Letters to the Editor

A GENERAL MAXIMUM LIKELIHOOD ESTIMATION PROGRAM

Dear Sir:

A computer program, MAXLIK, for general maximum likehood estimation (MLE), written in FORTRAN, is available to interested persons. MAXLIK estimates the values of parameters, such as gene frequencies or other variables, which determine the frequencies of specified classes, such as phenotypes. The main program is completely general in that the numbers of parameters and classes, as well as the relationships between them, are unspecified. These numbers and relationships are given for each particular class of problems, such as gene frequency estimation in the A_1A_2BO blood group system or estimation of nonpaternity and gene frequencies in the MNSs system.

Estimation is by maximum-likelihood scoring but differentiation by the user is not required; only the algebraic relations between classes and parameters (specified in a subroutine) are needed. In addition to estimates of the parameters and their variances and standard errors, chi square for testing the goodness of fit of observed class frequencies and the information, covariance, and information-covariance product matrices are given. Accuracy is usually to about four to six significant digits, depending on the version of the program used.

MAXLIK differs from other MLE programs described in genetics journals (e.g. Balakrishnan and Sanghvi, 1965; Kurczynski and Steinberg, 1967; MacCluer *et al.*, 1967) in being completely general. It should also be useful outside genetics. To date it has been used to estimate gene frequencies (up to six alleles; Reed, 1968) and various other parameters (including frequencies of nonpaternity and serological misclassification [Reed and Milkovitch, 1968] and proportion of racial mixture and selection parameters [Reed, 1969]). A short subroutine relating parameters to classes must be written for each class of problems, but we feel that any nonprogrammer geneticist, after 10–20 minutes study of the example given, could easily write his own particular subroutine.

A program listing of MAXLIK, including a test problem with sample input and output and brief instructions for preparation of cards, may be obtained by writing to one of us. Those wishing a version prepared for the IBM 7094 computer, in FORTRAN IV, double precision, should write to Dr. Reed. Those wishing a version for the IBM 1130 computer (in 1130 FORTRAN, similar to FORTRAN II) should write to Dr. Schull. Persons using other computers should note that both versions use the same algorithm, and either should be easily modifiable by a programmer for any other FORTRAN-using computer.

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