Acknowledgement: The course slides are adapted from the slides prepared by R. Sedgewick and K. Wayne of Princeton University.
Introduction

- Why study algorithms?
- Coursework
- Resources
- Outline
Instructor and Course Schedule

• Section I- Erkut ERDEM
  • erkut@cs.hacettepe.edu.tr

• Section II- Gonenc Ercan
  • gonenc@cs.hacettepe.edu.tr

• Section III- Engin Demir
  • engindemir@cs.hacettepe.edu.tr

• Lectures: Tuesday, 13:00-15:50 @D3-D4-D8
• Practicum (BBM204): Thursday, 09:00-10:50, 11:00-12:50, 13:00-15:50@Computer Lab.
Instructor and Course Schedule

- Teaching Assistants

- Merve Özdes merve@cs.hacettepe.edu.tr
- Selman Bozkır aucan@cs.hacettepe.edu.tr

- Thursday, 09:00-10:50, 11:00-12:50, 13:00-15:50@Computer Lab
This course concerns programming and problem solving, with applications.

The aim is to teach students how to develop algorithms in order to solve complex problems in the most efficient way.

The students are expected to develop a foundational understanding and knowledge of key concepts that underlie important algorithms in use on computers today.

Grading based on:
- 2 Midterm exams (55% = 30+25)
- Final exam 40%
- Attendance 5%
About BBM204

• The students are also expected to gain hands-on experience via a set of programming assignments supplied in the complementary BBM 204 Software Practicum.

• Grading for BBM204 will be based on:
  - a set of quizzes (20%),
    - 2 Short programming assignments (published before lab, submitted online)
    - Practical Exam
  - 4 programming assignments (done individually) (80%).
Why study algorithms?

Their impact is broad and far-reaching.

**Internet.** Web search, packet routing, distributed file sharing, ...

**Biology.** Human genome project, protein folding, ...

**Computers.** Circuit layout, file system, compilers, ...

**Computer graphics.** Movies, video games, virtual reality, ...

**Security.** Cell phones, e-commerce, voting machines, ...

**Multimedia.** MP3, JPG, DivX, HDTV, face recognition, ...

**Social networks.** Recommendations, news feeds, advertisements, ...

**Physics.** N-body simulation, particle collision simulation, ...

⋮
Old roots, new opportunities.

- Study of algorithms dates at least to Euclid.
- Formalized by Church and Turing in 1930s.
- Some important algorithms were discovered by undergraduates in a course like this!
Why study algorithms?

To solve problems that could not otherwise be addressed.

Ex. Network connectivity.
Why study algorithms?

For intellectual stimulation.

“For me, great algorithms are the poetry of computation. Just like verse, they can be terse, allusive, dense, and even mysterious. But once unlocked, they cast a brilliant new light on some aspect of computing.” — Francis Sullivan

“It has often been said that a person does not really understand something until he teaches it to someone else. Actually a person does not really understand something until he can teach it to a computer, i.e. express it as an algorithm. The attempt to formalise things as algorithms lead to a much deeper understanding than if we simply try to comprehend things in the traditional way. Algorithm must be seen to be believed.” — Donald Knuth
**Why study algorithms?**

To become a proficient programmer.

“I will, in fact, claim that the difference between a bad programmer and a good one is whether he considers his code or his data structures more important. Bad programmers worry about the code. Good programmers worry about data structures and their relationships.”

— Linus Torvalds (creator of Linux)

“Algorithms + Data Structures = Programs.”

— Niklaus Wirth
Why study algorithms?

They may unlock the secrets of life and of the universe.

Computational models are replacing mathematical models in scientific inquiry.

\[
E = mc^2 \quad \quad F = ma \quad \quad F = \frac{Gm_1m_2}{r^2}
\]
\[
\left[-\frac{\hbar^2}{2m}\nabla^2 + V(r)\right] \Psi(r) = E \Psi(r)
\]

20\textsuperscript{th} century science
(formula based)

21\textsuperscript{st} century science
(algorithm based)

“Algorithms: a common language for nature, human, and computer.” — Avi Wigderson
Why study algorithms?

For fun and profit.

Logos of various tech companies.
Why study algorithms?

- Their impact is broad and far-reaching.
- Old roots, new opportunities.
- To solve problems that could not otherwise be addressed.
- For intellectual stimulation.
- To become a proficient programmer.
- They may unlock the secrets of life and of the universe.
- For fun and profit.

Why study anything else?
Communication

• The course webpage will be updated regularly throughout the semester with lecture notes, programming assignments and important deadlines.

• http://web.cs.hacettepe.edu.tr/~bbm202

• Piazza for discussions and questions:
  https://piazza.com/hacettepe.edu.tr/spring2020/bbm202
  https://piazza.com/hacettepe.edu.tr/spring2020/bbm204
Getting help

- **Office Hours**
- **BBM204 Software Practicum**
  - Course related recitations, practice with algorithms, etc.
- **Communication**
  - Announcements and course related discussions
  - through [piazza](https://piazza.com/hacettepe.edu.tr/spring2020/bbm204)
Coursework and grading

**Class participation/Attendance  5%**

- Contribute to Piazza discussions.
- Attend and participate in lecture.

**Midterm exams  55% (30+25)**

- Two closed-book exams
  - Scheduled for weeks 6 and 10 (probably after lectures (16:00 ))

**Final exam.  40%**

- Closed-book
- Scheduled by Registrar.
Attendance Policy

• **Attendance to lectures is mandatory.**

• A student who do not attend the lectures more than 4 weeks will fail BBM202 directly with an F1 grade.

• A student will fail BBM204 directly with an F1 grade if he/she;
  • misses more than one recitation sessions
  • misses more than one quiz exams (out of 2)
  • does not submit more than two assignments
Programming assignments (PAs)

- Four assignments throughout the semester.
- Each assignment has a well-defined goal such as solving a specific problem.
- You must work alone on all assignments stated unless otherwise.
- Unless stated otherwise 2 weeks to work on each assignment

Important Dates

- Programming Assignment 1  10 March
- Programming Assignment 2  31 March
- Programming Assignment 3  21 April
- Programming Assignment 4  12 May
Cheating

What is cheating?
- Sharing code: by copying, retyping, looking at, or supplying a file
- Coaching: helping your friend to write a programming assignment, line by line
- Copying code from previous course or from elsewhere on WWW

What is NOT cheating?
- Explaining how to use systems or tools
- Helping others with high-level design issues

Penalty for cheating:
- A violation of academic integrity, disciplinary action

Detection of cheating:
- We do check
- Our tools for doing this are much better than most cheaters think!
Resources (textbook)


Booksite.
- Brief summary of content.
- Download code from book.

https://algs4.cs.princeton.edu/home/
Course outline

Introduction

Analysis of Algorithms
- Computational Complexity

Sorting
- Elementary Sorting Algorithms,
- Mergesort,
- Quicksort,
- Priority Queues and HeapSort

Searching
- Sequential Search
- Binary Search Trees
- Balanced Trees
- Hashing,
- Search Applications
Course outline

Graphs
- Undirected Graphs,
- Directed Graphs,
- Minimum Spanning Trees,
- Shortest Path

Strings
- String Sorts, Tries,
- Substring Search,
- Regular Expressions,
- Data Compression