NAG C Library Chapter Introduction

f03 – Determinants

Contents

1 Scope of the Chapter

This chapter is concerned with the calculation of determinants of square matrices.

2 Background to the Problems

The functions in this chapter compute the determinant of a square matrix A. The matrix is first decomposed into triangular factors

$$A = LU.$$

If A is positive-definite, then $U = L^T$, and the determinant is the product of the squares of the diagonal elements of L. Otherwise, the functions in this chapter use the Crout form of the LU decomposition, where U has unit elements on its diagonal. The determinant is then the product of the diagonal elements of L, taking account of possible sign changes due to row interchanges.

To avoid overflow or underflow in the computation of the determinant, some scaling is associated with each multiplication in the product of the relevant diagonal elements. The final value is represented by

$$\det A = d1 \times 2^{d2}$$

where $d2$ is an integer and

$$\tfrac{1}{16} \leq |d1| < 1.$$

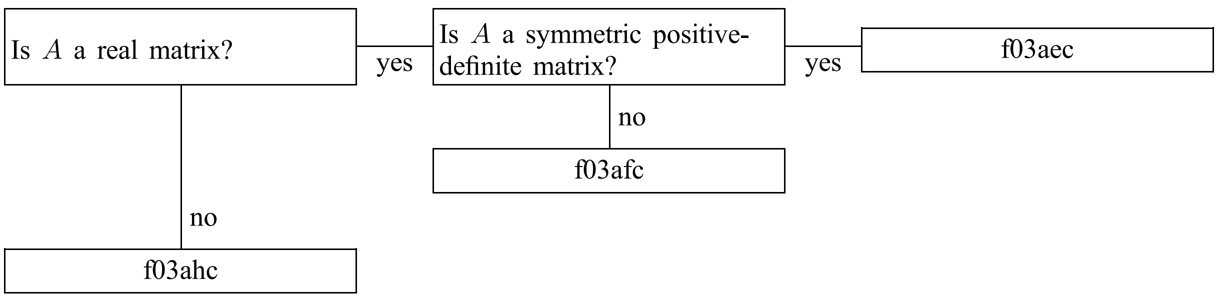
Most of the functions of the chapter are based on those published in the book edited by Wilkinson and Reinsch (1971). We are very grateful to the late Dr J H Wilkinson FRS for his help and interest during the implementation of this chapter of the Library.

3 Recommendations on Choice and Use of Available Functions

It is extremely wasteful of computer time and storage to use an inappropriate function, for example to use a function requiring a complex matrix when A is real. Most programmers will know whether their matrix is real or complex, but may be less certain whether or not a real symmetric matrix A is positive-definite, i.e., all eigenvalues of $A > 0$. A real symmetric matrix A not known to be positive-definite must be treated as a general real matrix.

4 Decision Tree

Note: if at any stage the answer to a question is 'Don't know' this should be read as 'No'.



5 Index

6 Functions Withdrawn or Scheduled for Withdrawal

None.

7 References

Fox L (1964) *An Introduction to Numerical Linear Algebra* Oxford University Press

Wilkinson J H and Reinsch C (1971) *Handbook for Automatic Computation II, Linear Algebra* Springer–Verlag