





Markov Chain Monte Carlo

Monte Carlo: randomized algorithm where the output is allowed to be incorrect

Use cases:

sampling from complicated distributions

- counting combinatorial objects
- Bayesian inference
- statistical physics
- volume estimation, integration

Bottlenecks



Markov Chain Monte Carlo

Key idea: Design a Markov chain so that its stationary follows the distribution that you want to sample from. Run the chain, wait for it to mix.

```
Runtime depends on... t_{mix}(\varepsilon)
```

How To Measure Conductance?

Measuring conductance = looking at all subsets of states with $vol(A) \le 2$. How many subsets, potentially?

Alternative: Get **lower bound** on $\Phi(M)$ using **second largest eigenvalue** of transition matrix.

$$\Phi(M) \geq \frac{1-\lambda_2}{2}$$

Eigenvalues are much faster to compute!