

## A1: The Module urllib2

- Module urllib2 is used to read web pages

- Function urlopen creates a url object
- `u = urllib2.urlopen('http://www.cornell.edu')`



- url has a method called read()
  - Returns contents of web page
  - Usage:** `s = u.read()` # s is a string

## Recall: The Python API

**Function name**

**Number of arguments**

**What the function evaluates to**

**This is a specification**

- Enough info to use func.
- But not how to implement
- Write them as **docstrings**

## Anatomy of a Specification

```
def greet(n):
    """Prints a greeting to the name n
    Greeting has format 'Hello <n>!'
    Followed by conversation starter.

    Parameter n: person to greet
    Precondition: n is a string"""
    print 'Hello '+n+'!'
    print 'How are you?'
```

One line description, followed by blank line

More detail about the function. It may be many paragraphs.

Parameter description

Precondition specifies assumptions we make about the arguments

## Anatomy of a Specification

```
def to_centrigrade(x):
    """Returns: x converted to centigrade
    Value returned has type float.

    Parameter x: temp in fahrenheit
    Precondition: x is a float"""
    return 5*(x-32)/9.0
```

"Returns" indicates a fruitful function

More detail about the function. It may be many paragraphs.

Parameter description

Precondition specifies assumptions we make about the arguments

## Preconditions

- Precondition is a **promise**
  - If precondition is true, the function works
  - If precondition is false, no guarantees at all
- Get **software bugs** when
  - Function precondition is not documented properly
  - Function is used in ways that violates precondition

```
>>> to_centrigrade(32.0)
0.0
>>> to_centrigrade(212)
100.0
>>> to_centrigrade('32')
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "temperature.py", line 19 ...
TypeError: unsupported operand type(s)
for -: 'str' and 'int'
```

Precondition violated

## Test Cases: Finding Errors

- Bug:** Error in a program. (Always expect them!)
- Debugging:** Process of finding bugs and removing them.
- Testing:** Process of analyzing, running program, looking for bugs.
- Test case:** A set of input values, together with the expected output.

Get in the habit of writing test cases for a function from the function's specification — even *before* writing the function's body.

```
def number_vowels(w):
    """Returns: number of vowels in word w.
    Precondition: w string w/ at least one letter and only letters"""
    pass # nothing here yet!
```

## Representative Tests

- Cannot test all inputs
  - "Infinite" possibilities
- Limit ourselves to tests that are **representative**
  - Each test is a significantly different input
  - Every possible input is similar to one chosen
- An art, not a science
  - If easy, never have bugs
  - Learn with much practice

### Representative Tests for number\_vowels(w)

- Word with just one vowel
  - For each possible vowel!
- Word with multiple vowels
  - Of the same vowel
  - Of different vowels
- Word with only vowels
- Word with no vowels

## Running Example

- The following function has a bug:

```
def last_name_first(n):
    """Returns: copy of <n> but in the form <last-name>, <first-name>

    Precondition: <n> is in the form <first-name> <last-name>
    with one or more blanks between the two names"""
    end_first = n.find(' ')
    first = n[:end_first]
    last = n[end_first+1:]
    return last+', '+first
```

Look at precondition when choosing tests

- Representative Tests:
  - last\_name\_first('Walker White') give 'White, Walker'
  - last\_name\_first('Walker White') gives 'White, Walker'

## Unit Test: A Special Kind of Script

- A unit test is a script that tests another module
  - It **imports the other module** (so it can access it)
  - It **imports the cornelltest module** (for testing)
  - It **defines one or more test cases**
    - A representative input
    - The expected output
- The test cases use the cornelltest function

```
def assert_equals(expected,received):
    """Quit program if expected and received differ"""
```

## Testing last\_name\_first(n)

```
import name # The module we want to test
import cornelltest # Includes the test procedures

# First test case
result = name.last_name_first('Walker White')
cornelltest.assert_equals('White, Walker', result)

# Second test case
result = name.last_name_first('Walker White')
cornelltest.assert_equals('White, Walker', result)

print 'Module name is working correctly'
```

Actual Output

Input

Expected Output

## Testing last\_name\_first(n)

```
import name # The module we want to test
import cornelltest # Includes the test procedures

# First test case
result = name.last_name_first('Walker White')
cornelltest.assert_equals('White, Walker', result)

# Second test case
result = name.last_name_first('Walker White')
cornelltest.assert_equals('White, Walker', result)

print 'Module name is working correctly'
```

Quits Python if not equal

Message will print out only if no errors.

## Test Procedure

```
def test_last_name_first():
    """Test procedure for last_name_first(n)"""
    print 'Testing function last_name_first'
    result = name.last_name_first('Walker White')
    cornelltest.assert_equals('White, Walker', result)
    result = name.last_name_first('Walker White')
    cornelltest.assert_equals('White, Walker', result)

# Execution of the testing code
test_last_name_first()
print 'Module name is working correctly'
```

No tests happen if you forget this