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Extinction Times for Birth-Death Processes: Continuum Asymptotics and the failure of the Fokker-Planck Approximation[1] CHARLES R. DOERING[2], KHACHIK V. SARGSYAN[3], LEONARD M. SANDER[4], University of Michigan — We consider extinction times for a class of birth-death processes commonly found in applications where there is a control parameter defining a threshold. Below the threshold, the population quickly becomes extinct; above, it persists for a long time. We give an exact expression for the mean time to extinction in the discrete case and derive its asymptotic expansion for large values of the population scale. We present results below the threshold, at the threshold, and above the threshold, observing that the Fokker-Planck approximation is valid only quite near the threshold. We compare the asymptotic results to exact numerical evaluations for the Susceptible-Infected-Susceptible (SIS) epidemic model. This is an interesting example of the delicate relationship between discrete and continuum treatments of the same problem.

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