Instructor: Ichiro Suzuki, EMS 1219, 229-3718, suzuki AT uwm.edu

Office Hours: TR 12:30 PM – 1:30 PM (till 12/14/17), or by appointment.

Prerequisite: Grad St; CS317(P) and CS535(P)

(P) indicates “A course in which a student is required to earn credit prior to being allowed to enroll in a subsequent higher-level course. A prerequisite course may not be taken for credit subsequent to the earning of credit in the higher-level course.” (UWM Schedule of Classes)


Course Homepage: Login to UWM D2L.

Objectives: To study some advanced ideas in the design and analysis of algorithms, and to be able to design and analyze algorithms using these ideas.

Outline: Tentatively, the lecture will cover the following material, roughly in the order listed. Some topics may be skipped or assigned for self-study, and additional material may be introduced. Some of the mathematical tools given in Appendices A, B and C of the textbook may be needed to fully understand the course material. The students are expected to study appropriate sections of the textbook such as these, based on what is needed. (1), (2), etc., indicate an approximate number of lectures on each subject.

- Introduction to Algorithm Design and Analysis [1.1–2.3]; Growth of Functions [3.1–3.2] (brief, 2). Review this CS535 material on your own.
- Divide-and Conquer and Recurrences [4.1–4.5, 33.4, 9.3] (3). Review the CS535 material in 4.3–4.5 on your own.
- Randomized Algorithms [5.1–5.3 and notes] (3).
• NP-Completeness [34.1–34.5] (5)
• Approximation Algorithms [35.1–35.3] (2).
  — Time Permitting —
• Computational Geometry [33.1–33.3] (2).

Grading:

• Homework and possibly some quizzes 35%, Midterm Exam (Tue 10/17/17) 30%, and Final Exam (Wed 12/20/17, 3:00 – 5:00 pm) 35%.
• Approximate grading scale (subject to adjustment): A or A- for a total score of 85/100 or higher, B+, B or B- for 75 or higher, C+, C or C- for 65 or higher, D+, D or D- for 55 or higher, and F for below 55.

More on the Prerequisites: You must take and pass CS317 and CS535 before taking CS704. The following is a partial list of topics typically covered in CS317 and CS535. Our experience indicates that students not familiar with these important topics are likely to perform poorly in CS704.

1. discrete math: sets, relations, functions, summations, permutations, combinations, binomial coefficients, probability, conditional probability, expected value
2. running-time analysis of algorithms, growth of functions, asymptotic notation \( O, \Theta, \Omega \).
3. recurrence relations
4. basic data types: lists, stacks, queues, priority queues, heaps, hash tables
5. various sorting algorithms: insertion sort, selection sort, quicksort, merge sort, heap sort.
6. lower bounds for sorting
7. graphs: vertex, edge, path, cycle, dag, connected component, tree
8. several specialized tree structures: for example, binary search trees, AVL trees, B-trees, red-black trees, 2-3 trees, etc.
9. graph algorithms: traversal, connected component, spanning tree, shortest path, breadth-first search, depth-first search

Study Guidelines and Requirements: TBA

Policies: TBA