Editorial

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Special Issue: 40th Linz Seminar on Fuzzy Set Theory. Copulas – Theory and Applications

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Since their inception in 1979 the Linz Seminars on Fuzzy Set Theory have emphasized the development of mathematical aspects in the context of fuzzy sets by bringing together researchers in fuzzy sets and established mathematicians whose work outside the fuzzy setting can provide direction for further research. As of 1996 the Linz seminars have been focusing on special topics like, e.g., *Non-classical measures and integrals* (LINZ 2013), *Fuzzy sets, probability and statistics – gaps and bridges* (LINZ 2007). Twenty years after the first plenary talk on copulas, delivered by Roger Nelsen on the occasion of LINZ 2003, ***Copulas – Theory and Applications*** became the topic and focus of the 40th Linz Seminar in 2023 (see the LINZ Seminar Archive on https://www.flll.jku.at/linz2023/ for further details). The goal of the seminar was to present and discuss recent advances of copulas and applied fields as well as their relationship to other aggregation functions such as quasi-copulas, semicopulas, distribution functions, but also triangular norms and uninorms. The participants could enjoy plenary talks by Irène Gijbels, Fang Han, Alfred Müller, and Andrea Zemánková, as well as about 20 contributed presentations throughout the seminar.

This special issue finally collects four peer-reviewed contributions relating to topics discussed at the seminar. In their contribution *Geometry of generators of triangular norms and copulas*, Kamila Houšková and Mirko Navara discuss aspects of additive generators of strict triangular norms which, in case they are convex, also serve as generators for (bivariate) Archimedean copulas. The contribution of Jonathan Ansari and Marcus Rockel addresses *Dependence properties of bivariate copula families* and provides on overview and illustration of dependence properties of many different bivariate copula families including extreme-value copulas. For Chatterjee's rank correlation (being consistent with the Schur order for conditional distributions) they provide some new closed-form formulas in terms of the parameter of the underlying copula family. Irène Gijbels and Margot Matterne focus in their article *Median and quantile conditional copulas* on the conditional dependence between random variables (conditionally on a covariate vector), study mean and quantile

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copulas, and provide nonparametric estimators for the latter. They also illustrate their findings by applying the developed methodology to two different public data sets. In the fourth article *On comprehensive families of copulas involving the three basic copulas and transformations thereof*, Susanne Saminger-Platz, Anna Kolesárová, Adam Šeliga, Radko Mesiar, and Erich Peter Klement also focus on the dependence behavior resp. the development of dependence parameters for comprehensive copula families allowing to cover the full range from counter-monotonicity, independence to comonotonicity.

We express our gratitude to all authors for contributing to this special issue. We also thank all colleagues involved in the reviewing process – their comments, remarks, and suggestions have helped to improve the original submissions.

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[1] “Geometry of generators of triangular norms and copulas” by Kamila Houšková and Mirko Navara. https://doi.org/10.1515/demo-2024-0004.
[2] “Dependence properties of bivariate copula families” by Jonathan Ansari and Marcus Rockel. https://doi.org/10.1515/demo-2024-0002.
[3] “Median and quantile conditional copulas” by Irène Gijbels and Margot Matterne. https://doi.org/10.1515/demo-2024-0008.
[4] “On comprehensive families of copulas involving the three basic copulas and transformations thereof” by Susanne Saminger-Platz, Anna Kolesárová, Adam Šeliga, Radko Mesiar and Erich Peter Klement. https://doi.org/10.1515/demo-2024-0007.