1. Suppose $X_1, \ldots, X_n$ are i.i.d. random variables having a distribution specified below. In each case use the factorization criterion to find sufficient statistic.

(a) Gamma distribution unknown $\alpha$ and known $\beta$.
(b) Normal distribution with mean zero and unknown variance $\theta$.
(c) Bernoulli distribution with parameter $\theta$.

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3. Suppose that a random variable $X$ has a normal distribution with mean zero and standard deviation $\sigma$. Find the Fisher information $I(\sigma)$ contained in $X$.

4. In the setting of the previous problem, find the Fisher information $I(\sigma^2)$ contained in $X$. [Here, the variance is regarded as the parameter.]

5. Suppose that a single observation $X$ is taken from a normal distribution with mean zero and standard deviation $\sigma$. Find an unbiased estimator of $\sigma$, determine its variance, and show that it is not efficient. [Hint: Calculate $E|X|$.]