CS 758 Computational Geometry

UNIVERSITY OF NEVADA LAS VEGAS
Department of Computer Science
Semester/Term:
Time:
Class Location: Remote Learning (Zoom Enabled)
Office Location:
Office Hours:
Phone:
Email:

Note: The instructor reserves the right to change the syllabus as it relates to how the course is administered.

Course Description

Elementary geometric methods: points, lines and polygons. Line segments intersection. Simple closed path, inclusion in a polygon, inclusion in a convex polygon, range search, point location in planar subdivision and duality.
Convex hull: Graham's scan, Jarvin's march, divide and conquer approach, on-line algorithms, approximate algorithms, convex hull of simple polygons, lower bound proofs and diameter of a point set.
Proximity: Closest pair, triangulation, divide and conquer approach for closest pair, Voronoi diagram and their properties, dual of Voronoi diagram, construction of Voronoi diagram, Euclidean minimum spanning tree, gaps and covers.
Intersections: convex polygons, polygons, star polygons, line segments, half planes and plane sweep paradigm.
Mesh generation algorithms: Delaunay triangulation, quad-trees, and Quadrangulations.
Visibility and path planning: visibility properties of polygons, visibility graphs, applications of computational geometry in robotics, shortest s-t path inside a simple polygon, shortest s-t path amidst polygons, introduction to path planning in 3-d, decomposition of polygons.

Text Books:

1. Computational Geometry: Algorithms and Applications by Marc van Kreveld, Mark Overmars, and Mark de Berg, Third Edition, Springer
2. Computational Geometry in C (Second Edition) by Joseph O'Rourke

Course Prerequisite(s):

CS 677/ CS 477 or consent of the Instructor

Course Rationale

This course gives advanced methods for understanding algorithms and data structures having geometric flavor. Students will learn new paradigm of algorithm development that include plane sweep paradigm and geometric reasoning.

Program Competencies

In-depth familiarity with areas of theoretical computer science.

Course Competencies

Elementary geometric objects
Visibility and Art Gallery Problems
Triangulation of points and 2-d shapes
Convex hull algorithms
Intersection algorithms
Voronoi Diagram and Delaunay Triangulations
Doubly connected edge list data structures
Geometric algorithms on planar straight line graph
Plane sweep methods
Path planning and robotics applications

Learning Outcomes (SLO) / Course Objectives

SLO 1: Exhibit a breadth of knowledge in the areas of algorithms, programming languages and compilers, theory, operating systems, and computer architecture.

SLO 2: Exhibit a depth of knowledge in at least one specialized area of computer science.

Topics relating to SLO 1 and 2: Problems having geometric flavor. Triangulation, visibility problems, convex hull, Voronoi diagram with applications, Fortuneôs algorithm, algorithmic motion planning, geometric algorithms for obstacle avoidance, paths with clearance from obstacles, robot motion planning.

Evaluation Methods

1. Assignments
   Written homework assignments. (20%).
2. Examinations
   Midterm (not cumulative,

Grading Scale

A	> 89
A-	85 ï 89
B+	81 ï 84
B	73 ï 80
B-	70 ï 72
C+	67 ï 69
C	63 ï 67
C-	60 ï 62
D	50 ï 59
D	64 ï 66
D-	60 ï 63
F	< 50

University Policies

Public Health Directives

Face coverings are currently mandatory for all faculty and students in the classroom. Students must follow all active UNLV public health directives while enrolled in this class. UNLV public health directives are found at Health Requirements for Returning to Campus, https://www.unlv.edu/coronavirus/health-requirements. Students who do not comply with these directives may be asked to leave the classroom. Refusal to follow the guidelines may result in further disciplinary action according to the UNLV Student Conduct Code, https://www.unlv.edu/sites/default/files/page_files/27/StudentConduct-Code.pdf, including being administratively withdrawn from the course.

Academic Misconduct

Academic integrity is a legitimate concern for every member of the University community. We all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy, and are encouraged to always take the ethical path whenever faced with choices. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLVôs educational mission. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another person, from the Internet or any other source without proper citation of the source(s). See the Student Conduct Code, https://www.unlv.edu/studentconduct/student-conduct.

Auditing a Course

Auditing a course allows a student to continue attending the lectures and/or laboratories and discussion sessions associated with the course, but the student will not earn a grade for any component of the course. Students who audit a course receive the same educational experience

Final Examinations

The University requires that final exams given at the end of a course occur on the date and at the time specified in the Final Exam schedule. The Final Exam schedule is typically available at the start of the semester, and the classroom locations are available approximately one month before

after they have been admitted to the University. Sending emails within WebCampus-Canvas is also acceptable.

Tutoring and Coaching