# DSEI1020 Fall 2019, Intro to Data Science, Michael Grossberg

## HW2:P4 Reviewing Data Structures

In this assignment you will be reviewing the kind of data Structures we did in class. You will be asked to implement something in a later problem so make sure you are comfortable. For now this assignment will require you to make 2 good multiple choice questions for all the sections I am assigning you. For this assignment you will need the student membership of the acm.org ($20/yr) and using that get to Oreilly Safari through the acm learning center and the free membership in Lynda.com via the New York Public Library

### Why learn this?

**Reason 1:** Choosing the right data structures are important both for data engineering and data science.

In CS/Engineering/Life we always have constraints. Time is limited, space is limited, computational cost can be an issue (particularly when you pay for it in the cloud). Choosing the right data structure can sometimes help or even sometime move somthing from impossible to easy.

**Reason 2:** Industry contacts are telling us that they are finding that many people interviewing for data scientists positions don't know data structures. Data structures questions are easy to ask and so they are assuming as technical people you can answer them:

* <https://www.geeksforgeeks.org/commonly-asked-data-structure-interview-questions-set-1>
* <https://medium.freecodecamp.org/the-top-data-structures-you-should-know-for-your-next-coding-interview-36af0831f5e3>

### Assignment Part A

Watch all of ["Programming Foundations: Data Structures" by Kathryn Hodge](https://www.lynda.com/Python-tutorials/Programming-Foundations-Data-Structures/751323-2.html) in lynda.com/linkedin Learning. If you have a CS background you can skip through but make sure you watch carefully and take notes on "Big O Notation", "Pros and Cons of Lists", "Pros and cond of stacks and queues", "Pros and cons of hash-based structures", "pros and cons of tree data structures". Submit:

1. screen shot showing you watched thought the course
2. from the material in the course describe when the pros and cons of
   * arrays
   * lists
   * stacks and queues
   * hash-based data structures (Key-Values)
   * trees
   * Write this up using markdown in a text files.

### Assignment Part B

You may find reading the article in part C useful to read before completing this part. Submit a screen shot of completion for each element

* 1. Create and account on Hacker Rank <https://www.hackerrank.com/>
  2. Complete Print the Elements of a Linked List <https://www.hackerrank.com/challenges/print-the-elements-of-a-linked-list/problem>
  3. Insert a node at a specific position in a linked list <https://www.hackerrank.com/challenges/insert-a-node-at-a-specific-position-in-a-linked-list/problem>
  4. Cycle Detection <https://www.hackerrank.com/challenges/detect-whether-a-linked-list-contains-a-cycle/problem>
  5. Equal Stacks <https://www.hackerrank.com/challenges/equal-stacks/problem>
  6. Balanced Brackets <https://www.hackerrank.com/challenges/balanced-brackets/problem>
  7. Queue using Two Stacks <https://www.hackerrank.com/challenges/queue-using-two-stacks/problem>

### Assignment Part C

Please read carefully the blog post:

Data Structures in Python: Stacks, Queues, Linked Lists, & Trees by Mosh Hamedani

<https://programmingwithmosh.com/data-structures/data-structures-in-python-stacks-queues-linked-lists-trees>

Write a python library based on the presented code. Do not copy past, nor use python list methods like pop or python link list libraries. Build your own library with methods and classes for

1. Linked List
2. Stack
3. Queue
4. Trees

Submit a link to a github.com repo with this library in it. Make the library privte but share it with me (github username mdogy). I would need to see the library being built up through multiple commits.<

Keep in mind [How to Write Beautiful Python Code With PEP 8](https://realpython.com/python-pep8/), which tells how python code should be written. Don't forget to use docstrings. The way to write good docstrings (best practices) is that [used by numpy](https://docs.scipy.org/doc/numpy/docs/howto_document.html). Some best practices for [libraries are described here](https://platanios.org/assets/pdf/teaching/writing_python_libraries.pdf).