Lemma 1. *If a Markov chain with transition matrix P is irreducible and aperiodic, then there exists $M > 0$ such that $(P^M)_{ij} > 0$ for all i and j.*

Theorem 2. *Every irreducible and aperiodic markov chain has a stationary distribution.*

Theorem 3. *For an irreducible and aperiodic markov chain with initial distribution $\boldsymbol{u}_0$,*

$$\lim \boldsymbol{u}_n \to \pi$$

as $n \to \infty$ where π is a stationary distribution of the Markov chain.

Theorem 4. *An irreducible aperiodic Markov chain has a unique stationary distribution.*