CSCI 70300 - Data Structures in a high level language

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

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

Grading

- 80% : Projects/programming assignments (listed by topic)
- 20% : Participation

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	Stanards 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 structurs
   - Exploring Java built in implemeentations
   - Assignment: Linked List data structure implementation continued
   - Standards
     - CT 2,3
     - NSD 1
6. July 15
   - Stacks
   - lab / assignment: stack design and implementaiton
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: mergesrot 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 hasing
      - open hashing.

17. July 30
    - Heaps

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