61A Extra Lecture 7
Announcements
Prefix Trees
All Words That Share a Prefix

A prefix tree (or just "trie") indexes words by prefix

**lookup:** Follow a path from the root using a prefix, then enumerate everything below the resulting node

*Example:* "JO"

**add:** Follow a path from the root using a word, adding branches for each new letter until the end is reached

*Example:* "JANET"

(Demo)

Image: [http://www.codeproject.com/Articles/18033/Phone-Directory-Implementation-Using-TRIE](http://www.codeproject.com/Articles/18033/Phone-Directory-Implementation-Using-TRIE)
Flask
The Flask Web Framework

Translates HTTP requests (described in a future lecture) to Python function calls

Manages data exchange between a browser and a Python program

TCP Initialization Handshake

HTTP GET request of content

HTTP response with content

Follow-up requests for auxiliary content

(Demo)
Threads
**Threads**

A thread executes a function call

Multiple threads can execute different calls simultaneously

For high-latency operations such as web requests, threading can increase speed enormously

**Thread**(target=<function>, args=<args>): Create (but do not start) a thread of execution

**.start()**: Start the function call, but do not wait for it to complete

**.join()**: Wait for the function call to complete (return value is ignored)

**.run()**: Start the function call and wait for it to complete

(Demo)
Shared State and Race Conditions

When multiple threads make changes to the same object, the result can be unpredictable.

```python
def do_something():
    y = x
    do_something()
    x = y * 2
    do_something()
    x = z + 1
```
A critical section is a sequence of statements that should be executed atomically.

```python
x = 10
s = Lock()
do_something()
s.acquire()
y = x
do_something()
x = y * 2
s.release()
do_something()
s.acquire()
z = x
do_something()
x = z + 1
s.release()
```

```
x: 10
y: 10
z: 10
x: 20
y: 10
z: 20
x: 21
y: 10
z: 20
```