TOPOLOGICAL APPROACH TO GAME THEORY

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We present a laboratory developed in the mathematics activities during the lessons of the research project “Mathematical High School” at the University of Salerno.
In Italian higher education, the topic of "Game Theory" is not included in the ministerial indications of the mathematics curriculum. Students do not have the prerequisites that enable them to understand and solve multi-variable optimisation problems. In order to avoid the impossibility of solving problems of this type using analytical methods, we have chosen to approach them from a geometric point of view. Simple geometry concepts are required, such as the definitions and properties of Euclidean geometry and formulas and solution processes of plane analytic geometry.
Location problems concern the location of resources in a given space. Competitive Localisation models also incorporate the fact that some structure is already present in the market and that the new structure will compete for market share.
studied them for the first time in 1929.
Let us consider a continuous location optimisation problem, where an optimal location is in a continuum on a plane. We introduce the Voronoi diagram to solve the location problem, where the number of players is exogenously determined. We use Delaunay triangulation to find the equilibrium point and consider some generalizations of the ordinary Voronoi diagram. The solution of the problem in the planar case with Euclidean distances and a variety of functions of attraction leads to a finite polynomial algorithm in the number of consumers.
Using dynamic geometry software we construct our case study on the Cartesian plane Cartesian plane, we–check how the results change as the starting conditions vary and we obtain the solutions without even performing the simple calculations required by the Cartesian geometry to find the equilibrium point.

Planned structure:

Insert the planned structure of the workshop in the table below. You can insert rows if needed.

Planned timeline	Planned activity	Working format /Responsible person
10 min	*State of art*	Group activities – **G. Bimonte**
10 min	*Dynamic mathematics software*	Group activities – **F.S. Tortoriello**
10 min	Topological approach to Game Theory	Group activities – **I. Veronesi**
15 min	*Laboratory of positional games*	Group activities – **G. Bimonte, F.S. Tortoriello, I. Veronesi**

45 min	Laboratory on the topological *approach, solutions and discussions*	Group activities – **G. Bimonte, F.S. Tortoriello, I. Veronesi**

Venue requirement:

Indicate the requirement of the venue capacity and facilities here. *It can be written in English or Chinese*.

References

A. Okabe, A. Suzuki, (1997) Locational optimization problems solved through Voronoi diagrams. *European Journal of Operational Research*, 98(3), 445–456.
L. Mallozzi, E. D'Amato, P. M. Pardalos, Spatial Interaction Models, Springer International PU, 2017.
F. Plastria, (2001) Static competitive facility location: an overview of optimisation approaches. *European Journal of Operational Research*, 129(3), 461–470.
F. Plastria, E. Carrizosa, (2004) Optimal location and design of a competitive facility, *Mathematical programming*, 100(2), 247–265.
J. Fernández, B. Pelegri, F. Plastria, B. TÃşth, (2007) Solving a Huff-like competitive location and design model for profit maximization in the plane. *European Journal of Operational Research*, 179(3), 1274–1287