser.groups.clear()
# Add group permissions
group = Group.objects.get(name='wizard')
group.permissions.add(permission)
```

- [1] https://docs.djangoproject.com/en/3.0/topics/auth/

## Using Permissions in Your Code

- Restrict certain actions to specific users:
  - Check if user has permission before executing code. Example, if only certain users can serch the library.

```
def searchlib(request):
    if request.user.has_perm('libapp.can_search'):
        # Code to process search request goes here
        #  …
    else:
        return HttpResponse('You do not have permission to search!')
```

## Summary

- Authentication
  - User objects
  - Authenticate(), login() and logout()
  - Permissions and Authorization
    - Groups
    - Default permissions

# Enabling Sessions

## Django Sessions

- Topics
  - Sessions Introduction
  - Sessions in Views
    - Session Objects
  - Setting Cookies
  - Saving Sessions
  - Additional Operations

- Edit the MIDDLEWARE_CLASSES setting
  - It should contain 'django.contrib.sessions.middleware.SessionMiddleware'.
  - The default settings.py created by django-admin.py startproject has SessionMiddleware activated.
- *Database Backed Sessions:* by default Django stores session data in the database.
  - Add 'django.contrib.sessions' to INSTALLED_APPS.
  - Django creates a single database table that stores session data.

## Alternative Configurations

- Use SESSION_ENGINE setting for alternative configurations:
  - Using cached sessions
    - Store session data using Django's cache system
  - Using file-based sessions.
    - Store session data using the computers file system.
    - Web server should have permissions to read and write to this location
  - Using cookie-based sessions.
    - Store session data using Django's tools for cryptographic signing and the SECRET_KEY setting.

## Session Object

- *Session Object*: A dictionary-like object, which is an attribute of a HttpRequest object.
  - When SessionMiddleware is activated, each HttpRequest object has a session attribute.
  - HttpRequest is the first argument to any Django view function.
  - By default, Django only saves to the session database when the session has been modified
    - if any of its dictionary values have been assigned or deleted
- You can read and write to request.session at any point in your view.
  - You can edit it multiple times.

## Session Objects

- Session objects use standard ***dict*** methods.
  - Can use usual dictionary access methods
  - Example:
    - fav_color = request.session['fav_color'] # __getitem__
    - request.session['fav_color'] = 'blue' # __setitem__
    - del request.session['fav_color'] # __delitem__
    - 'fav_color' in request.session # __contains__
  - Additional dict methods that can be used:
    - keys(), items(), setdefault(), clear()

## More Methods

- *flush()*:
  - Delete the current session data from the session and regenerate the **session key** value that is sent back to the user in the cookie.
    - Used to ensure that the previous session data can't be accessed again from the user's browser
- *set_test_cookie()*:
  - Sets a test cookie to determine whether the user's browser supports cookies.
- *test_cookie_worked()*:
  - Returns either True or False, depending on whether the user's browser accepted the test cookie.
- *delete_test_cookie()*:
  - Deletes the test cookie. Use this to clean up after yourself.

## More Methods

- *set_expiry(value)*:
  - Sets the expiration time for the session.
    - value is integer: session expires after that many seconds of inactivity.
    - value is datetime object: the session expires at specified date/time.
    - value is 0: session cookie expires when the Web browser is closed.
    - value is None: session uses the global session expiry policy.
- *get_expiry_age()*:
  - Returns the number of seconds until this session expires.
- *clear_expired()*:
  - Removes expired sessions from the session store.
- *cycle_key()*:
  - Creates a new session key while retaining current session data.

## Example

```
# This simplistic view sets a has_commented
# variable to True after a user posts a comment. It
# doesn't let a user post a comment more than once.

def post_comment(request, new_comment):
  if request.session.get('has_commented', False):
    return HttpResponse("You've already commented.")
  c = comments.Comment(comment=new_comment)
  c.save()
  request.session['has_commented'] = True
  return HttpResponse('Thanks for your comment!')
```

## Testing Cookies

1. Call set_test_cookie() method of request.session in a view.
2. Call test_cookie_worked() in a *subsequent* view – NOT in the same view.
   - you can't actually tell whether a browser accepted it until the browser's *next* request.
3. It's good practice to use delete_test_cookie() to clean up afterwards.
   - Do this after you've verified that the test cookie worked.

```
def login(request):
    if request.method == 'POST':
        if request.session.test_cookie_worked():
            request.session.delete_test_cookie()
            return HttpResponse("You're logged in.")
        else:
            return HttpResponse("Please enable cookies and try again.")
    request.session.set_test_cookie()
    return render('foo/login_form.html')
```

## Sessions Outside of Views

- An API is available to manipulate session data outside of a view.
  - The SessionStore object can be imported directly from the appropriate backend.
  - For django.contrib.sessions.models each session is a normal Django model.
  - Can be accessed using normal Django db API.

```
>>> from django.contrib.sessions.models import Session
>>> s = Session.objects.get(pk='2b1189a188b44ad18c35e113ac6ceead')
>>> s.expire_date
datetime.datetime(2015, 8, 20, 13, 35, 12)
```

## Session Expiration

- *SESSION_EXPIRE_AT_BROWSER_CLOSE*:
  - Controls if session framework uses browser-length sessions or persistent sessions.
  - Global default setting for session framework
  - ***get_expire_at_browser_close()***: True if session cookie expires when user's browser is closed.
    - Can be overwritten at a per-session level by explicitly calling the set_expiry() method of request.session.
  - By default, it is set to False
    - This means session cookies will be stored in users' browsers for as long as SESSION_COOKIE_AGE.
    - Use this if you don't want people to have to log in every time they open a browser
  - If it is set to True
    - Cookies expire as soon as user closes their browser.
    - Use this if you want people to have to **log in every time** they open a browser

## Clearing SessionStore

- When a user logs in, Django adds a row to the django_session db table.
  - Django updates this row each time the session data changes.
  - If the user logs out manually, Django deletes the row.
  - If the user does *not* log out, the row never gets deleted.
- As users create new sessions on your website, session data can accumulate in your session store.
  - If you're using the database backend, the django_session db table will grow.
  - If you're using the file backend, your temporary directory will contain an increasing no. of files.
- Django does *not* provide automatic purging of expired sessions.
  - It is your job to purge expired sessions on a regular basis.
  - Django provides a clean-up management command for this purpose: clearsessions.
  - It is recommended to call this command on a regular basis.

# Chapter 11 – Admin

## Basic Steps

### Django Admin Module

- Topics
  - Admin Site
  - ModelAdmin Objects
    - Registering objects
    - Options and methods
  - InlineModelAdmin Objects
    - Options

- Django provides an automatic admin interface.
  - It reads model metadata and provides a powerful interface for adding content to the site.
  - It is enabled by default (Django 1.6 onwards)
- Add 'django.contrib.admin' to INSTALLED_APPS setting.
- Determine which models should be editable in the admin interface.
  - For each of those models, optionally create a ModelAdmin class.
  - Tell AdminsSite about (register) each of your models and ModelAdmin classes.
- Hook the AdminSite instance into your URLconf.
  - path(r'admin/', admin.site.urls),

### ModelAdmin Class

- *ModelAdmin*: representation of a model in the admin interface.
  - Usually, stored in admin.py file in your APP.

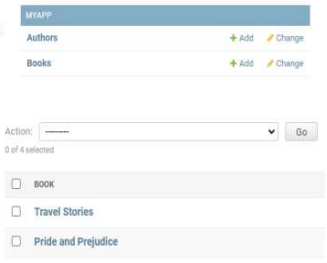
```
from django.contrib import admin
from .models import Author, Book
class AuthorAdmin(admin.ModelAdmin):
        pass
admin.site.register(Author, AuthorAdmin)
```

  - **If default interface is sufficient, register model directly**
    - **admin.site.register(Book)**

### List_display Option

- ***list_display***: controls which fields are displayed on the admin 'change list' page
  - e.g.: **list_display = ('first_name', 'last_name')**
  - Default: admin site displays a only the __str__() representation of each object.
  - Four possible values can be used in list_display

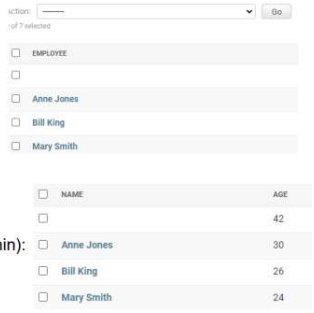
1.A field of the corresponding model
2.A callable that accepts one parameter for the model instance.
3.A string representing an attribute on the ModelAdmin.
4.A string representing an attribute on the model.




### Model Field in list_display

```
models.py
class Employee(models.Model):
        name =
    models.CharField(max_length=50)
        age = models.IntegerField()
        email =
    models.EmailField(max_length=100)
        start_date = models.DateField()

        def __str__(self):
            return self.name
admin.py
class EmployeeAdmin(admin.ModelAdmin):
    list_display = ('name', 'age')
```




### Callable in list_display

```
admin.py
def upper_case_name(obj):
        return obj.name.upper()

class EmployeeAdmin(admin.ModelAdmin):
    list_display = ('name', uppper_case_name, 'age',)

class AuthorAdmin(admin.ModelAdmin):
    list_display = ('name', upper_case_name, 'city')

# Register your models here.
admin.site.register(Author, AuthorAdmin)
admin.site.register(Employee, EmployeeAdmin)
```

### Model Attribute in list_display

#### ModelAdmin Attribute in list_display

```
class EmployeeAdmin(admin.ModelAdmin):
    list_display = ('name', uppper_case_name, 'age', 'status')

    def status(self, obj):
        if datetime.date.today() - obj.start_date < datetime.timedelta(180):
            return 'Trainee'
        else:
            return 'Regular'
        status.short_description = 'Employee Status'

# Register your models here.
```

```
models.py
class Author(models.Model):
        name = models.CharField(max_length=50)
        city = models.CharField(max_length=20, default='Windsor')
        books = models.ManyToManyField(Book)

        def local_author(self):
            if self.city == 'Windsor':
                return 'Yes'
            return 'No'
admin.py
class AuthorAdmin(admin.ModelAdmin):
        list_display = (name, uppper_case_name, 'local_author')

# Register your models here.
```

## ModelAdmin Actions

- ***Actions***: simple functions that get called with a list of objects selected on the change list page.
  - Very useful for making same change to many objects at once.
  - The function takes 3 arguments:
    - The current ModelAdmin
    - An HttpRequest representing the current request,
    - A QuerySet containing the set of objects selected by the user.
- Two main steps:
  - Writing actions
  - Adding actions to ModelAdmin
- Example: You want to update status of several articles at once.
  - Relevant models and functions defined in following slides.


## Example

```
# Book model
class Book(models.Model):
    STATUS_CHOICES = (
        (0, 'In stock'),
        (1, 'Available soon'),
        (2, 'Not Available'),
    )
    title = models.CharField(max_length=100)
    length = models.IntegerField()
    pub_date = models.DateField()
    status =
models.IntegerField(choices=STATUS_CHOICES)
```

## Writing Actions

```
# Book model
class Book(models.Model):
    STATUS_CHOICES = (
        (0, 'In stock'),
        (1, 'Available soon'),
        (2, 'Not Available'),
    )
    title =
models.CharField(max_lengt
h=100)
    length =
models.IntegerField()
    pub_date =
models.DateField()
    status =
models.IntegerField(choices=
STATUS_CHOICES)
```

```
def make_available(modeladmin, request,
  queryset):
      queryset.update(status=0)
```

- Default name in action list → "Make available"
- Also possible to iterate over queryset

```
  for obj in queryset:
      obj.status = 0
```

- Provide friendly description in action list.

```
def make_available (modeladmin, request,
  queryset):
  queryset.update(status=0)
  make_available.short_description = "Mark as
  available"
```

## Adding Actions

- To inform our ModelAdmin of the action:
  - Add the action to the list of available actions for the object.
  - "delete selected objects" action available to all models

```
from django.contrib import admin
from.models import Book

def make_available(modeladmin, request, queryset):
    queryset.update(status=0)
    return
make_available.short_description = 'Mark as available' #

class BookAdmin(admin.ModelAdmin):
    list_display = ('title', 'status')
    actions = [make_available]

# Register your models here.
admin.site.register(Book, BookAdmin)
```

## Fields Option

- Used to make simple changes in the layout of fields in the forms.
  - showing a subset of the available fields, modifying their order or grouping them in rows
- CAUTION: If a **required** field is excluded, it will cause ERROR when trying to save the object.
  - If only blank=True in model → ERROR
  - If a default value is provided in the model → OK.

```
class BookAdmin(admin.ModelAdmin):
    fields = ('title', 'length', 'pub_date')
```

  - displays only the above three fields for the model, in the order specified.
  - To show multiple fields on the same line, wrap those fields in their own tuple

```
class BookAdmin(admin.ModelAdmin):
    fields = ('title', ('length', 'pub_date'))
```

## Inlines

- ***Inlines***: Provides admin interface the ability to edit models on the same page as a parent model.
  - Two Subclasses: TabularInline and StackedInline
    - The difference between these two is merely the template used to render them
  - To edit the cars made by a company on the company page: Add inlines to a model

```
# Suppose two models are defined
from django.db import models

class Company(models.Model):
    co_name =
models.CharField(max_length=50)

class Car(models.Model):
    type =
models.CharField(max_length=20)
    company =
models.ForeignKey(Company)
```

```
from django.contrib import admin

class CarInline(admin.TabularInline):
    model = Car

class
CompanyAdmin(admin.ModelAdmin):
    inlines = [
        CarInline,
    ]
```

## Summary

- Admin Site
- ModelAdmin Objects
  - Registering objects
- Options and methods
  - Actions, fields and fieldsets
- InlineModelAdmin Objects
  - TabularInline
  - StackedInline


- [1] https://docs.djangoproject.com/en//ref/contrib/admin/