2. _Mean recurrence time_ : If k=j, then $\{f_{jj}^{(n)}, n = 1, 2, ...\}$ will represent the distribution of the recurrence time of (j).

Then $F_{jj} = 1$ will imply that the return to state (j) is certain and when $F_{jj} < 1$ return to state (j) is uncertain.

The mean recurrent time for the state(j) is:

$$M_{jj} = \sum_{n=1}^{\infty} n f_{jj}^{(n)}$$

1. Recurrent and Transient states

The state (j) is said to be recurrent if $F_{jj}=1$ (return to state j is certain)

The state (j) is said to be transient if $F_{jj}<1$ (return to state j is uncertain)

2. Positive and null recurrent

A recurrent state is said to be positive recurrent if the mean recurrent is finite ($M_{jj}<\infty$).

A recurrent state is said to be null recurrent if the mean is infinite($M_{jj}=\infty$).

3.Periodic and a Periodic states

A state(j) is said to be periodic with period t(t>1) if return to state (j) is possible only at (t,2t,3t,4t,….) when t is greatest integer with this property .

The state(j) is said to be Aperiodic or (non-periodic) if no such t (t>1)exist, for example (t=1).

4.Ergodic

A recurrent positive and Aperiodic state of M.C. is said to be ergodic.

And if all state in a M.C. is ergodic then the chain is an ergodic chain.