Time to extinction in branching processes and its application in population dynamics and epidemiological modeling

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Abstract

This work is intended to be a detailed survey of the impact of the theoretical studies of the extinction time of a branching process (BP) for different modeling purposes, in both fields: population dynamics and epidemiology. The results related to population dynamics are obtained consecutively in terms of the Bienaymé–Galton–Watson (BGWBP) [1], Bellman–Harris BP and Sevasty'anov's BP and characteristics like: the total waiting time until the "successful population experiment appears", the total progeny of the process, both conditioned on extinction, are also considered.

The second part of the work is devoted to the epidemiological modeling. The new ideas of incorporating the additional knowledge of the extinction time behavior in the models give birth of developing two different strategies based on the mean and quantiles of the distribution of the extinction time (see [2]). The models are verified at first on simulated data, then on the data about spreading of avian influenza in Vietnam in 2006. The ongoing research is connected to the more general setting, i.e. Crump-Mode-Jagers BP and applications to mumps data of Bulgaria for the period 2000–2008.

References

[1] Bruss, F.T., Slavtchova-Bojkova, M. (1999). *On waiting times to populate an environment and a question of statistical inference.* J. Appl. Probab., 36, 261-267.

[2] González M., Martínez R., Slavtchova-Bojkova M. (2010) *Stochastic monotonicity and continuity properties of the extinction time of Bellman-Harris branching processes: an application to epidemic modelling.* Jour. Appl. Prob., 47, 58-71.