Spatial Epidemics: Critical Behavior

Abstract. At each vertex of the integer lattice in $d$ dimensions is located a colony of $N$ individuals, each of whom is initially susceptible to infection by a contagious disease. Once infected, an individual remains contagious for one time period, after which he/she recovers and is thereafter immune to further infection. While contagious, an individual may infect susceptible individuals in neighboring colonies, according to the following rules:
(A) In the “symmetric” model, an infected individual at vertex $x$ will infect a susceptible individual in any of the $2d$ neighboring colonies with probability $1/(2dN)$.
(B) In the “totally asymmetric” model, an infected individual at vertex $x$ will infect a susceptible individual in any of the $d$ neighboring colonies “up or to the right” with probability $1/(dN)$.

The probabilities are chosen so that the epidemic is “critical”: the mean number of new infections caused by a contagious individual is 1.

Problem: If initially only individuals at the origin (or in some neighborhood of the origin) are infected, how far will the epidemic extend in space?