Instructor: Adrian Dumitrescu, EMS 1081, 229-4265, dumitres@uwm.edu

Office Hours: (may change) Tue & Thu 2:40–3:30pm or by appointment.

Midterm Exam: Thursday, Oct. 15, 5:30–6:45pm.

Final Exam: Tuesday, Dec. 17, 5:30–7:30pm.

Prerequisites: Graduate student; CS 704 or consent of instructor.


Objectives: To study core ideas in the design of randomized algorithms and in the probabilistic analysis of algorithms.

Outline: Tentatively lectures will cover the following topics (listed below). Most topics are from the textbook (Chapters 1-7 and 10-11). Some topics may be skipped or assigned for self-study, and additional material may be introduced.

1. Preliminaries: Events and probability [Ch. 1]
2. Discrete random variables and expectation [Ch. 2]
3. Moments and deviations [Ch. 3]
4. Chernoff bounds [Ch. 4]
5. Balls, bins, and random graphs [Ch. 5]
6. The probabilistic method [Ch. 6]
7. Derandomization of algorithms [Ch. 6]
8. Markov chains and random walks [Ch. 7]
9. Entropy, randomness, and information [Ch. 10]
10. The Monte Carlo method [Ch. 11]
11. Applications in: sorting and searching, number theory, graph theory, combinatorics, computational geometry, networks

Grading scheme: Homeworks and in class participation 15-20%, Overall behavior and discipline 5-10%, Midterm exam 30%, Final exam 45%.

The exams are open books and notes—but only limited material may be be used: the textbook and personally taken in class written notes. No electronic devices are permitted. Makeup exams will not be given.

Remarks:

1. Being disciplined and having an active class participation is part of your grade. This means being active in class without disrupting the class and having a positive learning attitude. You are expected to attend class and participate in the discussions (and so if you don’t attend class you will be missing points in these categories). Finding errors and/or inaccuracies in the lecture notes or textbook or on the board is encouraged.

2. In particular, the following rules of good behavior and discipline need to be respected: You need to show respect to the instructor and your colleagues and respectfully exchange ideas and opinions. You are expected to follow and participate in the discussion, and not be preoccupied with other activities. Occupy your seat before the start time of the class, and avoid leaving or entering during lecture time; If you need to leave class earlier, ask for permission beforehand. Do not bring food or drinks to class. If you send email to the instructor you need to address it properly: not by the first name, etc. When you are sick, avoid coming to class; if you still need to come (in an exceptional situation), you need to sit as isolated as possible in the back row and avoid contact with others in order to minimize the chance of transmitting your illness to others.

3. Electronic devices, including laptops, tablets, phones, etc., can only be used for class purpose, and when directed so by the instructor. In particular, recording the lectures or taking pictures are not
allowed; you should rather try to follow and write down the information on the board and make notes of points made during discussion.

4. Electronic devices are prohibited during exams; any such device should be turned off and put away (out of sight) in your bag. A student found in possession of an electronic device during an exam should be considered to be engaged in academic misconduct and should expect to receive a grade of zero on the exam. Before any exam you need to stow away your bag in a separate area of the exam room; you can only retrieve your bag after handing in your exam before leaving the room.

5. If you missed a class, you should try to borrow the notes for that class from another colleague. You are strongly advised to take written notes throughout the course, since not all topics may be covered in the textbook or the coverage/approach might differ from that in class. In addition, this will prepare you better for the written exams.

6. Homework assignments will be given and you will be asked to present your solutions in class. Homework is due for discussion usually one week after it was assigned. The homework will involve about 5 assignments. While you can discuss solutions to homework assignments with others, the solution must be prepared independently by you so you would be comfortable in explaining it. If you discussed any assignments with others, you need to specify their names in your solutions. Similarly, if you use other materials/sources you need to clearly specify them in your solutions. Note that the exams may use problems directly taken from homework assignments, so you are strongly advised to do the homework. It is unlikely that you will perform well in this course without a substantial effort to work on and understand the assignments.

7. You are expected to provide justifications and arguments, that is, show your work, to support your answers in all your assignments and exams, regardless if the problem explicitly asked for it or not. Unjustified or poorly justified answers will receive little or no credit. When you are asked to give an algorithm for a specific problem you first need to explain your algorithm in words and present its main ideas; if possible, you should also attempt to provide a sequential enumeration of the main steps (see also the textbook for such algorithm descriptions).

8. If you have to miss an exam or the deadline of an assignment because of an emergency, please contact the instructor at the earliest possible opportunity (use both e-mail and phone). If the instructor is not reachable, then try to contact the department secretary at 229-4677. No arrangements will be made for missed exams, unless these rules are followed and an acceptable evidence of legitimate emergency is submitted.

9. **Plagiarism** or **cheating** is taking someone else’s work and calling it your own. Plagiarism is not allowed and will be dealt with severely; it is a form of academic misconduct. In particular, copying from other sources (including the internet) without proper citation is disallowed. More information on academic misconduct is available at [http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/](http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/)

10. Your work will be graded not only on the correctness of the result, but also on the quality of presentation. An understandable handwriting is expected.

**Appendix:** For illustration the following topics are usually covered in CS 704 (with ref. to the textbook by Cormen et al.):

1. Selection (medians and other order statistics) [Ch. 9]
2. Matrix multiplication [Ch. 4]
3. Greedy algorithms [Ch. 16]
4. Randomized algorithms [Ch. 5]
5. Dynamic programming [Ch. 15]
6. Amortized analysis [Ch. 17]
7. Network flows [Ch. 26]
8. String matching [Ch. 32]
9. Geometric algorithms [Ch. 33]
10. Exponential time algorithms and NP-completeness [Ch. 34]
11. Approximation algorithms [Ch. 35]