ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ

ΤΜΗΜΑ ΜΑΘΗΜΑΤΙΚΩΝ

Εβδομαδιαίο Σεμινάριο

Mathematical Models for Species Extinction

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Modern biology provides many occasions for the development and application of interesting mathematics. In the study of extinction in its ecological and evolutionary context, mathematics is crucial because mathematical models help us to understand the process of extinction and may be used to forecast extinction. Extinctions are difficult to observe in the field, so theory (including mathematical theory) has an especially important role to play. In fact, much of the theory of stochastic processes had its origins in the study of small populations of a single species vulnerable to extinction. The classical techniques of birth-death processes remain a cornerstone for studies in mathematical ecology. However, these methods must be extended in various ways. For example, in conservation biology, we need to know the long-term viability of small populations of important organisms. Often we are interested in trends upwards or downwards rather than in extinction probability. This is a difficult problem since we must deal realistically with environmental variability, which is a complex multi-scale process. A related issue is multiple species extinction, caused by the shrinking of natural habitats. Here, we need to know rates of loss of biodiversity. This has been an active research area since 2001 with the publication of Hubbell's neutral theory of biodiversity, which showed unexpected predictive powers. This theory can been used to forecast the number of species lost through habitat loss and the time taken for the payment of extinction debt. In this talk I will focus on these various mathematical approaches motivated by the study of extinction and point out some of the important outstanding problems.

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