

AMS545/CSE555: Computational Geometry, Spring 2018

Instructor: Joe Mitchell, Math Tower P-139A, 632-8366, joseph.mitchell@stonybrook.edu
Office hours (tentative): Mon (2:00-3:30), Wed (2:30-4:00), or by appointment, or drop by whenever (don't be shy!)

Course Web Site and Blackboard: <http://www.ams.sunysb.edu/~jsbm/courses/545/ams545.html>;
Refer to Blackboard, where handouts, solutions and slides will be posted, and videos of lectures available through EchoCenter.

Piazza discussion board:

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to me or the TA, I encourage you to post your questions on Piazza.

Find our class page at: <https://piazza.com/stonybrook/spring2018/ams545cse555/home>

Lectures: Tuesday and Thursday, 10:00-11:20 in Melville Library 4540.

Teaching Assistant: TBA

Text: The main text is *Computational Geometry: Algorithms and Applications (3rd Edition)*, by de Berg, Cheong, van Kreveld, and Overmars. Also recommended is the excellent book, *Computational Geometry in C*, Second Edition, by Joe O'Rourke, and *Discrete and Computational Geometry*, by Devadoss and O'Rourke. We will also refer to excellent notes by David Mount, linked from the course webpage (<https://www.cs.umd.edu/class/spring2012/cmsc754/Lects/cmsc754-lects.pdf>).

Prerequisites: I will assume some knowledge of basic design and analysis of algorithms and data structures (e.g., efficient sorting algorithms); some of this material is reviewed in the first chapter of O'Rourke's book. You should have the ability to do mathematical reasoning at the level of an undergraduate course on analysis.

There will be an *optional* project (see below) that generally involves implementation and experimentation and is encouraged for those who want a "hands-on" experience in computational geometry.

Exams: There will be 5 short in-class quizzes (20 minutes) on dates to be announced, based directly on the homework problems; the lowest of the 5 scores will be dropped before computing the quiz average. There will be a final exam in the university-assigned time slot (Period 2: 11:15-1:45pm, Friday, May 11).

Homeworks: Homework problems will be posted regularly; problems may be posted on Blackboard, and some may also be posed during class meetings. Some problems will be for practice and need not be turned in, but you are expected to do them and to understand them; others will be assigned for submission via Blackboard. For homework problems for submission, you are expected to write up your solutions *on your own*, **without referring to other students' writeups or to solutions you may find on the web**; you are welcome to discuss problems with me, the TA, and classmates, but **must do the writeup entirely on your own**. Peer assessment (via Blackboard) may be used to assess some of the homework problem submissions.

Optional Project: There will be a variety of optional projects for students to do. Each will involve an implementation (e.g., in C, C++, Java, Python) of a geometric algorithm from a suggested list of possible projects (or one of your choosing, with my permission), and a presentation/demo. **Due dates:** Report and presentations/demos in class on Tuesday, May 1 (tentative).

Grades: For students who do not complete an optional project, the total average score will be the weighted average: 10% homework, 40% quizzes, 50% final.

For students who do successfully complete an optional project, the total average score will be the weighted average: 10% homework, 60% max(quizzes, final), 30% min(quizzes, final). Additionally, the most highly rated projects will result in bonus points of 1%, 2% or 3% being added to the total average score of the student(s) completing the best projects.

I will use your total average score to assign a letter grade; there is no pre-established scale or curve. Historical averages for letter grades in the course are that 40-50% receive A/A-, and 40-50% receive B+/B/B- letter grades (with a few outliers having lower grades).

Tentative Course Topics:

- Introduction: What is computational geometry?
- Convex hulls of point sets in the plane
- Computing/detecting intersections among a set of line segments
- Polygons, triangulation, visibility
- Linear programming in low dimensions
- Range searching: Find the points in a query box
- Point location search: Find a query point in a subdivision
- Voronoi diagrams and Delaunay triangulations
- Arrangements of lines, hyperplanes
- Geometric duality, polarity
- Visibility graphs, shortest paths, motion planning
- Binary space partitions
- Randomized algorithms
- Geometric optimization, approximation algorithms
- Clustering, data summarization, machine learning

Disability Support Services (DSS) Statement: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>

Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management Statement: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.