CS 3353: Data Structures and Algorithm Analysis I

Required Course: Required
Course Number: CS 3353
Course Name: Data Structures and Algorithm Analysis I
Credit Hours: 3
Lecture Hours: 3
Lab Hours: 0
Instructors: Dr. Nohpill Park

Book Title(s): Data Structures and Algorithms in java, Sixth Edition
Book Author(s): M.T. Goodrich, R.Tamassia and M.H. Goldwasser
Book Year(s):

Course Description: Storage, structures, data and information structures, list processing, trees and tree processing, graphs and graph processing, searching, and sorting.

Course Prerequisites: CS 2133(Computer Science II) and CS 3653(Discrete Mathematics for Computer Science), each with a grade of "C" or better.

Course Goals: After taking the course, students should have a foundation for designing and analyzing different types of data structures and algorithms. This may include determining how fast an algorithm will run, and how much memory a data structure will take.

Student Outcomes:

Student Outcome	Course Outcome
1	• Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. • Understand and identify abstraction of complex problems into formal models allowing for algorithmic solutions. • Knowledge of asymptotic notions and notations, and best-, expected- and worst-case analysis of algorithms
2	• Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. • Obtain knowledge of fundamental data structures and algorithms and knowledge of adequate algorithmic strategies for solution development and implementation.

6	• Map formal specifications of problems into algorithmic solutions for implementation. • Apply computer science theory and software development fundamentals to produce computing-based solutions.

Course Topics:

Knowledge Area	**Total hours of coverage**
Algorithms and complexity (AL)	34.5
Software development fundamentals (SDF)	4.5

Body of Knowledge Coverage:

KA	**Knowledge unit**	**Topics covered**	**hours**
SDF	Fundamental data structures, fundamental programming concepts	Arrays (static, dynamic), pointers, linked lists	2
AL, SDF	Fundamental data structures, basic analysis	Growth rates, asymptotic analysis	3
AL, SDF	Algorithmic strategies, Development methods	Iterative and recursion, divide and conquer	2
AL	Fundamental data structures and algorithms, basic analysis	Stacks and queues	3
AL	Fundamental data structures and algorithms, basic analysis	Tree basics, heaps, heapsort, hash tables	6
AL	Fundamental data structures and algorithms	Brute force and greedy, binary search tree, AVL tree, Splay tree, (2,4) tree, red-black tree	6
AL	Fundamental data structures and algorithms, basic analysis	Merge-sort, quick-sort, linear time sorting, bounds and comparison, selection sort, and etc.	6

AL	Fundamental data structures and algorithms, basic analysis	Depth first/breadth first traversal, directed acyclic graph, shortest path, minimum spanning trees, and etc.	6
AL	Advanced data structures, algorithms and analysis	Greedy approach and dynamic programming, and etc.	4
AL	Advanced computational complexity	P, NP, NP-hard, NPC	1