Quiz 2

Thursday, April 7, 2022 8:18 AM

- **This is an open-notes, open-book quiz.**
- **You are not allowed to discuss the questions with any individual at any time.**
- **You have 90 minutes to complete and upload your solution file.**
- **You must upload a single file.**
- **You must name your file Lastname_Firstname_Quiz2.***
- **Failing to follow these instructions will result in a grade of zero.**

1. We would like to find the maximum likelihood estimate of the variance of a univariate Gaussian density function. How will this be done if (a) we assume the mean is an already-known constant, and (b) we assume the mean is also a parameter to be estimated.
2. Show that

$$E[E(X|Y)] = E[X]$$

3. Consider the following density function.

$$p(x) = \begin{cases} \theta^2 x e^{-\theta x} & x \geq 0;\ \theta > 0 \\ 0 & otherwise \end{cases}$$

   a. What is the log-likelihood function of θ?
   b. Find the maximum likelihood estimate of θ in
      i. Closed form.
      ii. Iterative manner using stochastic gradient descent. Give the update Equation.