Markov Chain

ref:

- https://builtin.com/machine-learning/markov-chain
- https://youtu.be/i3AkTO9HLXo
- https://www.youtube.com/watch?v=VNHeFp6zXKU

> 💡 **Definition**
>
> A Markov chain is a stochastic model that uses mathematics to predict the probability of a sequence of events occurring based on the most recent event.
>
> ex) The way Google predicts the next word in your sentence based on your previous entry within Gmail.

> 💡 **Goal**
> identify **the probability of transitioning** from one state to another.

Characteristics

- ***memorylessness***: previous states of the process would not influence the probabilities. The predictions associated with a Markov process are conditional on its current state and are independent of past and future states.

$$P(X_{n+1} = x | X_n = x_n)$$

Kinds

- Reducible == Not Recurrent
- Irreducible == Recurrent
- **time-homogenous discrete-time Markov Chains:** transition probability between states **is fixed and does NOT vary with time**
- **time-inhomogeneous Markov Chains:** the transition probability between states **is not fixed and varies with time**

The transition matrix P

- Nx N: the probability distribution of the state's transitions.
- $\sum row = 1$ (← a stochastic matrix)
- Directed graph

Initial state vector S

- Nx 1: the probability distribution of starting at each of the N possible states. (the probability of beginning at that state)