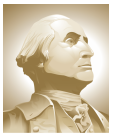
CSci 6212

Design and Analysis of Algorithms

Spring 2014 Jan 14 - Apr 30
Class: Tuesdays 6:10 – 8:40pm
Phillips Hall B156



THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Instructor: Dr. Juman Byun
E-Mail: jbyun@gwgamedev.com
This syllabus is subject to enhancement without notice.

Overview

Design and analysis of algorithms. Turing machines; NP-Complete theory. Algorithmic techniques: divide-and-conquer, greedy, dynamic programming, graph traversal, backtracking, and branch-and-bound. Applications include sorting and searching, graph algorithms, and optimization.

Goals

To be able to design and/or identify best algorithms to solve real-world issues in a predictable manner.

Evaluation

Grading

- 60% assignments/quizzes
- 20% mid-term exam
- 20% final exam

Early Planning Extra Credit (per Assignment)

- 5% extra credit for submitting a half-page assignment draft by Wednesday 11pm.

Late Assignment Submission Fee

- 10% per day

Prerequisites

CSci 1311: Discrete Structures I (3)

CSci 1112: Algorithms and Data Structures (3)

Textbooks

Introduction to Algorithms, Cormen, Leiserson, Rivest, and Stein

Recommendations

I can recommend you only if you demonstrate your ability: 1) Your spoken English skills and leadership must be demonstrated by communicating and facilitating discussions in every class in clear English. 2) In order to demonstrate your research skills and ability to write in English, you must to submit an extra research paper. Please arrange the topic with me as soon as possible if you think you want a recommendation from me.

Topics

Basic Principles of Algorithm Design and Analysis

Data Structures: Stacks, queues, linked lists, trees, binary search trees, heaps, graphs, sets, union-find

The Divide and Conquer Method: Overall technique, mergesort, quicksort, quickselect, FFT, etc.

The Greedy Method: Overall technique, the knapsack problem, optimal merge pattern, minimum spanning tree, single-source shortest paths problem, etc.

Dynamic Programming: Overall technique, matrix chain problem, all-pairs shortest path problem, optimal binary search trees, etc.

Graph Traversal Techniques: Tree traversal and applications, depth-first search, bread-first search, connectivity algorithms, biconnectivity

algorithms, etc.

Backtracking: Overall technique, generation of combinatorial objects such as graphs, sets, permutations, graph colorings, cliques, Hamiltonian cycles,

etc.

Branch and Bound method: Overall method, the job assignment problem, the 0/1 knapsack problem, the traveling salesman problem, etc.

Lower bound theory: Techniques for determining complexity lower bounds of problems, algorithm modeling, application to lower bound on sorting,

searching, and merging.

Introduction to the Theory of NP-completeness: Nondeterministic algorithms, complexity classes, NP-completeness, problem reduction, Specific

NP-complete problems.