Bio Stats II : Lecture 5, Likelihood

Reading: Hilborn & Mangel (1997), Chapter 7

Gavin Fay

2025-02-06

This Week…

2/04: linear regression
2/05: Lab 3, linear modeling
2/06: Likelihood

Objectives

- Revisit probability
- Present Likelihood
- Statistical inference based on maximum likelihood

Probability

Previously: probability & common probability distributions

Dicsussed these in terms of PDFs, $f(x) = P(X = x)$

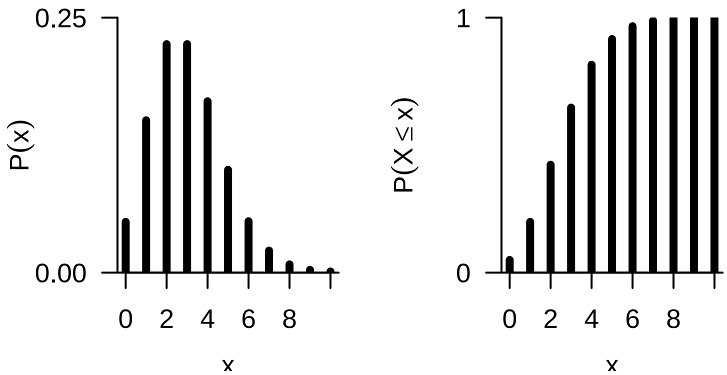
- Probability distribution function (discrete)
- Probability density function (continuous)

PDFs are a function of parameters.

We are frequently interested in estimating the values for parameters.

Example: Poisson $\lambda = 3$

$$P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$$



Often used for count data

Methods of estimation

- Method of Moments
- Least Squares
- Maximum Likelihood

Other techniques:
minimum chi-square, minimum mean-square error estimators, finite sampling theory, and Bayes procedures.

Method of Moments: equate sample results with their expected values under a sampling model. Expected value(s) in turn is a function of the parameter(s) of interest in estimating.

Likelihood function

Common problem:

Given some data, and a model of interest, find the one PDF among all the probability densities that the model prescribes, that is most likely to have produced the data.
inverse problem

i.e. Try to find values for parameters such that the model for $P(X)$ yields numbers that are as close to the data as possible.

We choose parameter estimates to **maximize** the likelihood function.