

Algorithms in Systems Engineering

IE170

Introduction

Dr. Ted Ralphs

Introductory Stuff

- Welcome back!
- E-mail [tkr2](#)
- Office [473 Mohler Lab](#)
- Office Hours [MW 12:00-1:00](#)
- Teaching assistant
 - Shantanu Chakraborty
- Check the syllabus for other administrative information

Course Description

- This class is about **algorithms**, especially those occurring in systems engineering applications.
- We will consider
 - how to **design** algorithms,
 - how to **implement** them,
 - how to **analyze** their behavior, and
 - how to use them to **solve problems**.

General Approach

- The course will be focused on **applications**.
- The first two weeks will lay the theoretical foundation.
- However, we will spend most of the course discussing the application of algorithms to solving specific kinds of problems.
- We will try to motivate everything we do with **examples**.
- The laboratories will provide context for the lectures.

Laboratories

- Each laboratory will focus on developing and implementing an algorithm to solve a given scenario-based problem.
- Typical lab requirements
 - Write a program implementing a particular algorithm to solve a given problem.
 - Analyze the algorithm, theoretically and empirically.
 - Report your results.
- During the laboratory itself, you will be asked to accomplish certain milestones in the development of your program.
- The final lab write-up, along with well-commented source code and answers to supplementary problems, will be due at the next lab.
- We will program in C++ using the Eclipse integrated development environment (IDE).

What do I expect you to know already?

- The basics of C++.
- Some basic mathematics.

Approximate Syllabus

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

Course Requirements

- Attendance
- Participation
- Reading
- Laboratories/Homework
- Exams
 - Mid-term
 - Final

Grading

- Your grade will reflect your learning and understanding of the course material.
- Some areas to keep in mind
 - Source code
 - * should be well-commented,
 - * should compile “out of the box,” and
 - * should run correctly.
 - Laboratory write-ups should be clear and concise.
 - Please make sure you follow the instructions.
 - Read the syllabus for more.
- Weighting
 - 50% Labs/Homework
 - 20% Mid-term
 - 20% Final
 - 10% Class Participation

Lateness

- You will get **seven total late days** over the semester.
- Each 24-hour period after the time the assignment is due counts as a late day.
- Your seven late days can be allocated in any way that you like.
- After that, there is a penalty of **10% per day late**.
- No assignment will be accepted more than seven days late.
- For group work, late days will be deducted for each person in the group.
- Please note on your assignment when it was turned in.

Group Work

- I encourage you to discuss ideas with other students and/or with the instructors orally.
- You must do the coding and the write-up yourself.
- YOU MAY NOT COPY ANY PART OF SOMEONE ELSE'S SOURCE CODE OR WRITE-UP.
- NO SHARING OF ELECTRONIC FILES!
- If you work with someone else, please acknowledge them in your write-up.

Use of External References

- The material in this course is covered extensively on the Internet.
- There is source code available for many of the algorithms we will discuss.
- **With the exception of source code**, you can use this supplementary material to enhance your understanding of course material.
- Please do not abuse this privilege.
- During the laboratories, please don't use the Internet.
- Outside of the lab, you may use external references for help.
- **YOU MUST CITE ANY EXTERNAL REFERENCES YOU USE!!**
- You may not copy other people's source code or anything else off of the Internet or from any other source.
- Above all, please be aware of and do not violate intellectual property laws.

The Textbook

- The textbook covers a lot more ground than we'll have time for in the course.
- There's also a bit more detail than we need in places.
- I will do my best to let you know what is important and what is not.
- The lectures slides will be a good guide.
- The textbook has an associated Web site

<http://www.introtoalgorithms.com>

Course Web Site

- The course Web site will be at

<http://www.lehigh.edu/~tkr2/teaching/ie170/>

- I will post lecture slides before class so you can use them to take notes.
- The slides will be in PDF format.
- All handouts for the class will also be available.
- There will also be links to other relevant sites and reference materials.
- Please read the syllabus.

Approach to Lectures

- Lectures should be as **interactive** as possible.
- You will get more out of this course if you **ask questions during lecture**.
- The pace and structure of the lectures can be adjusted.
- **I need feedback** from you to adjust appropriately.

Feedback

- If you have constructive comments on the way the class is going, please tell me!
- I will be making adjustments as we go, so I strongly encourage you to provide me feedback.
- There will be no retribution for constructive criticism.

Questions?