Math 170S
Homework for Section 6.4 *†

Instructor: Swee Hong Chan

Note: Homework will not be collected, but the question for Quiz 2 might be picked from the homework questions.

1. Let X be the binomial random variable with parameter n and p, where n is known but p is not. Let $x_1, \ldots, x_n$ be sample values for X.
   (a) Compute the log likelihood function $\ell(p)$ for X.
   (b) Show that the MLE for p is $\frac{x_1+\ldots+x_n}{n}$.
2. Let X be the geometric random variable with unknown parameter p. Let $x_1, \ldots, x_n$ be sample values for X.
   (a) Compute the log likelihood function $\ell(p)$ for X.
   (b) Show that the MLE for p is $\frac{n}{x_1+\ldots+x_n}$.
3. Let X be the Poisson random variable with unknown parameter λ. Let $x_1, \ldots, x_n$ be sample values for X.
   (a) Compute the log likelihood function $\ell(\lambda)$ for X.
   (b) Show that the MLE for λ is $\frac{x_1+\ldots+x_n}{n}$.
4. Let X be the uniform random variable on the interval $[0, \theta]$ with unknown parameter θ.
   (a) Let $x_1, \ldots, x_n$ be sample values for X. Show that the MLE for θ is given by
   $$\widehat{\theta}(x_1, \ldots, x_n) = \max(x_1, \ldots, x_n).$$
   (b) Show that $\widehat{\theta}$ is a biased estimator for θ.
5. Show that maximum likelihood estimation and method of moments give the same estimators for $N(\mu, \sigma^2)$.
6. Solve Problem 6.4-7 in the textbook.
7. Solve Problem 6.4-17 in the textbook.

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†This homework is based on Hanbaek Lyu's and Liza Rebrova's homeworks from the previous quarter, and I would like to thank her for her generosity here. "*Nanos gigantum humeris insidentes* (I am but a dwarf standing on the shoulders of giants)".