Homework 1
Statistical Methods in Applied Computer Science
DD2447

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November 4, 2012

Exercise 2.16 Mean, mode, variance for the beta distribution
Suppose $\theta \sim Beta(a, b)$. Derive the mean, mode and variance.

Solution.

Exercise 3.6 MLE for the Poisson distribution
The Poisson pmf is defined as $Poi(x|\lambda) = e^{-\lambda}\frac{\lambda^x}{x!}$ for $x \in \{0, 1, 2, ..\}$ where $\lambda > 0$ is the rate parameter. Derive the MLE.

Solution.

Exercise 3.7 Bayesian analysis of the Poisson distribution
In exercise 3.6, we defined the Poisson distribution with rate λ and derived its MLE. Here we perform a conjugate Bayesian analysis.

a. Derive the posterior $p(\lambda|D)$ assuming a conjugate prior $p(\lambda) = Ga(\lambda|a, b) \propto \lambda^{a-1}e^{-\lambda b}$.
Hint: the posterior is also a Gamma distribution.

b. What does the posterior mean tend to as $a \to 0$ and $b \to 0$? (Recall that the mean of a $Ga(a, b)$ distribution is a/b.)

Solution.