6.009
Fundamentals of Programming

Interlude:
Python, Sockets, and the Web

Adam Hartz
hz@mit.edu
CAT-SOOP

An “automatic tutor”: collect and assess online exercises
Written in Python, 2011-now, rewritten completely multiple times

Based on a program called “the tutor” by Tomás Lozano-Pérez (written in Scheme!)

CAT-SOOP is a fairly standard web application. What does it do?

• Receive request from user
  (“show me a page,” “submit this answer,” etc)
• Find relevant information
  (page content, user info, history of submissions, etc)
• Log new information if necessary, and
• Send response
  (typically, HTML to be displayed in the browser)
The World Wide Web

https://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html
3) IMAGE FILTERING VIA PER-PIXEL TRANSFORMATIONS

As our first task in manipulating images, we will look at an inversion filter, which reflects pixels about the middle gray value (i.e., black becomes white, and vice versa). For instance, here is a photograph of Adam H’s cat. On the left side is the original image, and on the right is an inverted version.

Most of the implementation of the inversion filter has been completed for you (it is invoked by calling the method called `inverted()`), but some pieces have not been implemented correctly. Your task in this part of the lab is to fix the implementation of the inversion filter.

Before you do that, however, let’s add a simple test case so that we can test whether our code is working.

Let’s start with a 1x1 image that is defined with the following parameters:

```
python
<graph>
<subcaption>Image Processing</subcaption>
</graph>

```
What Is A Server?
What Is A Server?
Sockets allow communication across processes (on the same machine or different machines).

Typically, a server will wait for a client to make a connection on a designated port (a virtual endpoint for a connection).

Once the client connects, the socket allows for communication between the server and the client.

Client and server can each send/receive data via the socket.

Example: yelling echo server.
The World Wide Web

https://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html
HTTP Request and Response

```
GET /doc/test.html HTTP/1.1
Host: www.test101.com
Accept: image/gif, image/jpeg, */*
Accept-Language: en-us
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0
Content-Length: 35

bookId=12345&author=Tan+Ah+Teck
```

```
HTTP/1.1 200 OK
Date: Sun, 08 Feb xxxx 01:11:12 GMT
Server: Apache/1.3.29 (Win32)
Last-Modified: Sat, 07 Feb xxxx
ETag: "0-23-4024c3a5"
Accept-Ranges: bytes
Content-Length: 35
Connection: close
Content-Type: text/html

<h1>My Home page</h1>
```
The Rest of Today

Designing a:

- Web Server
- Web Application Framework
- Web Application