

MTH 372 (Winter 2025): Tutorial III

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1. Let X_1, \dots, X_n be a random sample from $\text{Poisson}(\lambda)$, $\lambda > 0$.
 - (a) Find the method of moments estimator of λ .
 - (b) Find the maximum likelihood estimator (MLE) of λ .

2. Let X_1, \dots, X_n be a random sample from the pdf given by
$$f_{\theta}(x) = \theta x^{-2} \quad 0 < \theta \leq x < \infty.$$
 - (a) What is a sufficient statistic for θ .
 - (b) Find the method of moments estimator of θ .
 - (c) Find the maximum likelihood estimator (MLE) of θ .

3. Let X_1, \dots, X_n be a random sample from $\text{Binomial}(n, p)$, both are unknown. Find the method of moments estimator of (n, p) .

4. One observation, X , is taken from a $N(0, \sigma^2)$ population.
 - (a) Find an unbiased estimator of σ^2 .
 - (b) Find the MLE of σ .
 - (c) Discuss how the method of moments estimator of σ might be found.

5. Let X_1, \dots, X_n form a random sample from a uniform distribution on the interval $(\theta, \theta + 1)$, where the value of the parameter θ is unknown, $-\infty < \theta < \infty$. What will be the MLE of θ .

6. Find the maximum likelihood estimate of θ for the following two random samples.
 - (a) $X_i \sim \text{Binomial}(3, \theta)$, we observe $(X_1 = 1, X_2 = 3, X_3 = 2, X_4 = 2)$.
 - (b) $X_i \sim \text{Exponential}(\theta)$, we observe $(X_1 = 1.23, X_2 = 3.32, X_3 = 1.98, X_4 = 2.12)$.