

CS16: Introduction to Algorithms and Data Structures

<http://www.cs.brown.edu/courses/cs016/>

Spring 2009

Time & Place: TTh 10:30-11:50 (1 hour) in CIT 227

Instructor: John “Spike” Hughes ([jfh](#))

Head TAs: Ben Cohen ([btcohen](#)), Borislav Hristov ([bhristov](#))

Graduate TA: Aparna Das ([aparna](#)), Will Headden ([headdenw](#))

Undergraduate TAs: Ashley Tuccero ([atuccero](#)), Brian Moore ([bjmoore](#)), Christina Salvatore ([cpsalvat](#)), Gary Bressler ([gbressle](#)), Jihan Chao ([jec](#)), Laura Parkinson ([lparkins](#)), Patrick Doran ([pdoran](#)), Peter Kalmakis ([pkalmaki](#))

A Note on Notes

CS16 introduces students to algorithms and data structures that are fundamental to the development of applications. This course is more theoretical in nature than CS15 and may somewhat resemble a math course. The key to success is keeping up with the course; the best route is attending class and participating actively. Spike will be using PowerPoint slides only as supplemental material so the burden is on you to absorb. In general, you can, for any class topic, you can find dozens of pages about that topic on the web. They will be easier to understand if you *follow* the class rather than trying to slavishly write down everything that’s said.

Course Prerequisites

The prerequisite for this course is CS15. If you did not take CS15 in Fall ’08, ’07, or ’06, contact Spike to explore the possibility of a special arrangement. The following background is assumed: programming experience in Java; knowledge of basic binary arithmetic and elementary properties of polynomials, logarithms, and exponentials.

Reading Material

The following textbooks are recommended, but not required, for this course:

Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani; *Algorithms* (1st Edition). McGraw-Hill Higher Education, (2008).

Michael T. Goodrich and Roberto Tamassia, *Data Structures and Algorithms in Java* (4th Edition). John Wiley & Sons, Inc. (2006).

Many students find Goodrich and Tamassia an excellent resource while doing the projects (which were originally based on the GT approach to data structures). On the other hand, this book ends up being a very expensive reference manual; one possibility is to join with some other students and buy a single copy to share amongst several of you.

Topics

Analysis of Algorithms: time complexity, asymptotic notation, amortization, recurrence relations, total-work analysis, probabilistic algorithm analysis

Elementary Data Structures: stacks, queues, sequences, trees, positions

Searching: hash tables, binary search trees, splay trees

Sorting: insertion sort, selection sort, heap sort, merge sort, quicksort, radix sort

Text Processing: tries, data compression

Geometric Algorithms: convex hull

Graph Algorithms: depth-first search, breadth-first search, shortest path, minimum spanning tree, connected components, topological sort

Methods: Greedy algorithms, divide and conquer, simple recursion, dynamic programming

Basics: Mathematical Induction

Graded Work

- Five collaborative homeworks (20%)
- Data structure programming in Python (8%)
- Two in-class exams (30%)
- Five programming assignments
 - Stack / Introduction to Python (2%)
 - Queue / Dance Dance Revolution (10%)
 - Heap / Fish Food (10%)
 - Convex Hull (10%)
 - Graph / SimBroadband (10%)

Announcements and Questions

The CS16 Web site (<http://www.cs.brown.edu/courses/cs016>) is the main source of information about the course. Check the website's `motd` regularly, as announcements, clarifications, questions, and answers are posted often, as well as other course related information. You're responsible for knowing what's on the MOTD, reading the Google Group, and knowing what's covered in class, whether you're there or not. If you have questions about course material from lecture or assignments in progress, feel free to come to TA hours. If you have administrative questions, please email the TAs. Spike's hours are Thursday 2:30-4:00pm and by appointment (contact jfh@cs.brown.edu).

Handins

All paper handins should be placed in the wooden CS16 handin bin outside room 271 of the CIT (aka the SebLab). Please follow the handin instructions on the homework handout. All program handins should be submitted via the `cs016_handin` script.

Exams

There will be two exams in CS16: a midterm on March 12 and the final exam on May 11th. A week prior to the exam, problems which resemble those that will be on the exam will be distributed. The exam will consist of a subset of those problems.

Late Policy

As with most classes in the CS department, there is an official late policy for CS 16.

Homeworks: We do not accept late handins for homeworks. Please plan accordingly. However, your worst homework will be weighted half as much as the others.

Programs: Each program has a regular deadline which is specified on the program handout and an early handin 48 hours earlier. A handin two or more days early will receive a 4% bonus (a grade of 92% comes out a 96%). All programs handed in after the regular deadline are considered to be late. For every day late you will lose 10% of your grade (i.e. a grade of 92% two days late comes out a 72%).