

Transient

State is transient if upon entering the process may never return

i.e. not accessible from some other state

Recurrent

The process definitely will return

Absorbing

The process never will leave this state

i.e. $P_{ii} = 1$ & $P_{ij} = 0 \quad \forall i \neq j$

Irreducible

A Markov chain is irreducible if it is possible to get to any state from any state

Periodic

The period of state i is the integer k ($k > 0$), s.t. $P_{ii}^{(n)} = 0$ for all values of n other than $k, 2k, 3k, \dots$

i.e. any return to state i must occur in multiples of k timesteps

Aperiodic

The process can be in state i at times s or/and $s+1$, say $k=1$

Can return at irregular times