CS 667 (002), Design Techniques for Algorithms, Spring 2025

January 18, 2025

1 Basic Information

Instructor: Pan Xu, GITC 4310, pxu@njit.edu. Here is his website: https://sites.google.com/site/panxupi/. Office Hours: by appointment. Feel free to email the instructor to schedule an appointment.

Teaching Assistant (TA): An Hai Tran, at738@njit.edu. Link to his online Zoom room: https://njit-edu.zoom.us/j/2880246056?pwd=o26m2BskTSCvDpr4Flv9OE2ObRO4aj.1. Office hours: Tuesday (2 PM to 3 PM) each week.

Generally, the TA will host the office hour each week in his Zoom meeting room. **Please email the TA 24 hours before the office hour to confirm his availability**. Feel free to email the TA to schedule an online appointment outside of the TAs' office hours.

Class schedule and location: Friday, 2:30 PM to 5:20 PM. Location: Kupfrian Hall, Room 107. The class is delivered Face-to-Face.

Course Overview: The course will focus on algorithm design and analysis (not implementation). The first half of the semester will cover standard topics, including sorting algorithms, dynamic programming, and basic algorithm design paradigms such as Divide and Conquer. The second half will focus on advanced algorithm design and analysis, including topics such as approximation and randomized algorithm design and analysis for NP-hard problems like Vertex Cover and Coverage Maximization.

Prerequisite: CS 610. Students are expected to have good knowledge of discrete mathematics, probability theory, linear algebra, and calculus I and II. Also, it is assumed that students have basic programming skills.

Textbooks: No textbooks are required. Below is a list of useful online references:

- Algorithm Design and Analysis:
  https://www.cs.princeton.edu/~wayne/kleinberg-tardos/
  https://courses.cs.duke.edu/fall08/cps230/Book.pdf

- Approximation Algorithms:
  https://www.designofapproxalgs.com/book.pdf

https://cs-web.bu.edu/faculty/gacs/papers/approx-alg-notes.pdf

- Randomized Algorithms:
  http://www.cs.yale.edu/homes/aspnes/classes/469/notes.pdf
  https://courses.engr.illinois.edu/cs574/sp2022/lec/old_notes/rand_alg_sp18.pdf

2   Course Contents and Schedule

Dates	Topics
W1	Introduction, Asymptotic notations and analysis
W2	Introduction, Asymptotic notations and analysis
W3	Bubble Sort and Merge Sort
W4	Deterministic Quick Sort
W5	Randomized Quick Sort
W6	Introduction to NP-hard and Approximation Algorithms
W7	Pricing and LP-Based for Vertex Cover
W8	Midterm
W9	No Class (Spring Break)
W10	Pricing and LP-Based for Vertex Cover
W11-W12	MAX-SAT Problem
W13	No Class (Good Friday)
W14-15	COV-MAX, Greedy, LP-Based, Pipage Rounding
W16	Review for the Final Exam (**Class on Wed, May 7**)

There are several components to this course as follows:

1. Instructor lectures.

2. Individual assignments: There will be expectedly four homework assignments, involving algorithm design, analysis, and implementations.

3. Midterm and final exams.

4. Class participation.

3   Submissions and Grading of Assignments

Below are a few important notes.

Items	Grade (% of final grade)	(Post Date, Due Date)
HW1	12.5	(W2,W4)
HW2	12.5	(W5,W7)
HW3	12.5	(W10,W12)
HW4	12.5	(W14 Monday, W16 Monday)
Midterm	20	W8
Final Exam	30	TBD

- Generally, all HWs will be posted and due on the Friday of the week. By default, we assume HWs are due on the Friday, 11:59 PM (EST).

- **The midterm will take place in the classroom on Friday of Week 8 (W8), from 2:30 PM to 4:30 PM**, and the final is yet to be determined. Both midterm and final exams are open book exams, allowing the use of lecture notes. Every student is expected to take both the midterm and final exams in person. During the exams (midterm and final), any digital devices that can potentially be connected to the Internet must be powered off, including PCs, Apple watches, smartphones, and tablets. Students are encouraged to bring calculators and conventional watches for the exams. For paper exams, if any, please do not use pencils to write down your answers; otherwise, you will automatically be deprived of the right to complain about grading after the exam.

- 20% late submission penalty will be applied if submitted within 24 hours of the deadline. Beyond that, late submission is not accepted. Unless otherwise stated, all submissions are due by 11:59 PM (EST) on the designated date.

- For all HWs, students are required to upload a PDF on Canvas by the deadline. Note that only PDF files are accepted and all students are required to type their solutions. It is strongly encouraged that all students should use LaTeX editors to type their solutions, including all equations and math symbols in a proper way. A very useful online cloud-based LaTeX editor is overleaf: `https://www.overleaf.com/`, which is free to all NJIT students.

- Grading Scale: A: Top 25%; B+: Top 26-50%; B: Top 51-75%; C+/C/D/F/W: TBD.

4 Statement on Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: `http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf`.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating,

plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.