ASYMPTOTIC BEHAVIOR FOR A LONG-RANGE DOMANY-KINZEL MODEL

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Abstract: We consider a long-range Domany-Kinzel model. In this model, for every site (i, j) in a two-dimensional lattice there is a directed bond present from site (i, j) to $(i+1, j)$ with probability one. There are also $m+1$ directed bonds present from (i, j) to $(i-k, j+1)$, $k = -1, 0, ..., m-1$ with respective probabilities p_{k+1} where m is any positive integer. Given any $m > 0$, Let $\tau_m(M, N)$ be the probability that there is at least one connected-directed path of occupied edges from $(0, 0)$ to (M, N). In this talk I present that for each aspect ratio $\alpha = M/N$, there is an $\alpha_{m,c} = \frac{\sum_{k=1}^{m} q_k q_{k+1}^2 \cdots q_m^{m-k+1} - (m-1)}{1 - q_0 q_1 \cdots q_m}$ such that as $N \to \infty$, $\tau(M, N)$ is 1, 0 and 1/2 for $\alpha > \alpha_c$, $\alpha < \alpha_c$ and $\alpha = \alpha_c$, respectively. I also present the rate of convergence of $\tau_m(M, N)$ and the asymptotic behavior of $\tau_m(M_N^-, N)$ and $\tau_m(M_N^+, N)$ where $M_N^-/N \uparrow \alpha_c$ and $M_N^+/N \downarrow \alpha_c$ as $N \uparrow \infty$. In particular, let $m \to \infty$ and $p_n = p/(n+a)^s$ for some a, $p > 0$ and $n \geq 0$. Let $\tau(M, N) = \lim_{m\to\infty} \tau_m(N, M)$. I also discuss the rate of convergence of $\tau(M, N)$ and the asymptotic behavior of $\tau(M_N^-, N)$ and $\tau(M_N^+, N)$ depending on $s > 0$ where $M_N^-/N \uparrow \alpha_c$ and $M_N^+/N \downarrow \alpha_c$ as $N \uparrow \infty$. This is a joint work with Shu-Chiuan Chang.