Syllabus of CMPSC 465 Spring 2022

Instructors:

- Chunhao Wang
- Mingfu Shao

Teaching Assistants:

- Manohar Bandam
- Md Hasin Abrar
- Ishan Behoora
- Bucky Park
- Aditya Sharma
- Sanchal Thakkar
- Qimin Zhang
- Tianyang Zhao

Remote Synchronous Lectures:

- Section 1: TuTh 1:35-2:50pm
- Section 2: TuTh 3:05-4:20pm

Please join the lecture meetings through Canvas / Zoom.

Textbooks:

- [DPV] Algorithms, by Dasgupta, Papadimitriou, and Vazirani, 1st edition, **[required]**
- [KT] Algorithm Design, by Kleinberg and Tardos, 1st edition, **[recommended]**
- [CLRS] Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein, **[recommended]**

Canvas: Class announcements, lecture notes, recorded lectures, assignments, and exams will be posted through Canvas.

Gradescope: Assignments and part 2 of exams need to be submitted to Gradescope and will be graded there. https://www.gradescope.com/courses/347634

Piazza: Discussions and Q&A will be via piazza: https://piazza.com/psu/spring2022/cmpsc465

Prerequisites:

- CMPSC 132 (Programming and Computation II: Data Structures)
- CMPSC 360 (Discrete Math) or MATH 311W

Tentative Schedule

Week	Date	Mon	Tue	Wed (Recitation)	Thu			Fri
1	1/11		Lec A1	Recitation canceled	Lec A2	HW1 post (A1 + A2)		
2	1/18		Lec A3		Lec A4	HW2 post (A3 + A4)	HW1 due	
3	1/25		Lec A5		Lec A6	HW3 post (A5 + A6)	HW2 due	
4	2/1		Lec A7		Lec A8 **(Quiz 1)**	HW4 post (A7 + A8)	HW3 due	
5	2/8		Lec A9		Lec A10	HW5 post (A9 + A10)	HW4 due	
6	2/15		Lec A10		Lec A12	HW6 post (A11 + A12)	HW5 due	
7	2/22		Lec A13		Lec A14	HW7 post (A13 + A14)	HW6 due	
8	3/1		Lec A15 **(Quiz 2)**		Lec B1		HW7 due	
Week 9: spring break								
10	3/15		Lec B2	**Mid-term (3/16)**	Lec B3	HW8 post (B1 + B2 + B3)		
11	3/22		Lec B4		Lec B5	HW9 post (B4 + B5)	HW8 due	
12	3/29		Lec B6		Lec B7	HW10 post (B6 + B7)	HW9 due	
13	4/5		Lec B8 **(Quiz 3)**		Lec B9	HW11 post (B8 + B9)	HW10 due	
14	4/12		Lec B10		Lec B11	HW12 post (B10 + B11)	HW11 due	
15	4/19		Lec B12		Lec B13		HW12 due	
16	4/26		Lec B14		Lec B15 **(Quiz 4)**			
Final	5/2							

Grading:

- In-class Quizzes, 10%
- Assignments, 30%
- Midterm (tentatively scheduled at 3/16, 8-10pm ET), 30%
- Final (to be scheduled), 30%

Assignments:

- Assignments will be posted every week.
- For each assignment you have 1 week to finish and submit your solutions to Gradescope. Under no circumstances will we accept homework not submitted through Gradescope.
- All your solutions must be typed (Latex is preferred: a latex template has been provided on canvas; Microsoft Word is acceptable). Handwritten homework will not be accepted with the exception of drawn figures.
- We typically grade 3 problems for each assignment. If an assignment contains more than 3 problems, we may pick and grade 3 of them, in which case the problems that will be graded will not be announced before the due time.
- Please submit in advance to leave time for any technical difficulties -- if you encounter an issue right before the deadline and Gradescope does not let you submit the homework, it will not count as an excuse.
- Homeworks submitted late but no later than two hours will receive a 20% penalty. Homeworks not submitted within two hours after the deadline will receive 0. There will be no exceptions to this policy.
- You should be as clear and concise as possible in your write-up of solutions. Intelligibility is as desirable as correctness: a simple, direct solution is worth more points than a convoluted one. This policy aims to encourage you to write precise solutions.
- For any problem you have the option of “not answering but getting 10% points”, by explicitly writing down “I don’t know how to answer this question” and nothing else. Note that a solution that is wrong or incomprehensible may get a point of as low as 0. This policy aims to encourage you to think critically about your own solution.
- Assignments will be designed to practice your algorithm design, analysis, and logical reasoning and proving skills. They will also prepare you for “part 2” of exams.
- Solutions will be posted on canvas soon after the due date.

Collaboration on Assignments:

- Students may work on the homework in groups of up to three people. Each student must write their own solutions and explicitly acknowledge (in response to the first question of each assignment) everyone whom they have worked with or who has given them any significant ideas about the homework solutions.
- You may also use books or online resources to help solve homework problems. All consulted references must be acknowledged (in response to the first question of each assignment). We would like to emphasize that you should write your homework solution strictly by yourself. You should never provide your written solutions to anyone, nor should you obtain anyone else’s. If you are ever in doubt about what constitutes improper collaboration, ask your instructors.
- It is a violation of the collaboration policy to submit a problem solution that you cannot orally explain to an instructor or TA. In such cases, the whole assignment will receive a score of 0.

Quizzes:

- Four quizzes have been scheduled.
- Quizzes will be in-class using Canvas, in the form of multiple-choice questions.
- Quizzes will be designed to help you understand the concepts, theorems, etc, introduced in the lectures. They will also help you prepare for the “part 1” of exams.

Mid-term and Final:

- Exams will be non-cumulative, i.e., mid-term covers the first half (lectures 1-15) of this course, and the final covers the 2nd half (lectures 16-30).
- Each exam will consist of two parts: Part 1 consists of a set of multiple-choice questions while part 2 consists of a set of algorithm design/analysis questions.
- For any problem in part 2 (only) you have the option of “not answering but getting 10% points”, by explicitly writing down “I don’t know how to answer this question” and nothing else. Note that a solution that is wrong or incomprehensible may get a point of as low as 0.
- You should make your handwriting as legible as you can. Handwritings that are not recognizable will be regarded as wrong answers.
- You should be as clear and concise as possible in your solutions. Understandability of your answer is as desirable as correctness. A simple, direct analysis is worth more points than a convoluted one.

Overall Class Goals: Introduce data structures, principles of algorithm design, algorithm design techniques, and algorithm analysis techniques

Topics:

Introduction

- Introduction to algorithms
- Big-O/Omega/Theta notation, asymptotic analysis

Divide-and-Conquer

- Merge sort
- Master theorem
- Matrix multiplication
- Convex hull
- Half-planes intersection

Graph Algorithms

- DFS
- DAG, topological sort
- BFS
- Dijkstra’s algorithm
- priority queue
- Bellman-Ford algorithm

Greedy Algorithms

- Knapsack

- Max weighted path
- Minimum spanning tree
- Huffman, Matroid
- Horn formula
- Set cover problem

Dynamic Programming

- Edit distance
- Optimal binary search
- All-pair shortest path

Network Flow

- Ford-Fulkerson

Linear Programming

- Linear programming and applications

NP-completeness

- Polynomial-time reduction
- Computational classes
- NP-completeness

Class Recording: Video and audio recordings of class lectures will be part of the classroom activity. The video and audio recording is used for educational use / purposes and only may be made available to all students presently enrolled in the class. For purposes where the recordings will be used in future class sessions / lectures, any type of identifying information will be adequately removed.

Attendance Policy: Students are required to attend all the lectures and recitations live. Please let the instructor and the teaching assistants know if you will be missing a class or a recitation for an unavoidable reason.

Academic Integrity Statement: Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

The CSE Department has its own statement on Academic Integrity (http://www.eecs.psu.edu/students/resources/EECS-CSE-Academic-Integrity.aspx). Academic sanctions for each violation includes a reduction in score for the submission and optionally a reduction of the final letter grade in the course.

Disability Accommodation Statement: Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources Web site provides contact information for every Penn State campus (http://equity.psu.edu/student-disability-resources/campus-contacts). For further information, please visit the Student Disability Resources Web site (http://equity.psu.edu/student-disability-resources). In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelines (http://equity.psu.edu/student-disability-resources/applying-for-services). If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.

Counseling & Psychological Services Statement: Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS) (http://studentaffairs.psu.edu/counseling/): 814-863-0395

Counseling and Psychological Services at Commonwealth Campuses (http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/)

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400 Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Education Equity Statement: Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias webpage (http://equity.psu.edu/reportbias/).