# CSCI 70300 - Data Structures in a high level language

**Department Of Computer Science**

**Hunter College, CUNY**

**Summer Semester 2021**

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**Office Hours: TBA And By Appointment**

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## Course Description

This course will provide aspiring and practicing teachers with a deeper knowledge of computers science. Students will study data representation in computer systems and data abstraction techniques. Topics covered include static and dynamic storage methods, lists, stacks, queues, trees, recursion and analysis of algorithms and their applications relevant in a classroom setting.

### Schedule

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- July 9 - July 30, Monday - Friday 9:00 - 11:30
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### Grading

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- 80% : Projects/programming assignments (listed by topic)
- 20% : Participation
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### By the end of this course, students will be able to:

- understand each data structure covered in this course.
- implement the covered data structures to solve a variety of real world problems.
- design appropriate algorithms, data structures, and solutions to solve a variety of problems in a variety of domains
- design learning experiences for a diverse population of learners in the domains of data structures and algorithms and applied data structures and algorithms.

**Texts**

**Primary Resources**

- https://www.javatpoint.com/data-structure-tutorial
- https://www.geeksforgeeks.org/data-structures/

**Additional Resources**

- https://visualgo.net/en
- https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Readings and references can be found by going javatpoint.com site and finding the link matching the topic name.

**Standards Summary**

| Area | Standards covered |
|------|-------------------|
| CT   | 2,3,5,6,7         |
| NSD  | 1,4               |

**Topics**

1. July 9
   - Introduction to Data Structures (ArrayList as a data structure)
   - Examination of ArrayList source code
     - http://developer.classpath.org/doc/java/util/ArrayList-source.html
2. July 12
   - Introduction to pointers in Java
     - assignment: pointer diagram exercises
3. July 13
4. Linked Lists
   - Linked list definition
   - Node definition
   - Creating a linked list
   - Assignment: Linked list implementation
   - Standards
     - CT 2,3
     - NSD 1
5. July 14
   - Comparing and contrasting Linked Lists with Array based structures
   - Exploring Java built in implementations
   - Assignment: Linked List data structure implementation continued
   - Standards
     - CT 2,3
     - NSD 1
6. July 15
   - Stacks
   - lab / assignment: stack design and implementation
7. July 16
   - Queues
   - lab / assignment: queue design and implementation

8. July 19
   - comparison of array and linked list stack/queue implementation
   - lab: alternate implementations
9. July 20
   - Review of slow sorts and searches
   - start mergesort
   - assignment: mergesort part 1
10. July 21
    - lab: mergesort completion
    - assignment: mergesort vs slow sort tests
    - Standards
      - CT 6,7
11. July 22
    - Big Oh notation - all algorithms and data structures
    - assignment: mode lab
12. July 23
    - Trees introduction
    - Building a basic tree
    - Assignment: build a tree manually
13. July 26
    - Binary Search Trees
    - design and manually building
    - lab: search
    - assignment: search part 2
14. July 27
    - binary search trees continued
    - Insertion / deletion
    - lab/assignment: implementation
15. July 28
    - Binary search tree analysis
    - More advanced trees
    - Comparison between trees and other data structures (run-time)
    - Run Time analysis (Big-Oh notation)
    - Standards
      - NSD 4
16. July 29
    - Hash tables
      - closed hashing
      - open hashing.
17. July 30
    - Heaps
18. Final project
    - To be completed one week after the last class session and weighted twice other projects.
    - Students will complete a final project that incorporates data structures and/or algorithms studied in the class.

- Examples:
  - A Markov Chain based text generator using hash tables
  - An A* search implementation using Heaps as a priority queue

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