

CS 478/564 COMPUTATIONAL GEOMETRY (Spring 2024-2025)

Instructor: Uğur GÜDÜKBAY

Office Hours: Tuesday 13:30-15:30 (EA-403)

Course Schedule: Wednesday 08:30-09:20 (Spare Hour), 09:30-10:20,
Friday 13:30-14:20, 14:30-15:20 (EB-103)

Course Assistant: Sinan Sonlu

Course Homepage: http://www.cs.bilkent.edu.tr/~gudukbay/cs478_564/index.html.

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Office Number: EA-403, **Tel:** 1486

Please visit the course homepage frequently to see the announcements about the course and assignments.

SYLLABUS

1. Introduction

- Algorithmic Background
- Data Structures
- Geometric Preliminaries
- Models of Computation

2. Geometric Searching

- Introduction
- Point-Location Problems
- Range-Searching Problems

3. Convex Hulls

- Preliminaries
- Problem Statement and Lower Bounds
- Convex Hull Algorithms in the Plane
- Graham's Scan
- Jarvis's March
- Quick Hull techniques
- Dynamic Convex Hull
- Convex Hull in 3D

4. Proximity Problem

- A Collection of Problems
- A Computational Prototype: Element Uniqueness
- Lower Bounds
- The Closest-Pair Problem: A Divide-and-Conquer Approach
- The Voronoi Diagram
- Proximity Problems Solved by the Voronoi Diagram

5. Triangulation

- Planar Triangulations
 - Greedy Triangulations
 - Partitioning a Polygon into Monotone Pieces
 - Triangulating a Monotone Polygon
- Delaunay Triangulation

6. Intersections

- Application Areas
- Planar Applications: Intersection of Convex Polygons, Star-shaped Polygons; Intersection of Line Segments.
- 3D Applications: Intersection of 3D Convex Polyhedra; Intersection of Half-spaces

TEXTBOOK INFO

Main Textbooks:

1. Computational Geometry: An Introduction, F. P. Preparata and M.I. Shamos, Springer-Verlag, 1985. [Download].
2. Computational Geometry: Algorithms and Applications, M. de Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, Springer-Verlag, Revised Second Edition, 2000. [Download].

References:

- Computational Geometry in C, J. O'Rourke, Second Edition, Cambridge University Press, 1998. [Download].
- Computational Geometry and Computer Graphics in C++, M. J. Laszlo, Prentice-Hall, 1996.

GRADING: (Tentative)

- Midterm 20 %,
- Final 30 %,
- Assignments 20 %,
- Project 25 %,
- Attendance 5 %,