Algorithm definitions

“An algorithm is a finite, definite, effective procedure, with some input and some output.”
— Donald Knuth

“An algorithm is a finite, definite, effective procedure, with some input and some output.”
— webster.com

Algorithm etymology

**Etymology.** [Knuth, TAOC]

- **Algorism** = process of doing arithmetic using Arabic numerals.

- **A misperception:** *algiros* [painful] + *arithmos* [number].

- True origin: Abu ’Abd Allah Muhammad ibn Musa al-Khwarizm was a famous 9th century Persian textbook author who wrote *Kitāb al-jabr wa’l-muqābala*, which evolved into today’s high school algebra text.

COS 226 vs. COS 423

**COS 226.** Implementation and consumption of classic algorithms.

- Stacks and queues.
- Sorting.
- Searching.
- Graph algorithms.
- String processing.

Emphasizes critical thinking, problem-solving, and code.

```
private static void sort(double[] a, int lo, int hi) {
    if (hi <= lo) return;
    int lt = lo, gt = hi;
    int i = lo;
    while (i <= gt)
    {
        if (a[i] < a[lo]) exch(a, lt++, i++);
        else if (a[i] > a[lo]) exch(a, i, gt--);
        else i++;
    }
    sort(a, lo, lt - 1);
    sort(a, gt + 1, hi);
}
```
COS 226 vs. COS 423

COS 423. Design and analysis of algorithms.
- Greedy.
- Divide-and-conquer.
- Dynamic programming.
- Network flow.
- Randomized algorithms.
- Intractability.
- Coping with intractability.
- Data structures.

Why study algorithms?

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

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

Computers. Circuit layout, databases, caching, networking, 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, ...

Emphasizes critical thinking, problem-solving, and rigorous analysis.

We emphasize algorithms and techniques that are useful in practice.

Administrative stuff

Lectures. [Kevin Wayne]
- Monday and Wednesday 11–12:20pm in Friend 005.
- Attendance is required.
- No electronic devices except to aid in learning.

Precept. [Dan Larkin and Sachin Ravi]
- Thursday 4:30–5:20pm or Friday 2–3pm in a room TBA.
- Preceptor works out problems.
- Attendance is recommended.

Course website

Course Information | Problem Sets | Lecture Slides | Precepts

COURSE INFORMATION
Description. The course is designed to provide students with an understanding of the principles and techniques used in the design and analysis of efficient data structures and algorithms. We shall discuss and analyze a variety of data structures and algorithms chosen for their importance and their illustration of fundamental concepts. We shall emphasize analyzing the worst-case running time of an algorithm as a function of input size. We shall also spend some time exploring the boundary between feasible (polynomial time) and infeasible (compulsory) computations. The will include discussion of the notorious P=NP question.

Prerequisites. COS 226 and COS 340, or permission of instructor. The course requires some knowledge of elementary data structures and the understanding of the notion of a mathematical proof. Any proof-based main course such as MAT 205 is usually a sufficient substitute for COS 340.

www.cs.princeton.edu/courses/archive/spring13/cos423

Prerequisites. COS 226 and COS 340, or instructor's permission.

Kevin Dan Sachin

see me after class

viewing lecture slides taking notes

precept begins this week
Textbook


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Grades

**Problem sets.**
- "Weekly" problem sets, due via electronic submission.
- Graded for correctness, clarity, conciseness, rigor, and efficiency.
- Use \LaTeX\ template for writing solutions.

**Course grades.**
- Primarily based on problem sets.
- Staff discretion used to adjust borderline cases.
- Undergrads: determined without considering grad students.
- Grads: determined using undergrad scale.

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Collaboration

**Collaboration policy.** [see syllabus for full details; ask if unsure]
- Course materials (textbook, slides, handouts) are always permitted.
- No external resources, e.g., can’t Google for solutions.

"Collaboration permitted" problem sets.
- You may discuss ideas with classmates.
- You must write up solutions on your own, in your own words.

"No collaboration" problem sets.
- You may discuss ideas with course staff.

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Where to get help?

**Textbook.** Read the textbook—it’s good!

**Piazza.** Online discussion forum.
- Low latency, low bandwidth.
- Mark as private any solution-revealing questions.

**Office hours.**
- High bandwidth, high latency.
- See web for schedule.
Questions?