Bias

1. Let $X_1, \ldots, X_n | \theta \overset{\text{iid}}{\sim} \text{Poisson}(\theta)$.

   (a) Is X_1 an unbiased estimator of θ? Justify your answer.

   (b) Is $\hat{\theta}_{MLE} = \bar{X}$ an unbiased estimator of θ? Justify your answer.

   (c) Is the number 2 an unbiased estimator of θ? Justify you answer.

   (d) Compute $\mathbb{E}[X_i^2]$.

   (e) Give an unbiased estimator of $g(\theta) = \mathbb{E}[X_i^2]$. *Hint: what would be a smart sample moment to try?.*

   (f) Find an unbiased estimator of $g(\theta) = \theta^2$.