Scalable Variational Inference

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Things changed when Bayes met Deep Learning

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- Understand why and how combine Deep Learning and Bayesian methods

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- Learn how to synthesize images with VAE

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- Understand why and how combine Deep Learning and Bayesian methods

- Learn how to synthesize images with VAE

- Learn state-of-the-art Bayesian neural networks and their applications

Unbiased estimates

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$$\mathbb{E}_{p(x)}\, f(x)$$

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$$\mathbb{E}_{p(x)} f(x) \approx \frac{1}{M} \sum_{s=1}^{M} f(x_s)$$

$$x_s \sim p(x)$$

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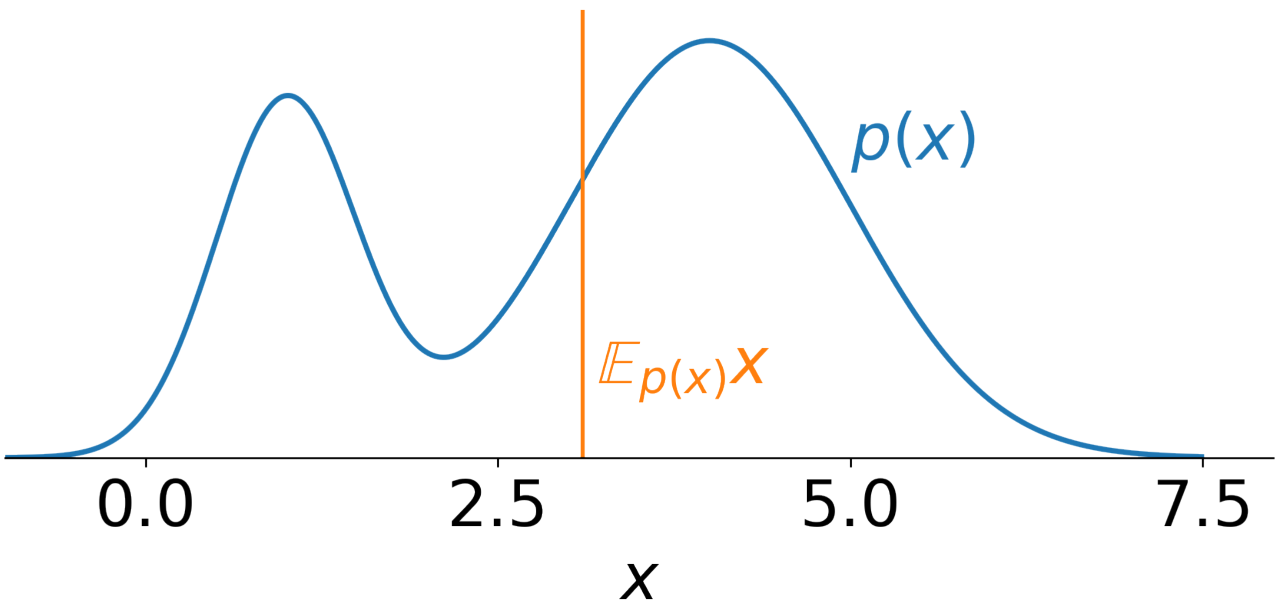

Unbiased estimates

$$\mathbb{E}_{p(x)} f(x) \approx \frac{1}{M} \sum_{s=1}^{M} f(x_s) = R$$

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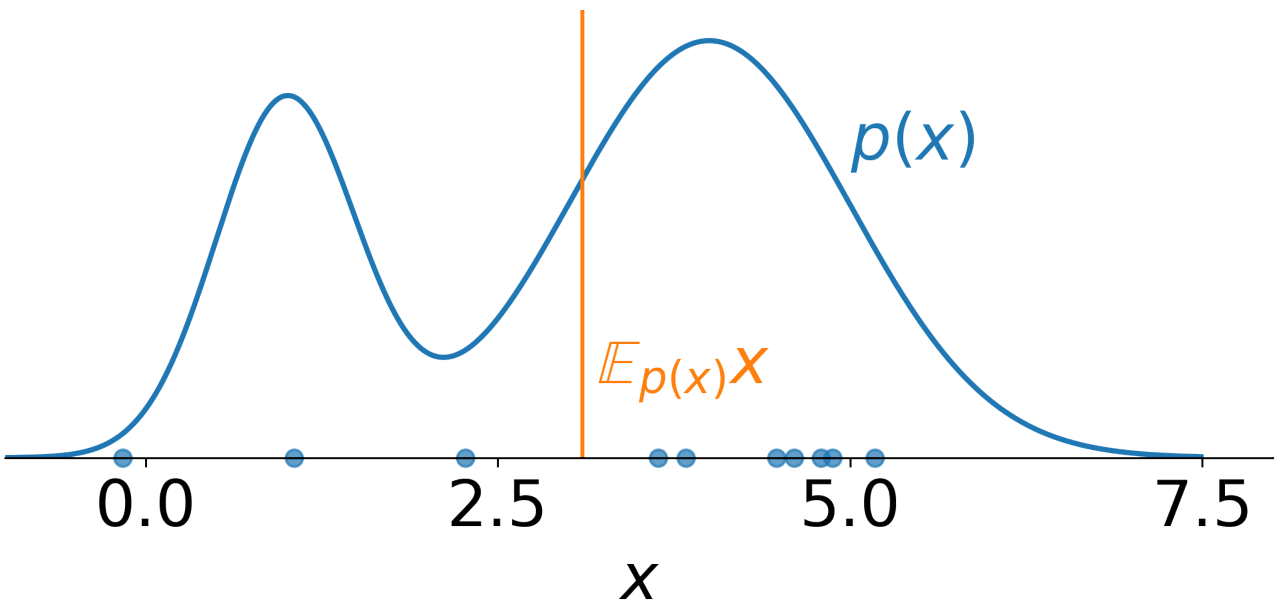

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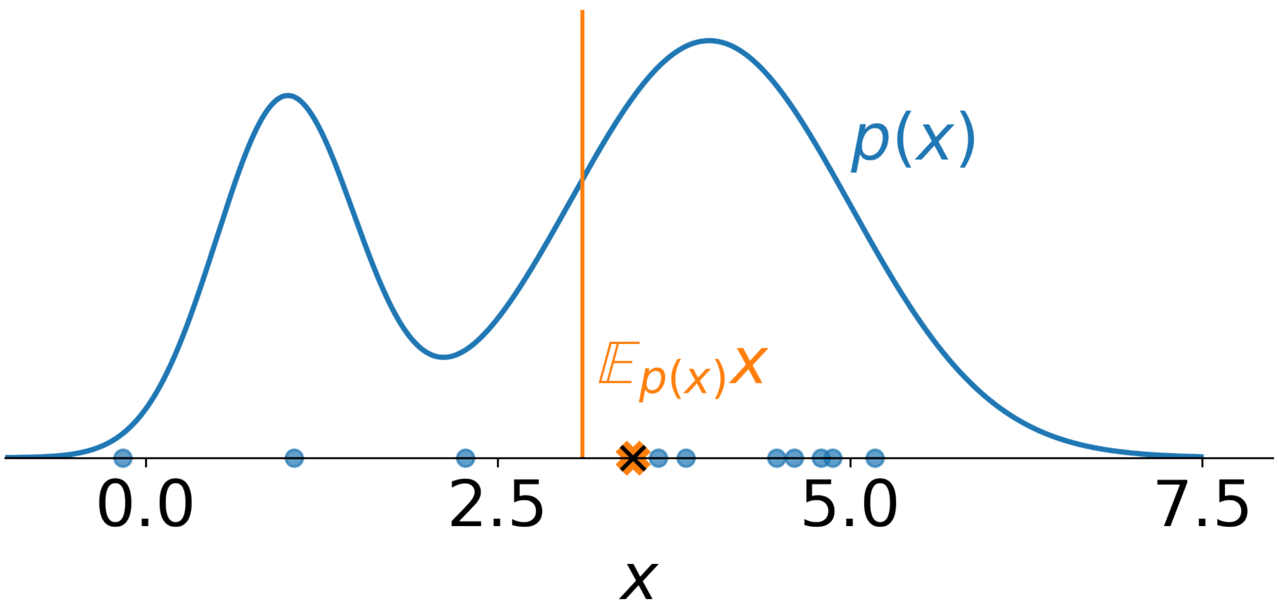

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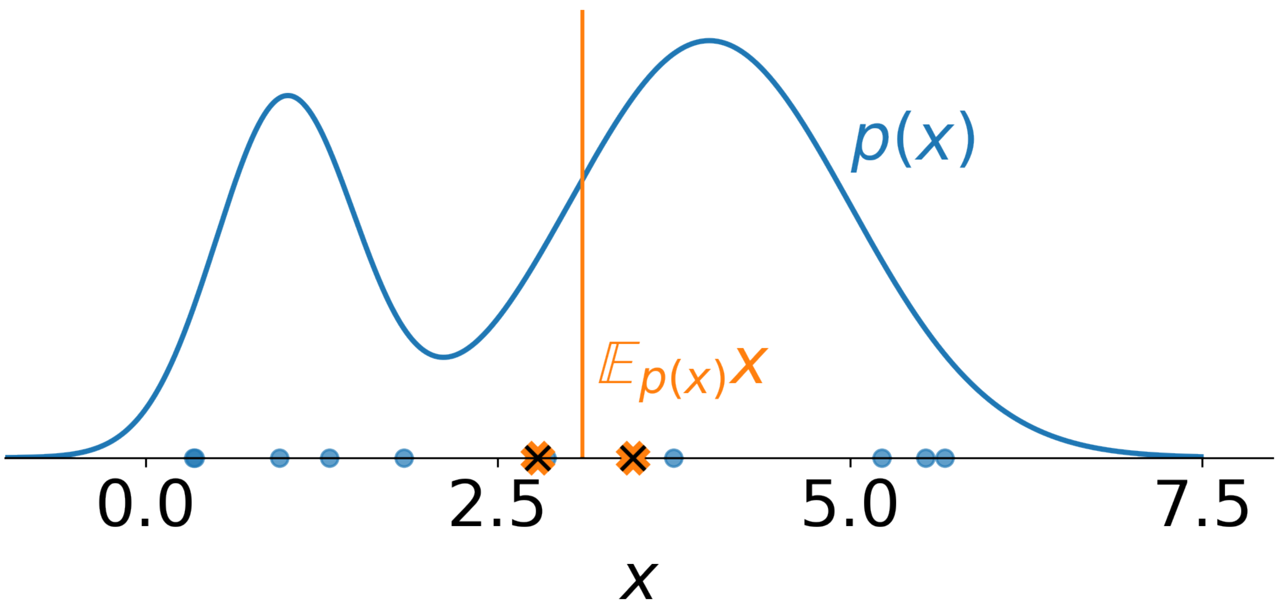

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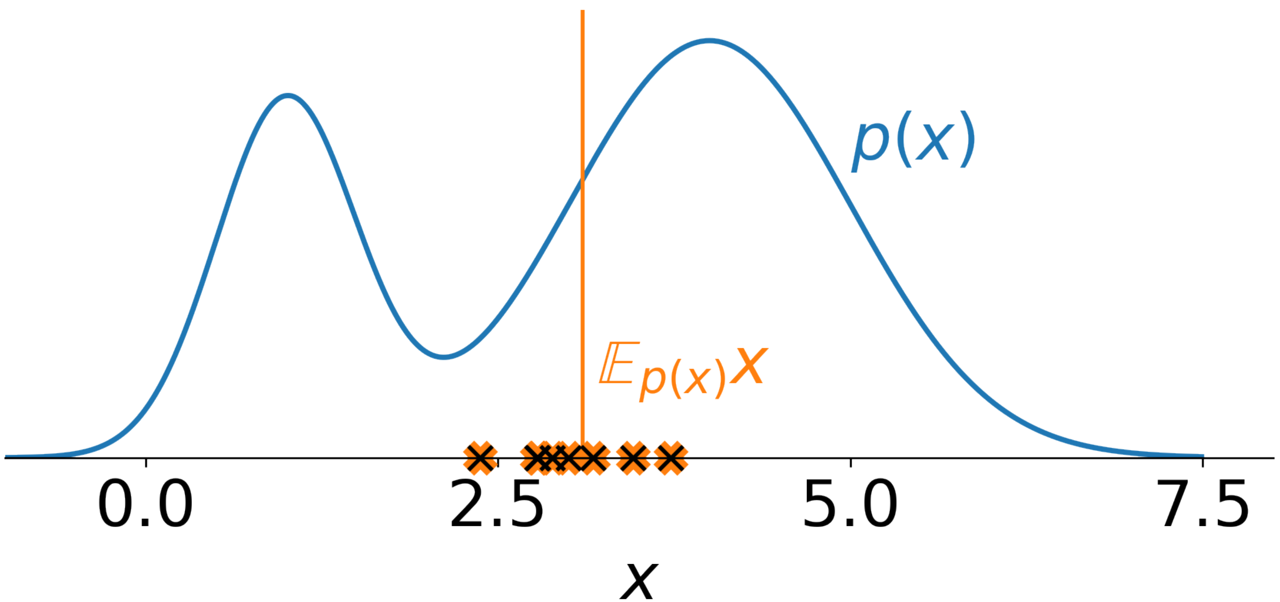

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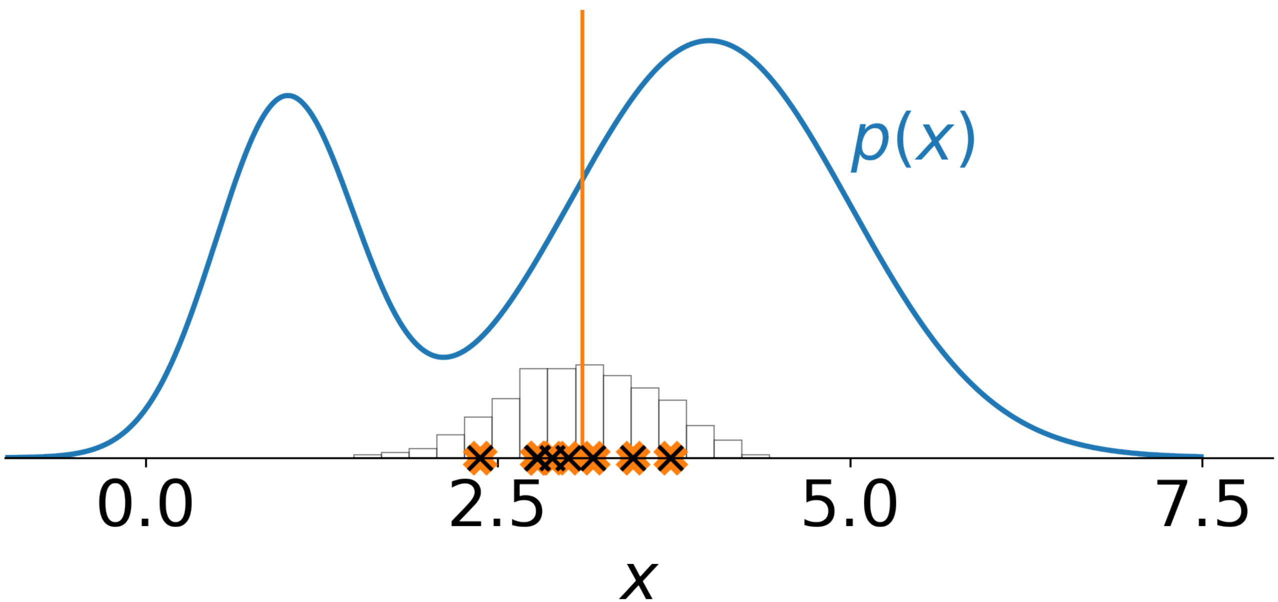

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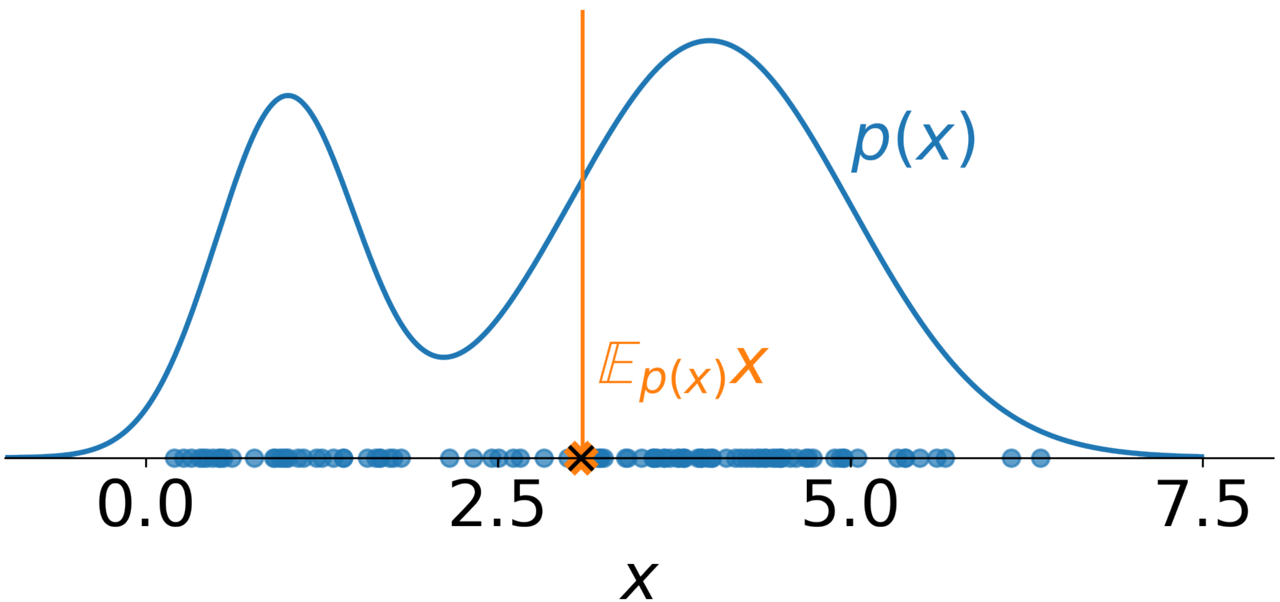

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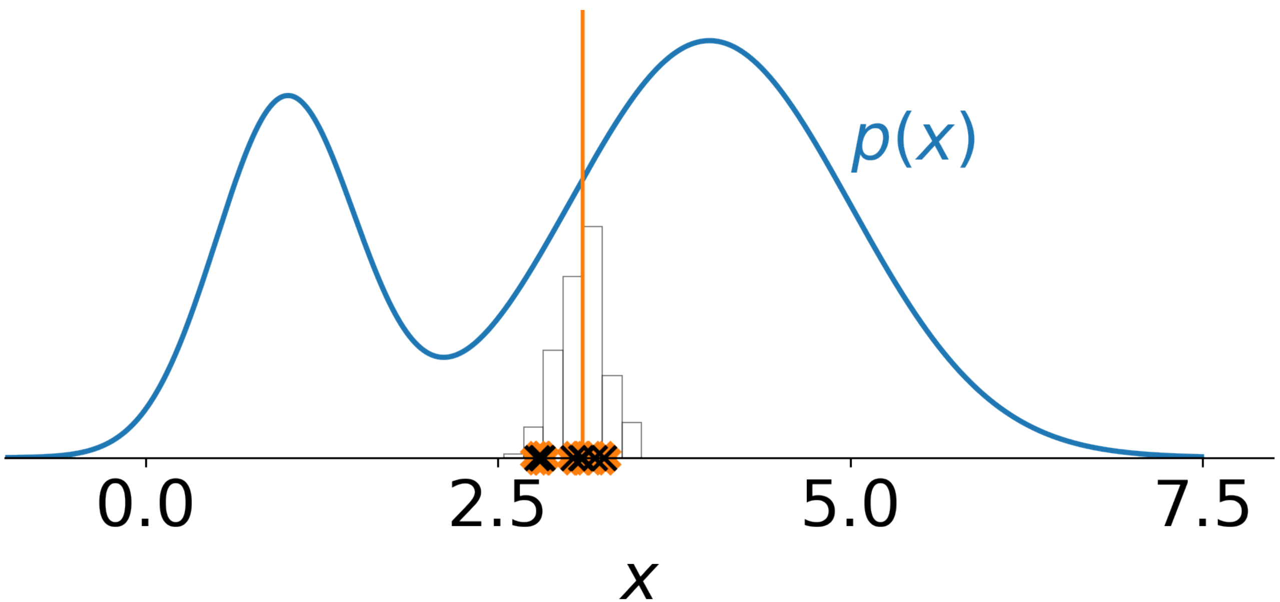

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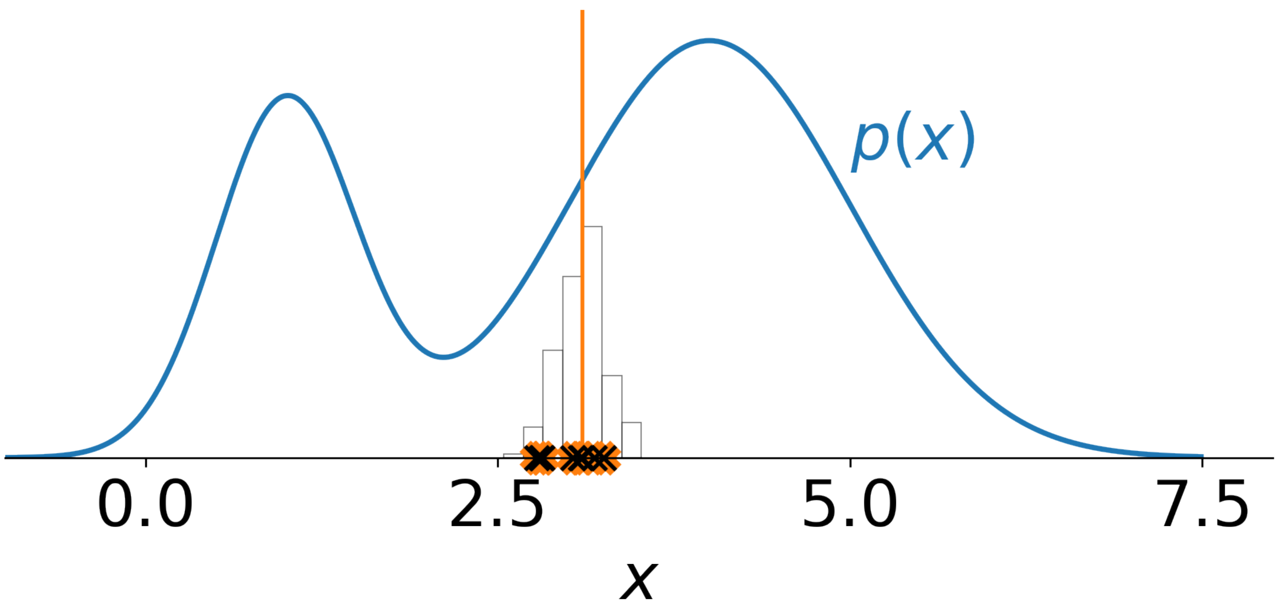
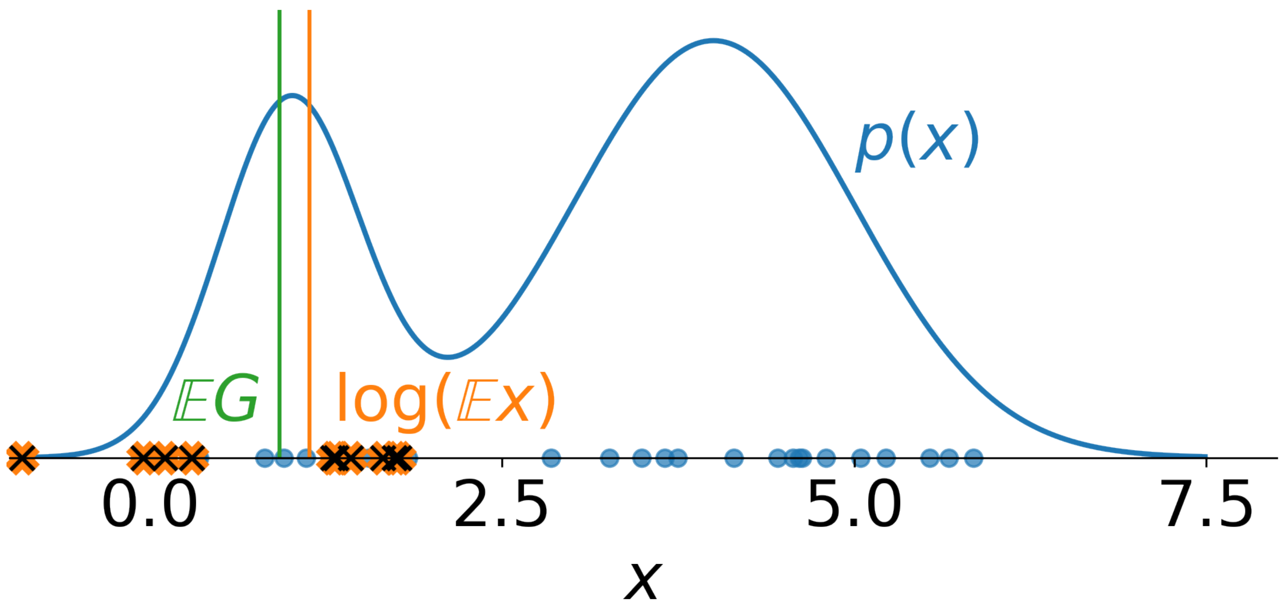
$$\mathbb{E}_{p(x)} R = \mathbb{E}_{p(x)} f(x)$$



Unbiased estimates

$$\log\left(\mathbb{E}_{p(x)}\, f(x)\right) \overset{?}{\approx} \log\left(\frac{1}{M}\sum_{s=1}^{M} f(x_s)\right) = G$$

$$x_s \sim p(x)$$



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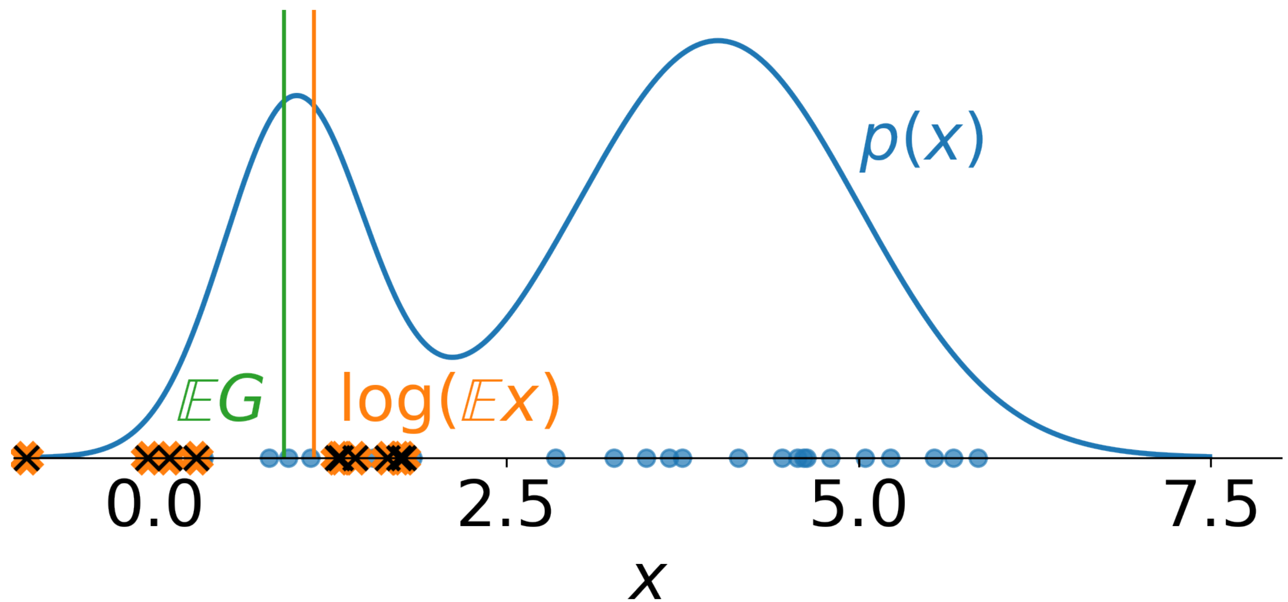
$$\mathbb{E}_{p(x)}\, G \neq \log\left(\mathbb{E}_{p(x)}\, f(x)\right)$$



Unbiased estimates

- Estimator called unbiased if its expected value equals to thing it estimates

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- This, is unbiased estimator:

$$\mathbb{E}_{p(x)} f(x) \approx \frac{1}{M} \sum_{s=1}^{M} f(x_s) = R$$

others may look unbiased, but you have to check