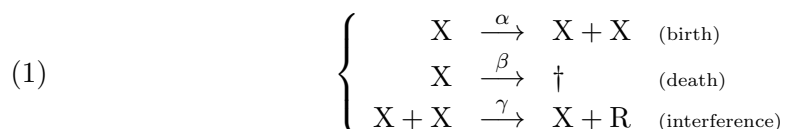


STOCHASTIC POPULATION MODELS

EXERCISE 13

13.

Consider the following individual-level processes:



where X is an active individual and R an individual that has been expelled (=removed) from the population.

- (a) Formulate a population model as a stochastic birth-death process assuming that birth, death and interference are independent Poisson processes.
- (b) What is the probability of a successful invasion if the population is introduced into a new and hitherto unoccupied territory?
- (c) Calculate numerically the quasi-stationary probability distribution of the population size and give the expected time till extinction if we take the quasi-stationary distribution as the initial state of the population.
- (d) What population model do we get if we let system size go to infinity?
- (e) Give the Fokker-Planck approximation for a semi-large system together with the corresponding SDE. Approximate the quasi-stationary distribution by a Gaussian distribution and give the auto-covariance and spectral density of the corresponding stationary process.