The ancestral problems in multitype Galton-Watson branching processes

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Abstract

When a population grows old, it is always interesting to know what happened to it in the past. Here, two kinds of ancestral problems will be discussed: the coalescence problem and the type problem. First, we pick some individuals at random from the current generation by simple random sampling without replacement and trace their lines of descent backward in time till they meet for the first time. We call the common ancestor of these chosen individuals at the coalescent time their most recent common ancestor. The coalescence problem is to investigate the limit behaviors of some characteristics of this most recent common ancestor such as the generation number and the type in a population with various types of individuals. Moreover, if an individual is randomly chosen from the current generation and the types of all the ancestors along its line of decent are recorded backwards in time, we show that this sequence of types converges in distribution to a Markov chain which has the stationary distribution.