CS 435, Data Structures Syllabus

Instructor: David Bahr (answers to Dave, David, Dr. Bahr, Mr. Bahr, yo, hey you, and others). Work Phone: 964-5147. Home phone: 303-449-9179 (before 10:00pm). dbahr@regis.edu.

Schedule: MWF, 10:30am-11:20pm.

Office Hours: Carroll Hall room 241. M 9:30-10:30am; WF, 9:30-10:30am and 2:30-3:30pm; Th 10:30-12:00am and 1:00-3:30pm. Occasional meetings will disrupt this schedule, but feel free to drop by or call at any time. I have an “open door” policy.

Summary: Writing slow and memory intensive computer programs is easy. Writing elegant and efficient programs requires practice and skills that will be developed in this course. While increasingly fast computers may tempt us to use sloppy code, today’s powerful machines are also solving phenomenally complex problems, manipulating terabytes of data, and threading thousands of simultaneous processes. The obvious (slow) solutions will rarely work on these processor-intensive and memory-hogging real-world problems. This course will help you evaluate the correct algorithms to use for practical applications.

Learning Objectives:
(1) Learn to store and access data in a computer with fast and efficient algorithms (data structures).
(2) Understand the mathematics behind algorithms so that you can evaluate the efficiency and speed of your own (and other’s) code.
(3) Strengthen your confidence in basic mathematical and logical thinking skills.
(4) Learn what algorithms are most efficient under different circumstances. An algorithm’s efficiency can change depending on the particular application, and you will learn to evaluate which tool is the correct one for the job.
(5) Get your first preview of the rich science and mathematics behind programming and computers.
(6) In particular, we will focus on
   a. Growth rates and why faster computers can’t help a bad algorithm.
   b. Lists
   c. Stacks
   d. Queues
   e. Trees
   f. Hashes
   g. Heaps
   h. Sorting (as an application of the above)
(7) Please note that you may have seen these data structures in other classes (maybe even high school), but seeing and using a data structure is entirely different from understanding the mathematics used to evaluate their efficiency. You will learn a more general approach to algorithm structures, beyond memorizing a suite of tools. It’s an exciting ride!
Requirements: Java will be used for examples. Some math is required, but nothing as complex as calculus, and you will probably come away from the course feeling more confident of your mathematical prowess. Object-oriented programming skills are most helpful. Intro programming skills are sufficient with only a little more effort.

Computer Required: Seems obvious, but you absolutely must have your own computer for this class. No exceptions. See me if this is a problem.

Exams: Mid-term exam, final exam

Homework: Weekly assignments are generally due at the beginning of class each Monday, but check the assignment for confirmation. If Monday is a holiday, then the assignments are due at the beginning of the next scheduled class. Late homework is not accepted and the grade will be a zero. But don’t panic! Your lowest homework grade will not be considered in the final grade. Note: Most assignments will be turned in by email. If your email gives me a virus (causing untold hours of pain, anguish, and despair) then your grade will be a zero. No one wants to see me in anguish (right?), so invest in a good anti-virus program and keep it up to date!

Grade: Class participation: 10%
Homework: 30%
Midterm: 30%
Final Exam: 30%

Note that class participation counts for a full letter grade.

Online Notes: I know you are begging for more, so I’ve posted my lecture notes online at http://academic.regis.edu/dbahr/. They are great for review, and even better as a class preview (just imagine how impressed everyone will be with your knowledge of the day’s topic). The online notes do have some occasional typos and outright errors (after all, these are nothing more than my “scribbled” notes). I’m going to eventually publish these notes as a CD, so I’ll grant extra credit to the first person that points out and corrects an online typo or error. The amount of credit depends on the subtlety and magnitude of the error. I’ll also credit you on the CD, making your name live forever in “print”.

Topics:
Week 1: Introduction and mathematical review.
Week 2: The beauty of mathematical algorithm analysis: O(N)
Week 3: More O(N) and running time calculations
Week 4: O(N) last gasp
Week 5: Abstract data types, lists
Week 6: More lists
Week 7: Stacks, queues
Week 8: Midterm (Monday, October 7, subject to change), Trees
Week 9: More trees
Week 10: Hashes
Week 11: Heaps
Week 12: Sorting
Week 13: More sorting
Week 14: Searching, advanced topics as time permits
Week 15: Review
Week 16: Final exam

**Special needs:** If you have a disability requiring academic adjustments for this class, please contact Disability Services (303-458-4941). They will help determine appropriate accommodations. I recommend that you make arrangements as soon as possible because accommodations cannot be provided retroactively.

**Ethics:** It hardly needs to be said, but Regis takes a very dim view of cheating. Students who cheat, plagiarize, copy, fake, bootleg, or attempt to con, defraud, swindle, bamboozle, fleece, dupe, fool, trick, or deceive will fail the course. Other synonyms are also prohibited. For clarity, copying homework is considered cheating. If you have any questions about proper conduct please come talk to me.

Consistent with the College's Academic Integrity Policy, I will report all violations to the Dean's office. Students who have committed multiple instances of academic dishonesty can be subject to institutional penalties like probation, suspension, or expulsion, in addition to the penalties for this course. The Academic Integrity policy is described in the Bulletin; detailed information about the policy and the appeals process can be found in the Dean's office.

**Dr. Bahr’s Grading Policy (in gory detail)**

My goal is to produce graduates that I would hire if I was running my own business. I also want to produce graduate students that I would accept into a PhD program. This means, of course, that I can’t pass out A’s like free candy. However, it does mean that I am invested in your progress, and I very much want all of my students to do well.

In the past, I have worked as a manager at various “.coms”. I have also worked with graduate students on complex research at the cutting edge of science. I know what is necessary to succeed in the workplace and in graduate school. Therefore, my grading is not designed to penalize but instead to prepare you with important and necessary skills. Ideally, this preparation will pay off with the best possible job after graduation and place you into the best possible graduate school.

To that end, the following might help you to understand my homework assignments and grading.
(1) My assignments typically have some problems that will reinforce what you have learned in the classroom and in any assigned reading. Each assignment will also have one or more problems designed to “push your envelope” and to see if you can stretch your newfound knowledge into a situation that was not covered explicitly in the classroom.

(2) In some classes, the assignments are “cumulative” with a build-up to the final project. Initial assignments develop skills that are used later in the semester.

(3) Students that do the assigned reading almost always get a better grade. The required reading, if any, is at the top of each assignment.

(4) I always drop your lowest homework score for the semester. In other words, you get one “freebie”. Why? Because everyone has a bad hair day. You might get the flu, you might have a family emergency, or you might just have trouble with the assignment. I remove that lowest score, no questions asked. But please, consider saving that freebie for a rainy day. Don’t blow off an assignment early in the semester, or you might not have the freebie later in the semester when you really need it. That’s a rookie mistake.

(5) I don’t accept late homework. All assignments are due at the beginning of the class hour. That includes any written, emailed, and/or oral portions of the assignment. It is not acceptable to print or email your work an hour after class. This policy is uniform and fair to all concerned.

By the way, I am MOST interested in having you learn the material, so if your assignment is late, you may still turn it in. I will grade the late work, but I won’t give you credit. Remember, if your job assignment is late, then they just fire you. In that light, my policy seems downright lenient. 😊

(6) I do not grade on a curve. In some semesters, I have had every student in my class get an A for the semester. Awesome! However, I am not afraid to pass out low grades, and I occasionally have to fail a student. I hate doing that, and if you are struggling please seek my assistance early. I have never had to fail anybody that sought help on a regular basis.

(7) I do not tolerate cheating or copying. It’s an automatic fail for the class. You may always work together on assignments, but I recommend sitting face to face so that you cannot actually copy your partner’s work. (By the way, it is a common misconception that your code will be identical to everybody else’s. Everyone has different code, even for the simplest assignments.)

(8) 10% of your final grade at the end of the semester is for “participation”. This is not an attendance score. Instead, I’m looking for interaction, interest, questions, and positive contributions inside the classroom. If you are contributing and asking questions regularly, I almost always give the full 10%.
(9) Please note that I do not give credit for “effort” on individual assignments – some folks just have to put in more time than others. That’s neither a positive nor negative assessment of your skills, so homeworks are graded strictly on merit. But any extra effort will certainly count towards the 10% participation grade!

(10) I am neither the easiest nor the toughest grader on campus, but I am reasonable and open to questions. If you are ever puzzled by your grade, you should feel free to ask. On some occasions, I will give back points if you can explain your motivation.

(11) I can be very particular about the details. This is not because I hate you, I promise. Instead, I’m trying to encourage good habits that will make you a star on the job. So I will frequently take off a small number of points for poor spelling, poor grammar, poor formatting, poor commenting, poor exception handling, etc. With atrocious grammar, would you expect to keep a job as a journalist? No. Similarly, you can’t expect to keep a job as a programmer with atrocious formatting, commenting, etc. So, after four years of careful critique, most of my students do an excellent job at “getting the details right”.

(12) Finally, I return assignments promptly. If you have not received your graded assignment after one week, that would be very odd. So come to see me and make sure that (1) my dog didn’t eat your assignment, and (2) the world hasn’t ended.

For your effort on the assignments, I promise that you will have a better understanding of the material, and that this will translate to confidence on the job. Talk to some of my graduates, and they will tell you that the homework really pays off! My students have been very successful in the workplace, and some employers call me each year to ask specifically for my graduating seniors.