

# Homework #1

## CS 525/DS 595, Spring 2018

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100 points total [6% of your final grade]

**Due:** February, 1, 2018 by 11:59pm

[no submission will be accepted after February 4, 2018 at 11:59pm]

**Delivery:** Submit via Canvas

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For this assignment, you will:

(0 pts) Get started with Python

(100 pts) Implement boolean retrieval with Python

### Part 0: Getting Started with Python

As in all the homeworks this semester, you will be using Python. So let's get started first with our Python installation.

#### Python Installation and Basic Configuration

First off, you will need to install a recent version of [Python 3.6.x](#). Right now, the latest version is 3.6.4. There are lots of online resources for help in installing Python. Here are several depending on your platform:

Windows: <http://docs.python-guide.org/en/latest/starting/install3/win/>  
<https://docs.python.org/3/using/windows.html>

Linux: <https://www.digitalocean.com/community/tutorials/how-to-install-python-3-and-set-up-a-local-programming-environment-on-ubuntu-16-04>

Mac OSX: <http://docs.python-guide.org/en/latest/starting/install3/osx/>

Alternatively, there is a nice collection called Anaconda, that comes with Python plus tons of helpful packages that we may use down the line in this course:

[Anaconda](#): which has install instructions for Windows, Linux, and Mac OSX.

#### Introduction to Python (optional)

Once you feel confident that everything is setup correctly, you can try out one of these tutorials:

<http://www.learnpython.org/>  
<http://www.daimi.au.dk/~chili/CSS/pythonForJavaProgrammers.htm>  
<https://learnpythonthehardway.org/python3/>  
<https://www.codecademy.com/learn/python>

If that's not enough, you should spend some time reading the Python tutorial:

<http://docs.Python.org/tutorial/introduction.html>  
<http://docs.Python.org/tutorial/controlflow.html>  
<http://docs.Python.org/tutorial/datastructures.html>  
<http://docs.Python.org/tutorial/modules.html>

<http://docs.Python.org/tutorial/inputoutput.html>

<http://docs.Python.org/tutorial/errors.html>

<http://docs.Python.org/tutorial/classes.html>

## Installing Python Libraries (optional)

You may need to install python libraries in the future (this homework does not require additional libraries). To manage your Python installations, we recommend pip. Pip is a tool for installing and keeping track of python packages. It is a replacement for easy\_install which is included with python. It's a bit smarter than easy\_install, and gives better error messages, so you probably want to use it. You can install pip and the two packages we currently need by running these commands:

```
> easy_install pip
```

```
> pip install -r reqs.pip
```

Let's assume you need to read and write [json](#) files. So, you will need a json encoder and decoder. You'll find several possibilities online. We recommend [simplejson](#) or [cjson](#). To install one of these packages, you can use the command:

```
> pip install simplejson
```

or alternatively,

```
> pip install cjson
```

## Part 1: Boolean retrieval with Python

For this assignment, we will build a basic boolean search engine, including the tokenization, stemming, indexing, and basic boolean query components. Begin by downloading hw1.zip and decompressing it; you should find three python files and five sample document files.

a) cs525.py - This helper class will be used to represent a student's identifying information in all programming assignments. In this assignment, you don't need to modify it. But, you must instantiate a student object in hw1.py. Any assignments without an instantiated student object of type Student will not be graded.

b) PorterStemmer.py – Implementation of Porter Stemmer. Just use it for stemming. Do NOT modify it.

c) hw1.py - This is where you will fill out four functions: index\_dir(...), tokenize(...), stemming(...) and boolean\_search(...). Your overall goal is to build a basic index that can support simple boolean queries (AND, OR queries only).

- index\_dir(self, base\_path): This function should crawl through a nested directory of text files and generate an inverted index of the contents of these files. We give a simple example in the comments of hw1.py to illustrate what the resulting index should look like. This function should call tokenize and stemming as helper functions.
- tokenize(self, text): This helper function should take a raw string (either extracted from each file or input by the user as a query) and convert it to a list of valid tokens. For the purposes of this assignment, a valid token consists of only English alphabet characters (a-z, A-Z) or numbers (0-9). All other characters are considered as token delimiters. For example, the text 'http://www.cnn33.com' should result in the tokens: 'http', 'www', 'cnn33' and 'com'. The text: 'This 3rd class is cool, right?' should result in the tokens: 'this', '3rd', 'class', 'is', 'cool' and 'right'. Note that you should convert all letters to lower case.

- `stemming(self, tokens)`: This helper function should take a list of tokens returned from the `tokenize` function. Convert the list of tokens to a list of stemmed tokens. For the stemming task, you should use `Porter Stemmer`, importing `PorterStemmer.py`.
- `boolean_search(self, text)`: This function search for the terms in the string `text` in the inverted index. This function should call `tokenize` and `stemming` as helper functions to tokenize the string `text` and do stemming, respectively. In order to make search function simple, we assume "`text`" contain either single term or three terms. If "`text`" contains only single term, search the term from the inverted index and return document names containing the term. If "`text`" contains three terms including "`or`" or "`and`", do OR or AND search depending on the second term ("`or`" or "`and`") in the "`text`". For example, if the `boolean_search` is called with '`mike or sherman`', then the return value should be a list of documents that include '`mike`' OR '`sherman`'. If the `boolean_search` is called with '`mike and sherman`', then the return value should be a list of documents that include '`mike`' AND '`sherman`'.

We have provided a sample set of five documents. Feel free to test your code over these five documents. You should be able to manually check whether your code is doing what you think it should. Once you submit your final code, we will evaluate it by constructing an index over our own set of 1,000 documents and issuing several queries (single term and three terms containing either "`or`" or "`and`").

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#### **What to turn in:**

- Submit to Canvas your `hw1.py` file.
- This is an individual assignment, but you may discuss general strategies and approaches with other members of the class (refer to the syllabus for details of the homework collaboration policy). At the top of `hw1.py` you will see a list of `COLLABORATORS`. Please fill this out with the names of classmates you consulted and the nature of your discussion.