Stat 363: Likelihoods

Example: Does having boys or girls run in the family? Using demographic data from the National Longitudinal Survey of Youth, can we identify biases in sex composition patterns of children? The data is found in Table 2 in the Rodgers and Doughty (2001) article, and relevant R code can be found under **likelihood.Rmd**.

**Model 1 – Sex Unconditional Model**. Each child is independent of the others, and there is a constant probability () that a child is a boy.

1. Consider a small example with 3 families with compositions of children given by BBG, GBG, and GG.

Find the *maximum likelihood estimator (MLE)* for  by:

1. Conducting a numerical search in R for the largest likelihood over a fine grid of values 0-1.
2. Conducting a numerical search in R for the largest *log-likelihood* between 0 and 1.

Illustrate the process graphically, and report the maximum value of the likelihood and log-likelihood functions. Does it make sense that both methods would agree (and agree with the mathematical approach)?

2. Apply Model 1 to the NLSY data (families in Table 2 with 3 or fewer children). Find the MLE for  by adapting the R code for (1).

**Model 2 – Sex Conditional Model**. The probability of having a boy depends on whether you’ve had boys previously, so Model 2 will have three parameters:

= probability of a boy when previously have had an equal number of boys and girls (neutral)

= probability of a boy when previously have had more boys than girls (boy bias)

= probability of a boy when previously have had more girls than boys (girl bias)

3. Write out the likelihood function given Model 2 for the small set of data in (1). [You could also try BGG, GGB, BBB just for fun.]