WILLIAM JESSUP UNIVERSITY

**CSCI-361: “Data Structures and Algorithms 2”**

Instructor Prerequisites

Jim Donahue Data Structures 1

Course Description

Once you get beyond the basics of programming (assignment, procedure call, conditionals, and loops), you need to build a toolkit of algorithms, data structures, and programming techniques to become a solid programmer. That’s what the “Data Structures and Algorithms” sequence is all about -- building up that toolkit! The first semester of “Data Structures and Algorithms” covers some basic data structures (stacks, lists, queues), sorting and searching algorithms, and techniques for analyzing algorithmic performance. The second semester starts with a quick review of DS 1 and then goes into more advanced topics (trees, graphs, hashed data structures) with discussions of randomized and probabilistic algorithms.

Course Objectives/Outcomes

* Become a better programmer.
* Sharpen your analytical skills.
* Apply knowledge of data structures and algorithms using Python.

Textbooks

“Problem Solving with Algorithms and Data Structures using Python.” Brad Miller and David Ranum (MR). <http://interactivepython.org/runestone/static/pythonds/index.html>

Additional material from:

\* “Algorithms Illuminated (Parts 1 and 2)”, Tim Roughgarden. [www.algorithmsilluminated.org](http://www.algorithmsilluminated.org).

\* “Hands-On Data Structures and Algorithms with Python - Second Edition”, Basant Agarwal, Benjamin Baka (AB). <https://www.packtpub.com/application-development/hands-data-structures-and-algorithms-python-second-edition>

\* “Python High Performance -- Second Edition”, Gabriele Lanaro. <https://www.packtpub.com/application-development/python-high-performance-second-edition>

Grading

* Weekly exercises -- 100% of grade.
* No midterms, final

Course Content

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| Week week 1 | Algorithm Analysis; Stacks, Queues, Deques | MR:2,3 AB: 5 |
| Week week 2 | Lists, Tuples, and Arrays | MR: 3, AB: 4 |
| Week week 3 | Recursion; Divide and Conquer | MR: 4, AB: 3 |
| Week week 4 | Sorting (Merge Sort, Quick Sort, Randomized QS) | MR: 5, AB: 10 |
| Week week 5 | Searching (Selection, Randomized Selection) | MR: 5, AB: 11 |
| Week week 6 | Trees, Binary Trees; Traversals and Searching | MR: 6, AB: 6 |
| Week week 7 | Priority Queues and Heaps | MR: 6 , AB: 8 |
| Week week 8 | Balanced Search Trees (AVL, Splay, Red-Black) | MR: 6 |
| Week week 9 | Graphs (Definitions, Data Structures); BFS and Shortest Path | MR: 7, AB: 8 |
| Week week 10 | DFS, Topological Sorting, and Connected Components | MR: 7, AB: 8 |
| Week week 11 | Hashing and Dictionaries; Skip Lists | MR: 8, AB: 7 |
| Week week 12 | Consistent Hashing; Bloom Filters | Algorithms Illustrated |
| Week week 13 | Text Processing: Pattern-Matching | MR: 8, AB: 12 |
| Week week 14 | Text Processing: Compression |  |
| Week week 15 | Review |  |