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Mean-field theory of four species in cyclic competition[1] C.H. DURNEY, S.O. CASE, M. PLEIMLING, R.K.P. ZIA, Virginia Tech — We consider a simple model of cyclic competition of M species: When a pair of individuals from species k and $k+1$ interact, the latter transforms into the former. Even with no spatial structure, such systems often display interesting and counterintuitive behavior. With possible applications in both biological systems (e.g., Min proteins, E. Coli, lizards) and game theory (e.g., rock-paper-scissors), the $M = 3$ case has attracted considerable recent attention. We study a $M = 4$ system (with no spatial structure) and find major differences, e.g., (1) the presence of macroscopically many absorbing states, (2) coexistence of species, and (3) violation of the "law" of survival of the weakest - a central theme in the $M = 3$ case. Like the game of Bridge, the system typically ends with "partner pairs." After describing the full stochastic model and its master equation, we present the mean-field approximation. Several exact, analytic predictions will be shown. Their limitations and implications for the stochastic system will also be discussed.

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