| Program | Level | First cycle |
|---|---|---|
| | Name of the program | Theoretical Computer Science, Mathematics and Informatics Education |

| COURSE | | | | |
|---|---|---|---|---|
| Course title | **Introduction to Computational Geometry** | | | |
| Course code | Semester | Course status | ECTS | Contact hours (L+AE+LE) |
| CS380 | VI | Mandatory course/Elective course | 4 | 2+0+2 |
| Lecturer | | | | |
| Course Goals | This course focuses on solving application-driven, data-centric problems with geometric input and output. The course aims to introduce students to basic geometric algorithms and their applications to solve various interesting practical problems. | | | |
| Learning Outcomes | By the end of the course, the students should master the basic algorithmic techniques of computational geometry. | | | |

**COURSE CONTENT**

- The problems and significance of geometric algorithms. The areas of application of computational geometry, such as computer graphics, CAD-CAM, robotics, computer vision, GIS, etc.
- The analysis of algorithms and data structures. The implementation of elementary geometric objects: dot, line, triangle, polygon. Algorithms for drawing segments and circles.
- Data structures for manipulating geometric objects. Elementary geometric algorithms: finding of a simple polygon, convex hull, fast algorithms for finding a convex hull (Incremental, Graham scan, Gift wrapping, Divide-and-Conquer).
- The closest pairs of points, the intersection of rectangular segments, one-dimensional and two-dimensional search range, and randomization in geometric algorithms.
- Triangulation of the polygon: the line segments and their intersections, the need for triangulation, the simple algorithms for triangulation, a division of polygons into monotone parts, the triangulation of a monotone polygon, and the problem of an art gallery.
- Problems of closeness and Voronoi diagrams: the definition of the Voronoi diagram, a recursive algorithm for calculating the Voronoi diagram.
- Delaunay triangulation: a quadratic algorithm for the triangulation of a plane set of points.

**LITERATURE**


[1] Joseph O'Rourke, Computational Geometry in C, (1997), Cambridge University Press.
[2] Miodrag Živković, Algoritmi, (2000), Matematički fakultet.
[3] Adis Alihodžić, Kompjuterska geometrija I, (2015), Interna skripta, PMF.
[4] Franco P. Preparata, Michael lan Shamos, Computational geometry, An Introducion, (1985), Springer Verlag.
[5] Mark de Berg, Marc van Kreveld, Mark Overmars, Otfried Schwarzkopf, Computational Geometry, Algorithms and Applications, 3rd edition, (2008), Springer Verlag.


**STUDENT WORKLOAD (hours in a semester)**

| Lectures | 30 | Exercises | 30 | Individual work | 40 | T o t a l | 100 |
|---|---|---|---|---|---|---|---|

| GRADING | | | REMARKS |
|---|---|---|---|
| Criterion | Maximum points | Minimum points | |
| Midterm exams | 30 | 17 | |
| Assignments | 5 | 3 | |
| Projects | 25 | 13 | |
| Final exam | 40 | 22 | |
| T o t a l | 100 | 55 | |