

# Models of population evolution

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**Summary.** We shall study three classes of stochastic processes that can be interpreted as theoretical models for the random evolution of populations

- the birth-and-death Markov chains, in the case of finite and infinite countable state space
- the Galton-Watson process, which was first considered by Galton and Watson while seeking a quantitative explanation for the phenomenon of the disappearance of family name, even in a growing population
- the so-called “Branching Markov chains”, which combine Markov chains and Galton-Watson process.

We will first study basic properties of Markov chains (definition, classification of states, irreducibility classes, spectral radius and the properties of recurrence/transience ...)

We will also try to develop further simulations with computers for these models in order to show explicitly their evolution with time.

## References.

WOESS WOLFGANG *Denumerable Markov Chains*, EMS Textbooks in Mathematics 2009.

HARRIS TH. *The theory of branching processes*, Die Grundlehren der Mathematischen Wissenschaften, Bd. 119 Springer-Verlag, Berlin ; Prentice-Hall, Inc., Englewood Cliffs, N.J. 1963 ,

WIKIPEDIA [http://en.wikipedia.org/wiki/Galton-Watson\\_process](http://en.wikipedia.org/wiki/Galton-Watson_process)

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