Assignment 4 — Due Dec 9, 2019

1. Galapagos Islands. The data come from a 1973 study. (Data from M. P. Johnson and P. H. Raven, "Species Number and Endemism: The Galapagos Archipelago Revisited," Science 179 (1973): 893–5.) The number of species on an island is known to be related to the island's area. Of interest is what other variables are also related to the number of species, after island area is accounted for, and whether the answer differs for native species and nonnative species. (Note: Elevations for five of the islands were missing and have been replaced by estimates for purposes of this exercise). Analyze the data with number of native species as the response using log-linear regression.

   (a) Fit the model with log area, log elevation, log of distance from nearest island, and log area of nearest island as explanatory variables; and then check for extra-Poisson variation.

   (b) Use backward elimination to eliminate insignificant explanatory variables.

   (c) Describe the effects of the remaining explanatory variables.

   (d) Repeat the previous exercise, but use the number of nonnative species as the response variable (total number of species minus the number of native species).

2. El Niño and Hurricanes. Consider the El Niño and Hurricane data set with the numbers of Atlantic Basin tropical storms and hurricanes for each year from 1950 to 1997. The variable storm index is an index of overall intensity of the hurricane season. (It is the average of number of tropical storms, number of hurricanes, the number of days of tropical storms, the number of days of hurricanes, the total number of intense hurricanes, and the number of days they last—when each of these is expressed as a percentage of the average value for that variable. A storm index score of 100, therefore, represents, essentially, an average hurricane year.) Also listed are whether the year was a cold, warm, or neutral El Niño year, a constructed numerical variable temperature that takes on the values -1, 0, and 1 according to whether the El Niño temperature is cold, neutral, or warm; and a variable indicating whether West Africa was wet or dry that year. It is thought that the warm phase of El Niño suppresses hurricanes while a cold phase encourages them. It is also thought that wet years in West Africa often bring more hurricanes. (These data were gathered by William Gray of Colorado State University, and reported on the USA Today weather page: www.usatoday.com/weather/whurnum.htm). Use Poisson log-linear regression to describe the distribution of

   (a) number of storms as a function of El Niño temperature and West African wetness.

   (b) number of hurricanes as a function of El Niño temperature and West African wetness.