

# Algorithms for Systems Engineering

## IE 172 — Spring 2009

Instructor: Pietro Belotti  
Mohler Lab 322  
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Course page: [http://coral.ie.lehigh.edu/~belotti/?page\\_id=44](http://coral.ie.lehigh.edu/~belotti/?page_id=44)  
Meeting: Monday, Wednesday, Friday, 9:10am – 10:00am, Mohler 453  
Lab: Tuesday, 1:10pm – 4:00pm, Mohler 444  
Office hours: Monday and Wednesday, 3:00pm – 5:00pm, or by appointment.  
Prerequisites: CSE 17 and ENG 1.

### Evaluation

Problem sets: 25%  
Lab: 25%  
Midterm: 20%  
Final exam: 30%

Both the midterm and the final exam will be taken in class. They will consist of a set of simple problems on the analysis of algorithms.

### Scope of the course

Countless problems in Engineering are solved with software packages of various size. At the core of any software package is a set of *data structures* and *algorithms* that are the result of an accurate analysis of the problem. This course focuses on the most important data structures and algorithms for solving problems in Engineering. You will learn to analyze a certain problem in Engineering and to choose the proper data structure and algorithm for solving it. All lab activities will be conducted in the C++ programming language.

### Course material

The textbook for this course is:

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein. Introduction to Algorithms, Second Edition (McGraw-Hill, 2003).

Each lecture of the course will focus on one or more chapter of this textbook, which you are suggested to read. Three other very interesting books, providing examples and insights, are the following:

- Donald Knuth. The Art of Computer Programming (Addison-Wesley);
- Robert Sedgewick. Algorithms in C++ (Addison-Wesley);

- David Harel, Yishai Feldman. *Algorithmics: The Spirit of Computing* (Addison-Wesley).

Needless to say, the Web is full of resources on algorithms, data structures, programming languages, and implementation tricks. You are encouraged to explore the online material and to get inspiration from it when you develop your own algorithm — after all, this is how most algorithm developers work. However, you must refer to them for inspiration only, cite all the resources you have used, and **never** copy any material without citing it properly. Failure to follow this policy will have very serious consequences on your final grade.

### Calendar (subject to change!)

Week	Block	Topic	Reading	Laboratory
1	Introduction	Intro and C++ Review	Chapters 1-2	<i>Eclipse</i>
2		Analyzing Algorithms	Chapter 3	Search
3		Recursion, recurrences	Chapter 4	Selection
4	Sorting	Heaps and Quicksort	Chapters 6-7	Stacks, Queues
5	Searching	Binary Search Trees	Chapter 12	Sorting
6		Hash Tables	Chapter 11	Binary Search Trees
7		Review		Hash Tables
8	Networks	Graph Algorithms	Chapter 22	Midterm
9		Shortest Paths	Chapter 24	Shortest paths
10		Min. Spanning Trees	Chapter 23	Graph Search
11	Numerical	String Matching	Chapter 32	Shortest Paths
12		Cryptography	Chapter 31	String Matching
13		Matrix Operations	Chapter 28	Cryptography
14		Systems of Equations	Chapter 28	Review

### Problem sets and labs

Every week, a lab session of about three hours will focus on notions learned in the previous lectures. Each student is required to solve an Engineering problem by designing and implementing proper data structures and algorithms. At the end of the lab, the resulting code must be emailed to me for evaluation. A problem set related to the lab problem has to be solved afterwards and the result must also be emailed to me, before the beginning of the next lab. **Note:** problem sets will be penalized of **50%** for each day they are late. After two days, they will not be accepted. **No exception.**

### Online resources

Announcements and messages will be posted on the course website. Lecture notes, course information, homeworks, solutions, and other material will also be posted on the course webpage, while grades will be posted on Blackboard.

## **Policy**

You are expected to come to class regularly and to be prepared for each class by reading the relevant sections of the textbook ahead of time. I will post slides in advance so that you may bring them to class if you wish. You are also expected to participate in class discussions and ask questions when you are confused.

*Plagiarism:* I encourage you to consult with your colleagues when you're working on homework. However, you will not understand the material or do well on the exams unless the work that you turn in is ultimately your own. Therefore, you must write up your answers alone, and without looking at anything you wrote down while working with your group. This means that if you solved the problem with a friend, you're going to have to go home and solve it all over again, by yourself. The work you turn in **must be** your own.

You must cite everyone with whom you worked or consulted about each problem, as well as any material (books and online resources other than the course books and lecture notes) that you used to solve the problem. Any breach of this policy will be considered an act of plagiarism, and no credit will be given for such assignments. Repeat offenses will be grounds for failure for the course.

*Extended Absences:* If you believe you will miss two or more consecutive lectures due to illness, family emergencies, etc., please contact me as early as possible so that we can develop a plan for you to make up the missed material. Under no circumstances will I give credit for missed homework or exams unless you have discussed your absence with me in advance.

See also <http://www.lehigh.edu/~inprv/academicintegrity.html>.

## **Accommodations for Students with Disabilities**

If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted. For more information, please visit the student support services website:

<http://www.lehigh.edu/~inacsup/disabilities>.

**Note:** this document is subject to change.