CSE 350-002
Algorithms & Complexity
Fall 2018

Instructor(s): Paul Doliotis

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Office Hours: Tuesday and Thursday after class and by appointment.

Teaching Assistant (GTA): Molly Shove ([mshove [AT] pdx.edu](mshove [AT] pdx.edu)), Office hours: (Monday & Wednesday 12-1pm @Fishbowl)

Section Information: CSE 350-002 with CRN: 11316

Time and Place of Class Meetings: Tuesday & Thursday 14:00-15:50 (KMC room 580)

Description of Course Content: This course describes techniques for the design and analysis of algorithms. The course utilizes case studies of existing algorithms (e.g. sorting, searching, graph algorithms, dynamic programming, matrix multiplication). NP-completeness is discussed.

Student Learning Outcomes: Upon the successful completion of this course students will be able to:

- Analyze the running time and space complexity of algorithms.
- Use the big Oh notation. (e.g., $O(n \log(n))$)
- Describe how to prove the correctness of an algorithm.
- Use the mathematical techniques required to prove the time complexity of a program/algorithm. (e.g., limits and sums of series.)
- Perform inductive proofs.
- Prove and apply the Master Theorem.
- Describe the notions of P, NP, NPC, and NP-hard.
- Compare the rates of growth of functions.
- Apply algorithmic complexity principles in the design of programs.
- Design divide and conquer and dynamic programming algorithms.

Required Textbooks and Other Course Materials: Introduction to the Design and Analysis of Algorithms, 3rd Edition, by Anany Levitin (2nd Edition is likely just fine)

Prerequisites: CS 250, 251, 202

Description of major assignments and examinations: There will be 4 homework assignments, 1 midterm exam, 1 final exam and 1 Group Project.

- **Homework Assignments:** Handwritten or printed assignments are due at the start of class. Please check the course schedule for specific deadlines for homework assignments.
- **Examinations**: There will be an in-class midterm and a final examination. <u>For all exams you are allowed to bring a note sheet. It must be hand-written on a standard size sheet of paper. You are permitted to use both sides of the page.</u> There will be no make-up exams except in a case of medical or family emergency. (The instructor reserves the right to request documentation in this case.) It is your responsibility to contact the instructor and arrange for special accommodations.
- **Group Project:** There will be a group project in which you will explore a problem domain and discuss the algorithms in use and their pros and cons. We will begin the projects after the midterm. You will work in groups of 2-4 and submit a paper detailing your results

Grading:

Item	Details	Weighting
Homework	4 Homework assignments, 5% each	20%
Midterm	Tuesday 10/23 in class	20%
Final	Tuesday 12/03 in class	25%
Group Project	Further details will be made available. Some of these points will be awarded for the project proposal.	30%
In-class work & participation	For participation in class. Also this includes small quizzes in-class. These quizzes will be connected to the reading for the week, and will develop the concepts further for the lecture. They'll be graded more on effort and understanding than on correctness.	5%

Late Policy: Late homework will not be accepted without prior approval except in the case of emergencies. If you need an extension, talk to Molly or myself in advance.

Collaboration and Outside Sources: You are encouraged to discuss homework problems with your classmates. However, everyone must write up their own solution sets. Furthermore, any collaboration must be acknowledged by writing the names of your collaborators on the front page of the assignment. Copied assignments or code, or unacknowledged collaboration will be considered academic misconduct, an ethical breach of trust, and I will deal with such cases harshly. Likewise, information or solutions from sources outside of the course materials or textbook must be cited clearly.

Make-up Exams: Make-ups for graded activities may be arranged if your absence is caused by illness or work/personal emergency. A written explanation (including supporting documentation) must be

submitted to the Instructor. If the explanation is acceptable, an alternative to the graded activity will be arranged. Make-up arrangements must be arranged prior to the scheduled due date.

University Policies: All university policies apply, the most relevant being:

- **Reasonable Accommodation/Access Policy:**
  PSU students with disabilities are provided with reasonable accommodations that give them the opportunity for equal access to educational programs, activities, and university life. Prospective students are provided with reasonable accommodations to assist them in the application process. The Disability Resource Center (DRC) works to ensure equal access to University courses, programs, facilities, services, and activities by providing students with documented disabilities, reasonable accommodations, academic adjustments, auxiliary aids and services, training, consultation, and technical assistance. Besides accommodations offered by the DRC, I am happy to work with students on any quality-of-life tweaks to course materials, etc. that might improve the course experience.

- **Academic Integrity:**
  Students are expected to obey the University Academic Integrity policy and violations will result in a zero for the work in question and a report to the Conduct Office. The policy governing academic integrity is part of the Code of Student Conduct and Responsibility. Academic integrity is a cornerstone of any meaningful education and a reflection of each student's maturity and integrity. The Code of Student Conduct and Responsibility, which applies to all students, prohibits all forms of academic misconduct, fraud, and dishonesty. These acts include, but are not limited to: plagiarism, buying and selling of course assignments and research papers, performing academic assignments (including tests and examinations) for other persons, unauthorized collaboration, disclosure and receipt of academic information, and other practices commonly understood to be academic misconduct.

Emergencies: For information about emergency preparedness, please go to the Fire and Life Safety webpage (https://www.pdx.edu/environmental-health-safety/fire-and-life-safety).

Schedule

Lecture#	Date	Topics, Activities	Readings	Assignments
1	09/25 Tuesday	Introduction / Course Overview		
2	09/27 Thursday	Algorithm analysis framework. Asymptotic Analysis	2.1, 2.2	
3	10/02 Tuesday	Asymptotic Analysis. Analyzing Iterative Algorithms	2.3	
4	10/04 Thursday	Recurrence Relations. Analyzing Recursive Algorithms	2.4	HW1 announced
5	10/09 Tuesday	Brute Force (Selection Sort, Bubble Sort)	3.1, 3.2, 3.3	
6	10/11 Thursday	Exhaustive search	3.3, 3.4	HW1 due HW2 announced
7	10/16 Tuesday	Insertion Sort, Decrease and Conquer	4.0, 4.1, 4.2, 4.3	
8	10/18 Thursday	Decrease by a constant factor and variable size decrease Midterm review	4.4, 4.5	HW2 due
9	10/23 Tuesday	**Midterm Exam**		
10	10/25 Thursday	Master theorem. Merge Sort . QuickSort	5.0, 5.1, 5.2	Project Proposals Discussion
11	10/30 Tuesday	DFS, BFS, Dijkstra's Algorithm	3.5, 9.3	
12	11/01 Thursday	Space & Time tradeoffs	7-7.2	
13	11/06 Tuesday	Space & Time tradeoffs (continued)	7.3, 7.4	Project Proposals Due
14	11/08 Thursday	Memoization and Dynamic Programming	8.1	
15	11/13 Tuesday	More Dynamic Programming	8.2	
16	11/15 Thursday	Introduction to Complexity Theory: the limitations of algorithmic power (P vs NP)	11.1-11-3	
17	11/20 Tuesday	Special Topic		
18	11/22 Thursday	No Class (Thanksgiving)		
19	11/27 Tuesday	Group Project Presentations		
20	11/29 Thursday	Review Class		Project due
21	12/03 Tuesday	**Final Exam**		