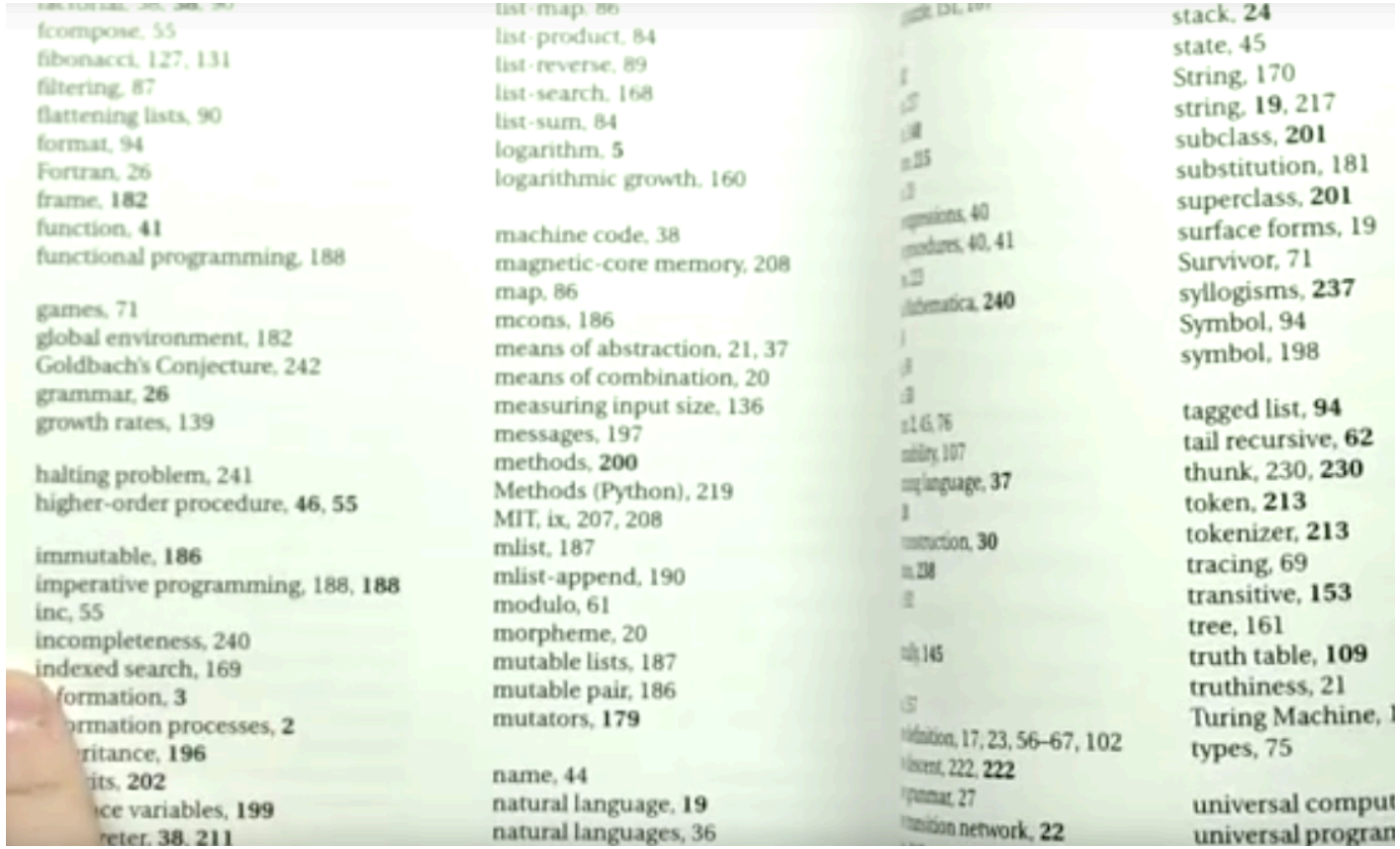
Intro to Computer Science

Local Laboratory

*** Udacity – Intro to Computer Science**

Unit 4: Responding to Queries



Quiz: Data Structures

아래 중 어떤 자료구조가 우리의 검색엔진을 위한 인덱스를 표현하기에 가장 좋은 방법일지 선택하시오.

- ❑ [<keyword_1>, <url_1_1>, <url_1_2>, <keyword_2>, ...]
- ❑ [[<keyword_1>, <url_1_1>, <url_1_2>],
  [<keyword_2>, <url_2_1>], ...
  ]
- ❑ [[<url1_1>, [<keyword_1>, <keyword_23>, ...]],
  [<url2_1>, [<keyword_2>, ...]],
  ...]
- ❑ [[<keyword_1>, [<url_1_1>, <url_1_2>]],
  [<keyword_2>, [<url_2_1>]], ...]

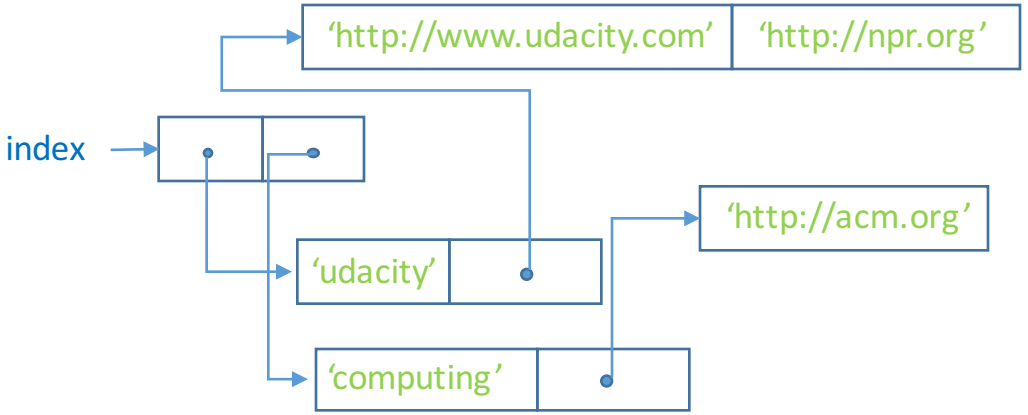
Quiz: Add to Index

아래 3개의 입력을 받는
add_to_index라는 프로시져를 정의하시오.

- an index [[<keyword>, [<url>, ...]], ...]
- a keyword string
- a url string

만약 keyword가 이미 index에 있다면, keyword와 연관된 url list에 url을 추가하시오.
만약 keyword가 index에 없다면 index에
다음과 같이 entry를 추가하시오: [keyword, [url]]

```
index = []
add_to_index(index, 'udacity', 'http://udacity.com')
add_to_index(index, 'computing', 'http://acm.org')
add_to_index('udacity', 'http://npr.org')
```



Add to Index

```
def add_to_index(index, keyword, url):
    for entry in index:
        if entry[0] == keyword:
            entry[1].append(url)
            return
    index.append([keyword, [url]])
```

Quiz: Lookup

다음 2개의 입력을 가지는
lookup 이라는 프로시져를 정의하시오.

- an index
- keyword

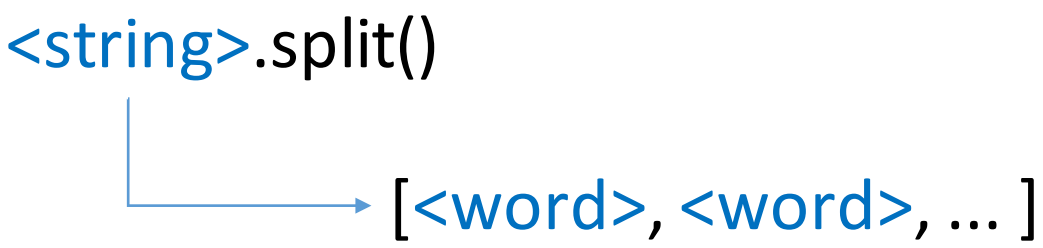
출력(리턴값)은 keyword와 연관된 url들의 list여야 한다.
만약 keyword가 index에 존재하지 않는다면, 출력값은 빈 list여야 한다.

lookup(index, ‘udacity’) -> [‘http://udacity.com’, ‘http://npr.org]

Lookup

```
def lookup (index, keyword):
    for entry in index:
        if entry[0] == keyword:
            return entry[1]
    return []
```

Building the Web Index



code

```
quote = "in Washington, it's dog eat dog. In academia, it's exactly the opposite.  --- Robert Reich"
print(quote.split())
```

result

```
['In', 'Washington,', "it's", 'dog', 'eat', 'dog.', 'In', 'academia,',
"it's", 'exactly', 'the', 'opposite.', '---', 'Robert', 'Reich']
```

Quiz: Add Page to Index

다음 3개의 입력을 받는
add_page_to_index 라는 프로시져를 정의하시오.

- index
- url (string)
- content (string)

이 프로시저는 단어와 관련 있는 url list에 url을 추가하여,
page에서 찾은 모든 단어에 대한 index를 update한다.

code

```
index = []
add_page_to_index(index, 'www.fake.com', 'This is a test')
print(index)
print(index[0])
```

result

```
[['This', ['www.fake.com']], ['is', ['www.fake.com']], ['a', ['www.fake.com']], ['test', ['www.fake.com']]]
['This',['www.fake.com']]
```

Quiz: Add Page to Index

```
def add_page_to_index(index, url, content):
    words = content.split()
    for word in words:
        add_to_index(index, word, url)
```

Beautiful Index

```
from bs4 import BeautifulSoup

def add_page_to_index(index, url, html):
    bs = BeautifulSoup(html, 'html.parser')
    content = html.get_text()
    words = content.split()
    for word in words:
        add_to_index(index, word, url)
```

Quiz: Finishing the Web Cralwer

```
def crawl_web(seed):
    tocrawl = [seed]
    crawled = []
    index = []
    while tocrawl:
        page = tocrawl.pop()
        if page not in crawled:
            html = get_page(page)
            add_page_to_index(index, page, html)
            union(tocrawl, get_all_links(html))
            crawled.append(page)
    return index
```

Dictionaries

String

'hello'

sequence of
charactors

immutable

s[i]

i th charactor in s

~~s[i] = 'x'~~

List

['alpha', 23]

list of
elements

mutable

p[i]

i th element of p

p[i] = u

replace value of
i th element with u

Dictionary

{ 'hydrogen': 1,
'helium': 2 }

set of <key, value> pairs

mutable

d[k] ← key

value associated with k in d

d[k] = v

update k -> v

Using Dictionaries

code

```
elements = {'hydrogen': 1, 'helium': 2, 'carbon': 6}
print(elements)
print(elements['hydrogen'])
print(elements[‘carbon'])
print(elements[’lithium'])
```

result

```
{'hydrogen': 1, 'helium': 2, 'carbon': 6}
1
6
KeyError: 'lithium'
```

code

```
elements['lithium'] = 3
elements['nitrogen'] = 8

print(elements['nitrogen'])
elements['nitrogen'] = 7
print(elements['nitrogen'])
```

result

```
8
7
```

Quiz: Population

세계에서 가장 큰 도시들에 대한 정보를 제공하는
population 이라는 Dictionary를 정의하시오.
key는 도시의 이름(문자열)으로 하고,
연관된 value는 백만단위(millions)의 인구수로 하시오.

Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

code

```
population = {}
population['Shanghai'] = 17.8
population['Istanbul'] = 13.3
population['Karachi'] = 13.0
population['Mumbai'] = 12.5
population['Charlottesville'] = 0.043

print(population['Shanghai'])
print(population['Charlottesville'])
```

result

```
17.8
0.043
```

A Noble Gas

code

```
elements = {}
elements['H'] = {'name': 'Hydrogen', 'number': 1, 'weight': 1.00794}
elements['He'] = {'name': 'Helium', 'number': 2, 'weight': 4.002602,
                  'noble gas': True}
print(elements['H'])
print(elements['H']['name'])
print(elements['H']['weight'])
print(elements['He']['noble gas'])
print(elements['H']['noble gas'])
```

result

```
{'name': 'Hydrogen', 'number': 1, 'weight': 1.00794}
Hydrogen
1.00794
True
KeyError: 'noble gas'
```

Quiz: Modifying the Search Engine

list index를 Dictionary index로 변경할 때,
아래 우리가 만든 검색엔진의 프로시져 중에 변경되어야 하는 함수를 고르시오.

- ❑ get_all_links
- ❑ crawl_web
- ❑ add_page_to_index
- ❑ add_to_index
- ❑ lookup

```python
def add_page_to_index(index, url, content):
    words = content.split()
    for word in words:
        add_to_index(index, word, url)
```

```python
def add_to_index(index, keyword, url):
    for entry in index:
        if entry[0] == keyword: entry[1].append(url)
            return
    # not found, add new keyword to index
    index.append([keyword, [url]])
```

```python
def get_all_links(page):
    links = []
    while True:
        url, endpos = get_next_target(page)
        if url:
            links.append(url) page = page[endpos:]
        else:
            break
    return links
```

```python
def crawl_web(seed):
    tocrawl = [seed]
    crawled = []
    index = []
    while tocrawl:
        page = tocrawl.pop()
        if page not in crawled:
            content = get_page(page)
            add_page_to_index(index, page, content)
            union(tocrawl, get_all_links(content))
            crawled.append(page)
    return index
```

```python
def lookup(index, keyword):
    for entry in index:
        if entry[0] == keyword:
            return entry[1]
    return None
```

Modifying the Search Engine

```
def crawl_web(seed):
    tocrawl = [seed]
    crawled = []
    index = []   index = {}
    while tocrawl:
        page = tocrawl.pop()
        if page not in crawled:
            content = get_page(page)
            add_page_to_index(index, page,
content)
            union(tocrawl, get_all_links(content))
            crawled.append(page)
    return index
```

```
def add_page_to_index(index, url, content):
    words = content.split()
    for word in words:
        add_to_index(index, word, url)
```

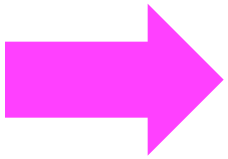
```
def add_to_index(index, keyword, url):
    for entry in index:
        if entry[0] == keyword:
            entry[1].append(url)
            return
    # not found, add new keyword to index
    index.append([keyword, [url]])
```

→

```
def add_to_index(index, keyword, url):
    if keyword in index:
        index[keyword].append(url)
    else:
        # not found, add new keyword to index
        index[keyword] = [url]
```

Quiz: Changing Lookup

```
def lookup(index, keyword):
    for entry in index:
        if entry[0] == keyword:
            return entry[1]
    return None
```



```
def lookup(index, keyword):
    if keyword in index:
        return index[keyword]
    else:
        return None
```