cs281 exercise

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1 Importance Sampling

1.1 Problem

Derive $\mu = E(f(x))$ for an importance sampler with a mixture model, where there are K distributions q_k, each with prior probability π_k.

1.2 Solution

The equation for the importance sampler estimator is:

$$\mu = \frac{1}{n} \sum_{i=1}^{n} \frac{f(x_i)p(x_i)}{q(x_i)}$$

To get the probability of an individual sample under our proposal distribution, we simply sum up the likelihoods under each mixure model:

$$q(x_i) = \sum_{k=1}^{K} \pi_k q_k(x_i)$$

This gives:

$$\mu = \frac{1}{n} \sum_{i=1}^{n} \frac{f(x_i)p(x_i)}{\sum_{k=1}^{K} \pi_k q_k(x_i)}$$