

CS 306 Syllabus and Portfolio Spring 2019

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What's It All About?

This course is about **algorithms and complexity**.

Objectives

- Become conversant with the topics and issues surrounding algorithms and complexity. These 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; decrease and conquer; backtracking;
 - 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.
- 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 (e.g., lisp) some or all of the following algorithmic techniques: Brute Force, Divide/Decrease/Transform-and-Conquer, Greedy, Dynamic Programming, Iterative Improvement and Backtracking.

Prerequisites

You must have successfully completed the following courses:

- CS 235 Data Structures
- CS 237 Discrete Mathematics I

You must have **some** working knowledge of:

- Procedural, Object-Oriented, and Functional Programming
- Basic data structures (sets, lists, maps, trees, graphs, etc.)
- Summation notation (Σ)
- Recurrence relations
- Limits
- Logarithms
- Matrices

Requirements

You are required to:

- attend class each class period (but then again, why wouldn't you?);
- read assigned portions of the course materials *before* the class meeting when they will be discussed;
- complete weekly preparation assessments; and
- do weekly homework assignments to deepen your understanding of selected topics.

Required Text

Introduction to the Design and Analysis of Algorithms

Anany Levitin

Third Edition, 2012, Pearson

ISBN: 9780132316811

Required Software

To install these tools, see the instructions here (and go to the *Tools* section).

- git
- Emacs/Spacemacs

Required Behaviors

You are required to:

- attend class, as assessments will happen in class each day that are not reproducible outside of class;
- read assigned portions of the course materials *before* class meetings when they will be discussed;
- complete all team and personal assessments to deepen your understanding of selected topics; and
- acquire and maintain a three-ring binder that will hold your portfolio of completed work (see below).

Course Periodicity

This course has a weekly period, i.e., you can count on knowing ahead of time what you will be doing each day of each week. Each class period consists of three 30-minute sections.

On Mondays these sections are:

Presentation — A time where I will add depth information to the preparation material you finished reading **before class**.

Class Directed Learning — You will participate in a class-wide activity that reinforces what you've read and what I've shown you.

Create and Explain Solutions to Exercises — During this time period, as a team of between three and five classmates you will create a solution to an exercise. On completion of your exercise you, as an individual, will explain your solution to someone not on your team until they understand your solution. Further information on this will be given in class.

On Wednesdays these sections are:

Answer Questions — I will answer questions that have been submitted to the class Slack workspace (more on which later — but for now please [click here to join](#)).

Class Directed Learning — You will participate in a class-wide activity that reinforces what you’ve read and what I’ve shown you.

Work Problems — This is in-class time for individual work on the assignment for the week. Successful students will have started working on these problems **before** this half-hour.

Questions

- The questions answered on Wednesday are generalized from those you submit via the slack channel on Tuesday Evenings.
- You must submit any and all unanswered questions on Tuesday evening. Not submitting questions leads to a reduced learning experience.
- You will have plenty of questions. Submit them! Choose knowledge over ignorance.

Work

Exercises

Exercises are smaller experiences that are designed to float uncertainties and questions you have to the surface of your mind. They are designed to be smaller so you can find out what you don’t know and then take the steps necessary to know.

Problems

Problems are weightier experiences that invite you to explore topics in algorithms and complexity, as well as increase your algorithmic problem solving prowess. All involve writing mathematically.

Late Work

Late work is accepted *only if* the reason is extraordinary, and acceptance is reached through private and prolonged negotiation. Also, you must come talk to me in person in my office — **NOT** by email, nor any other means of communication.

Assessment

About every four weeks you will meet with me in my office. The purpose of this meeting is for you to present your portfolio of work to me, make a grade-to-date claim, and provide evidence justifying that claim.

Your portfolio **MUST** be a modified version of this file. All entries must follow the example format you will find at the end of this document (when it is updated). Also, your evidences must be complete and internally consistent. You are required to produce the portfolio using Spacemacs, export it as an HTML file (see how at the top of this file), and print it.

Grades

In each of our three personal meetings, you will present your portfolio and a letter-based grade-to-date claim. Afterwards I will give you my thoughts on the strength of your claim. The last claim that you make (not an average of the three), taking into account any feedback from me, will be your final grade for the course. All of your claims must be evidence-based. That means you **MUST** bring the evidence with you, in your portfolio, that supports your claim.

Letter-Based

When making your claim, you are required to use the BYU-Idaho standard letter-based definition of grades, reproduced below:

- “A” represents outstanding understanding, application, and integration of subject material and extensive evidence of original thinking,

skillful use of concepts, and ability to analyze and solve complex problems. Demonstrates diligent application of Learning Model principles, including initiative in serving other students.

- “B” represents considerable/significant understanding, application, and incorporation of the material that would prepare a student to be successful in next level courses, graduate school, or employment. The student participates in the Learning Model as applied in the course.
- “C” represents sufficient understanding of subject matter. The student demonstrates minimal initiative to be prepared for class. Sequenced courses could be attempted, but mastering new materials might prove challenging. The student participates only marginally in the Learning Model.
- “D” represents poor performance and initiative to learn and understand and apply course materials. Retaking a course or remediation may be necessary to prepare for additional instruction in this subject matter.
- “F” represents failure in the course.

Note that the above description of an “A” implies that you have gone **above and beyond**. To claim this grade you **must** have continually (not continuously) done one or both of the first two and one or both of the last two things listed below **each week** throughout the 4-week period, and you must also record evidence of these behaviors in your portfolio:

1. teaching and/or helping others in the class but not in your group;
2. teaching a Non-CS, Non-CE, Non-EE, Non-SE major about the material in this class to help them with a class they are taking;
3. applying what you’ve learned in this class in another class you are currently taking; and
4. doing work not assigned (such as the puzzles — see above), exploring other topics in mathematics, writing code implementing what you are learning that has not been assigned, etc.

Regarding the first two, quoting Truman Madsen (quoting the Prophet Joseph Smith): Now one of the strongest and wisest statements I have ever heard on egoism. The question was put to him, “Joseph, is the principle of self-aggrandizement wrong? Should we seek our own good?” Listen to his

answer. “It is a correct principle and may be indulged upon only one rule or plan — and that is to elevate, benefit, and bless others first. If you will elevate others, the very work itself will exalt you. Upon no other plan can a man justly and permanently aggrandize himself.”

Legal

Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an education program or activity that receives federal funds, including Federal loans and grants. Title IX also covers student-to-student sexual harassment. If you encounter unlawful sexual harassment or gender based discrimination, please contact the Personnel Office at 208-496-1130.

Disability

Brigham Young University-Idaho is committed to providing a working and learning atmosphere which reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the Services for Students with Disabilities Office, 496-1158. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. Services are coordinated with the student and instructor by this office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Personnel Office at 208-496-1130.

Readings

These readings are to be completed **before** each listed week’s Monday’s class.

Week	Reading from Textbook
01	Preface, Chapter 1, Appendix A
02	Chapter 2, Appendix B
03	Chapter 3
04	Chapter 4
05	Chapter 5
06	Chapter 6 sections 1-2
07	Chapter 6 sections 3, 5-6
08	Chapter 7
09	Chapter 8
10	Chapter 9
11	Chapter 10
12	Chapter 11
13	Chapter 12

Other

This document may be modified by the instructor at any time without notification.