If MC is irreducible with finite state space, then there exists a unique vector π satisfying

$$\pi P = \pi$$

$$\sum_{i \in S} \pi_i = 1 \qquad (S \text{ is state space})$$

which is called the stationary distn. of the chain. π describes the long run proportion of time spent in each state:

$$\lim_{n \to \infty} \frac{1}{n} \sum_{t=1}^{n} I_{\{X_t = i\}} = \pi_i \qquad \text{(with prob 1)}$$

If the MC is also aperiodic, then π also gives the limiting probability of being in each state:

$$\lim_{n \to \infty} P(X_n = i) = \pi_i$$

regardless of the initial distn (or starting state).