1 SUMMARY

To find the number of real roots above, below and within a specified interval \( x_1 \leq x \leq x_2 \).

Sturm’s sequence polynomials are used. The degree of the polynomial must be less than 21.


2 HOW TO USE THE PACKAGE

2.1 Argument list

*The single precision version*

\[
\text{CALL PA04A}(A, X1, X2, NB, NR, NA, N)
\]

*The double precision version*

\[
\text{CALL PA04AD}(A, X1, X2, NB, NR, NA, N)
\]

\( A \) is a REAL (DOUBLE PRECISION in the D version) array which must be set by the user to the coefficients of the polynomial, i.e. set \( A(j+1) = a_j, j=0, 1, ..., n \). **Restriction:** \( a_n \neq 0 \).

\( X1 \) is a REAL (DOUBLE PRECISION in the D version) variable which must be set by the user to the lower limit \( x_1 \) of the search interval. See the description of \( X2 \) for more details. **Restriction:** \( x_1 \leq x_2 \).

\( X2 \) is a REAL (DOUBLE PRECISION in the D version) variable which must be set by the user to the upper limit \( x_2 \) of the search interval. The subroutine calculates the number of real roots in the interval \( x_1 \leq x \leq x_2 \). **Restriction:** \( x_1 \leq x_2 \).

\( NB \) is an INTEGER variable which the subroutine will set to the number of real roots below the limit \( x_1 \).

\( NR \) is an INTEGER variable which the subroutine will set to the number of real roots found in the interval \( x_1 \leq x \leq x_2 \).

\( NA \) is an INTEGER variable which the subroutine will set to the number of real roots above the limit \( x_2 \).

\( N \) is an INTEGER variable which must be set by the user to \( n \) the degree of the polynomial. **Restriction:** \( 0 \leq n \leq 20 \).

3 GENERAL INFORMATION

*Workspace:* An internal 21x21 work array called SS limits the degree of the polynomial to be \( n \leq 20 \).

*Use of common:* None.

*Other routines called directly:* None.

*Input/output:* None.

*Restrictions:* \( 0 \leq n \leq 20, \ X1 \leq X2 \).
4 METHOD

The subroutine forms a Sturm’s sequence of polynomials starting with

\[ P(x) = a_0 + a_1 x + a_2 x^2 + ... + a_n x^n \]

and its derivative \( P'(x) \) as the first two polynomials in the sequence. The sequence is then evaluated at the two limit points and the difference in the sign count is used to determine the three counts \( \text{NB} \), \( \text{NR} \) and \( \text{NA} \).