

NAG Library Routine Document

E01RBF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of ***bold italicised*** terms and other implementation-dependent details.

1 Purpose

E01RBF evaluates continued fractions of the form produced by E01RAF.

2 Specification

```
SUBROUTINE E01RBF(M, A, U, X, F, IFAIL)
INTEGER          M, IFAIL
double precision A(M), U(M), X, F
```

3 Description

E01RBF evaluates the continued fraction

$$R(x) = a_1 + R_m(x)$$

where

$$R_i(x) = \frac{a_{m-i+2}(x - u_{m-i+1})}{1 + R_{i-1}(x)}, \quad \text{for } i = m, m-1, \dots, 2.$$

and

$$R_1(x) = 0$$

for a prescribed value of x . E01RBF is intended to be used to evaluate the continued fraction representation (of an interpolatory rational function) produced by E01RAF.

4 References

Graves–Morris P R and Hopkins T R (1981) Reliable rational interpolation *Numer. Math.* **36** 111–128

5 Parameters

- 1: M – INTEGER *Input*
On entry: m , the number of terms in the continued fraction.
Constraint: $M \geq 1$.
- 2: A(M) – **double precision** array *Input*
On entry: A(j) must be set to the value of the parameter a_j in the continued fraction, for $j = 1, 2, \dots, m$.
- 3: U(M) – **double precision** array *Input*
On entry: U(j) must be set to the value of the parameter u_j in the continued fraction, for $j = 1, 2, \dots, m-1$. (The element U(m) is not used).
- 4: X – **double precision** *Input*
On entry: the value of x at which the continued fraction is to be evaluated.

5: F – *double precision*

Output

On exit: the value of the continued fraction corresponding to the value of x .

6: IFAIL – INTEGER

Input/Output

On entry: IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.

On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the recommended value is 0. **When the value -1 or 1 is used it is essential to test the value of IFAIL on exit.**

6 Error Indicators and Warnings

If on entry IFAIL = 0 or -1 , explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL = 1

The value of X corresponds to a pole of $R(x)$ or is so close that an overflow is likely to ensue.

7 Accuracy

See Section 7 in E01RAF.

8 Further Comments

The time taken by E01RBF is approximately proportional to m .

9 Example

This example reads in the parameters a_j and u_j of a continued fraction (as determined by the example for E01RAF) and evaluates the continued fraction at a point x .

9.1 Program Text

```
*      E01RBF Example Program Text
*      Mark 14 Revised. NAG Copyright 1989.
*      .. Parameters ..
      INTEGER                M
      PARAMETER              (M=4)
      INTEGER                NIN, NOUT
      PARAMETER              (NIN=5,NOUT=6)
*      .. Local Scalars ..
      DOUBLE PRECISION F, X
      INTEGER                I, IFAIL
*      .. Local Arrays ..
      DOUBLE PRECISION A(M), U(M)
*      .. External Subroutines ..
      EXTERNAL              E01RBF
*      .. Executable Statements ..
      WRITE (NOUT,*) 'E01RBF Example Program Results'
      WRITE (NOUT,*)
*      Skip heading in data file
      READ (NIN,*)
      READ (NIN,*) (A(I),I=1,M)
      READ (NIN,*) (U(I),I=1,M-1)
```

```
      READ (NIN,*) X
      IFAIL = 1
*
      CALL E01RBF(M,A,U,X,F,IFAIL)
*
      IF (IFAIL.GE.0) THEN
        WRITE (NOUT,99999) 'X =', X
        WRITE (NOUT,*)
        WRITE (NOUT,99999) 'The value of R(X) is ', F
      ELSE
        WRITE (NOUT,99998) IFAIL
      END IF
*
99999 FORMAT (1X,A,1P,E12.4)
99998 FORMAT (1X,' ** E01RBF returned with IFAIL = ',I5)
      END
```

9.2 Program Data

E01RBF Example Program Data

4.000	1.000	0.750	-1.000
0.000	3.000	1.000	
6.000			

9.3 Program Results

E01RBF Example Program Results

X = 6.0000E+00

The value of R(X) is 1.7714E+01
