

# Stat 8112 (Geyer) Spring 2013

## Homework Assignment 5

Due Friday March 29, 2013

**5-1.** Fill in the details for the proof of Theorem 2 in the handout about exponential families.

**5-2.** Give the details for the proof of Corollary 4 in the handout about exponential families.

**5-3.** Prove Lemma 6 in the handout about exponential families.

**5-4.** Prove the formulas for first and second derivatives of the cumulant function given in Section 9 of the handout about exponential families. You may assume the formula for the moment generating function given in the first displayed equation of that section and the properties of moment generating functions but you must verify the derivatives of the moment generating function and cumulant generating function are as given in that section.

**5-5.** Show that the univariate, two-parameter normal distribution is an exponential family. What are the natural parameters and the corresponding natural statistics?

**5-6.** Show that the family of nondegenerate multivariate normal distributions (for some fixed dimension) is an exponential family. What are the natural parameters and the corresponding natural statistics?

**5-7.** Show that the family of nondegenerate multinomial distributions (for some fixed dimension) is an exponential family. What are the natural parameters and the corresponding natural statistics? What is a minimal representation for this family? Show that so-called loglinear models (log cell probabilities are linear functions of the parameters) for categorical data analysis are natural affine submodels.

**5-8.** Show that MLE for the Cauchy location family is strongly consistent (using the Wald consistency theorem).

**5-9.** Show that MLE for the Cauchy location-scale family is strongly consistent (using the Wald consistency theorem).