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Maxim J. Goldberg* (mgoldber@ramapo.edu), School of Theoretical and Applied Science, Ramapo College of NJ, 505 Ramapo Valley Rd., Mahwah, NJ 07430, and **Seonja Kim** (seonja777@hotmail.com), The Gildart Haase School of CS and Eng., Fairleigh Dickinson University, Mail Code T-BE2-01, Teaneck, NJ 07666. *Using the pmf of the time to reach a subset of states in an irreducible finite Markov chain for clustering.* Preliminary report.

We derive an explicit and easily computable formula for the probability mass function (pmf) of the random variable which counts the number of steps needed to reach a specified subset of the set of states in an irreducible finite Markov chain, from another specified subset (with a given initial probability distribution). As a consequence, we can compute the characteristic function of this random variable and then explicitly find all of its moments. Using the pmf allows us to define the separation at level α between two subsets to be the number of steps necessary to reach the second subset from the first with probability at least α (in general, the separation is not symmetric). This notion of separation is more flexible than using the mean first passage time, which usually suffers from a large variance, and seems to have been only applied to measure the separation between two individual states. We explore the possibility of using separation at level α to define natural neighborhoods of points and sets. (Received September 25, 2006)