1 Course Link

You can access this course at [I-Learn](#) (if you are registered for it).

2 Catalog Description

Introduces formal techniques to support the design and analysis of algorithms, focusing on both the underlying mathematical theory and practical considerations of efficiency. Topics include asymptotic complexity bounds, techniques of analysis, and algorithmic strategies.

3 Course Goals

Students should:

1. Become conversant with the topics and issues surrounding algorithms and complexity. Topics include (but are not limited to):
   - Basic algorithms analysis: Asymptotic analysis of upper and average complexity bounds;
   - Best, average, and worst case behaviors;
   - Big-Oh, little-Oh, Big-Omega, and Big-Theta notation;
   - Standard complexity classes;
   - Empirical measurements of performance; time and space tradeoffs in algorithms;
   - Using recurrence relations to analyze recursive algorithms;
   - Fundamental algorithmic strategies: brute-force; greedy; divide and conquer; backtracking; branch-and-bound; pattern matching and string/text algorithms;
   - Graph and tree algorithms: depth-and-breadth-first traversals; shortest-path (Dijkstra’s and Floyd’s algorithms); minimum spanning tree (Prim’s and Kruskal’s algorithms); topological sort

2. Learn the techniques (i.e., acquire the “tools”).
   - Analyze and compare algorithms using Big-Oh, Big-Omega, and Big-Theta.
   - Describe and implement in a high level language (C++) some or all of the following algorithmic techniques: Divide/Decrease/Transform and Conquer, Greedy, Dynamic Programming, Backtracking, Branch and Bound, and Brute Force.

4 Prerequisites

4.1 Courses

- CS 235 Data Structures
- CS 237 Discrete Mathematics I
4.2 Knowledge

- Object oriented C++
- Basic data structures (lists, trees, graphs, etc.)
- Summation notation ($\Sigma$)
- Recurrence relations
- Matrices
- Limits
- Proofs

5 Course Materials

**Required Text:**

*Introduction to the Design & Analysis of Algorithms*

Anany Levitin

*Second Edition, 2006, Addison-Wesley*

ISBN: 0321358287

6 Requirements

You are required to...

- attend class, as attendance and participation factor into your grade.
- read assigned portions of the course materials **before** the class meeting when they will be discussed.
- take quizzes to make sure your reading is effective.
- take tests to reinforce the concepts you have learned.
- do homework assignments to enhance your understanding of selected topics.
- do research and write a paper on an advanced algorithmics-related topic.
- take a comprehensive two-part final exam.

7 Assignments

Homework assignments come in two flavors: Exercises and Explorations.

7.1 Exercises

Exercises are homework assignments meant to help reinforce the concepts we discuss in class. These consist mostly of exercises from the book that will be due two days after we discuss their section’s material. We may go over a few of them in class. They will be graded by you and/or your peers after a grading key is made available.

There will also be exercises in the form of individual and group learning activities that will require either a small amount of preparation before class, or participation during class, or both. These will be **self-and/or-peer-graded** as well.
7.2 Explorations

Explorations are programming or project-type assignments that allow you to explore some of the topics we will investigate. They are designed to deepen your understanding of key course concepts, and entail writing papers and programs. All papers will meet college level writing standards and will be graded on such criteria as organization, quality of information, grammar and spelling, and how responsive they are to their requirements. All programming will be done in C++ and must compile and run correctly on the Linux machines in AUS 213.

7.3 Late Policy

Explorations are due by 11:59:59 PM on the day indicated in the schedule. Submissions will be accepted up to 24 hours late, with a 10% penalty. Work submitted more than 24 hours late suffers a 100% penalty, in other words, it earns zero points.

This does not apply to exercises, which have their own sliding degradation schedule.

8 Assessments

Assessments (or Examinations) come in two flavors, Quizzes and Tests.

There will be frequent take-before-class (or in-class) quizzes. These consist of multiple choice, multiple answer, true/false, fill in the blank, ordering or matching type questions, and are given either in class or else online beforehand via I-Learn (in either case they are closed book, closed notes, closed google, wikipedia, neighbor, etc.).

Five tests will be given as outlined in the schedule. These will be closed book, closed notes, (closed google, closed wikipedia, etc.) and will be proctored by the Online Testing Center.

9 Grading

- Assignments: 70%
  - Exercises: 15%
  - Explorations: 35%
  - Research: 20%
- Assessments: 30%
  - Quizzes: 10%
  - Tests: 20%

Your weighted final percentage as shown on I-Learn will determine your final grade as follows:

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