Knight Foundation School of Computing and Information Sciences

Course Title: Introduction to Computational Geometry **Date:** 02/17/2014

Course Number: COT 4521

Number of Credits: 3

Subject Area: Computer Science and Computing Technologies	**Subject Area Coordinator:** Hadi Amini **email:** amini@cs.fiu.edu
Catalog Description: Study of efficient algorithms to solve geometric problems. Topics covered include convex hulls, Voronoi diagrams, Delaunay triangulations, arrangements, search and intersection, and motion planning.	
Textbook: Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars. *Computational Geometry: Algorithms and Applications*. Springer, 3rd edition, 2008.	
References: 1. *Discrete and Computational Geometry*. Satyan L. Devadoss and Joseph O'Rourke. Princeton University Press, 2011. 2. *Computational Geometry: An Introduction*. Franco P. Preparata, Michael I. Shamos. Springer, 1985. 3. *https://www.cgal.org/*. CGAL - Computational Geometry Algorithms Library. **Other Related Material:** Lecture notes; Related journal articles and conference papers.	
Prerequisites Courses: COP 3530	
Corequisites Courses: N/A	

Type: Elective for CS (Foundations group)

Prerequisites Topics:

- Data structure, Algebra.
- Basic programming skills.

Objectives:

Students will get knowledge of geometric data structures and state-of-the-art computational solutions to different geometric problems, and learn their applications in wide range of disciplines.

Major Topics:

Knight Foundation School of Computing and Information Sciences
COT 4521
Introduction to Computational Geometry

- Introduction to Computational Geometry
- Geometric Data Structures
- Line Segment Intersection
- Linear Programming
- Range Searching
- Point Location
- Voronoi Diagrams
- Arrangement and Duality
- Delaunay Triangulations
- Convex Hulls
- Robot Motion Planning

Learning Outcomes:

1. Be familiar with the basic geometric concepts;
2. Master the geometric data structures;
3. Be familiar with the optimization tool: linear programming;
4. Master the fundamental algorithms for line segment intersection, range searching, and point location.
5. Be familiar with the fundamental algorithms for Voronoi diagrams, Delaunay triangulations, and arrangement.
6. Be familiar with the algorithms for convex hulls;
7. Be familiar with the motion planning methods;
8. Be familiar with the usage of computational geometric techniques in real-world applications.

Knight Foundation School of Computing and Information Sciences
COT 4521
Introduction to Computational Geometry

Course Outline

Major Topics	Number of Lecture Hours	Outcome
Introduction to Computational Geometry	2	**1, 8**
Geometric Data Structures	2	**2, 8**
Linear Programming	2	**3, 8**
Line Segment Intersection	2	**4, 8**
Range Searching	2	**4, 8**
Point Location	2	**4, 8**
Voronoi Diagrams	2	**5, 8**
Arrangement and Duality	2	**5, 8**
Delaunay Triangulations	2	**5, 8**
Convex Hulls	2	**6, 8**
Robot Motion Planning	2	**7, 8**

Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
• 5 two-week period assignments (problem sets) to evaluate the students' learning. • 1 term project on learning Computational Geometry Algorithms Library (CGAL, https://www.cgal.org/) by carrying out 3 small and coherent projects.	
1, 2	2 week: Assignment 1
3, 4	2 week: Assignment 2
5, 8	2 week: Assignment 3; 1 week: Term Project.
6, 8	2 week: Assignment 4; 1 week: Term Project.
7, 8	2 week: Assignment 5; 1 week: Term Project.

Oral and Written Communication:

- Number of written reports: **1** for the term project.
- Approximate number of pages for term project report: **10** (including figures, tables, references).
- Number of assignments: **5** (each is due in two weeks from the day of assignment).
- Number of required oral presentations: **1** for the term project.
- Approximate time for each presentation: **20 minutes** for each group (each has at most 4 students).

Grading Policy:

- Assignments: 50%
- Term Project Presentation: 20%
- Term Project Report and Program: 25%
- Participation: 5%

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: https://abet.cs.fiu.edu/csassessment/