

WILLIAM JESSUP UNIVERSITY
Computer Science Major – Course Syllabus
CSCI-561: “Data Structures and Algorithms”
(3 units)

Instructor

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- Office hours: by appointments. Meet online using ZOOM or on San Jose campus

Course Description

Provides the core principles of computer science: algorithmic thinking and computational problem solving. Techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics include divide-and-conquer, binary heap and (balanced) binary search trees, dynamic programming, incremental improvement, complexity, and tree and graph algorithms.

Course Objectives/Outcomes

Upon completion of the course, students will have learned:

- different data structures and associated algorithms
- performance of algorithms and how to analyze them
- various techniques in deciding the right algorithms for problems

Prerequisites

Basic Python programming skills and knowledge of Python data structures like lists, strings, sets, and dictionaries.

Textbook

- **(Required)** Problem Solving with Algorithms and Data Structures Using Python second edition by Bradley N. Miller, Franklin, Beedle & Associates, 22 Sep 2013, ISBN-10: 1590282574, ISBN-13: 9781590282571. (The ebook is available online at <http://interactivepython.org/runestone/static/pythonds/index.html>)
- (Reference) Algorithms Illuminated: Part 1: The Basics, by Tim Roughgarden, 2017, ISBN: 0999282908
- (Reference) Algorithms Illuminated: Part 2: Graph Algorithms and Data Structures, by Tim Roughgarden, 2018, ISBN: 0999282921
- (Reference) Data Structures and Algorithms in Python, by Michael T. Goodrich and Roberto Tamassia, 2013, ISBN: 1118290279

Supplemental Internet Resources

The Internet may be used to find additional resources. Course participants are encouraged to alert others in the class when a true gem is found. This is best accomplished through the use of the course discussion forum and *e-mail* or other *online tool*. Please take time to check regularly (at least weekly) for new posts.

Course Content

Review of asymptotic, basic data structures and algorithms. Techniques in sorting and searching

1. Python Review (Assume Anaconda/Python was already installed.)
2. Algorithmic Analysis: Big-O notations
3. Basic Data Structures: Queues, Deques, Python Lists, Linked Lists, and their Applications.
4. Recursion, Searching, sorting with incremental and divide-by-conquer methods)
5. Trees and Tree Algorithms: Binary Heap, (Balanced) Binary search tree
6. Graphs and Graph Algorithms: BFS, DFS, topological order, strongly-connected-components, shortest path trees, minimum spanning trees and algorithms (Dijkstra's and Prim's).

Grading:

30% class exercises (quizzes and short answer questions)

70% weekly programming assignments (including your postings on weekly discussion forum)

| DEFINITIONS | Percent |
|-------------------|-----------------|
| A=Distinguished | A = 90% —100% |
| B=Above Average | B = 80% — 89.9% |
| C=Average | C = 70% — 79.9% |
| D=Minimum Passing | D = 60% — 69.9% |
| F=Failing | F = 0% — 59.9% |

Late Policy

2% penalties per weekday (10% per week). No works are accepted after the last day of the class.