1 SUMMARY

Given \( n+1 \) points \( x_i, y_i \), \( i=0, 1, 2, ..., n \) calculates the **coefficients of the polynomial that passes through** all \( n+1 \) points, i.e. the interpolation polynomial

\[
P(x) = a_0 + a_1x + a_2x^2 + ... + a_nx^n
\]
such that

\[
P(x_i) = y_i \quad i=0, 1, 2, ..., n.
\]

The coefficients of the Lebesgue polynomials \( L_i(x) \), i.e. such that \( L_i(x_k) = 0 \), \( i \neq k \) and \( L_i(x_i) = 1 \), are calculated using PC01 and PB01, the coefficients \( a_0, a_1, ..., a_n \) are then obtained from

\[
P(x) \equiv \sum_{i=0}^{n} y_i L_i(x)
\]

**ATTRIBUTES** — Version: 1.0.0. **Types:** PC02A; PC02AD. **Calls:** PB01 and PC01. **Original date:** May 1964. **Origin:** L. Morgan, Harwell.

2 HOW TO USE THE PACKAGE

2.1 Argument list

*The single precision version*

```fortran
CALL PC02A(X,Y,COE,W1,W2,N)
```

*The double precision version*

```fortran
CALL PC02AD(X,Y,COE,W1,W2,N)
```

**X** is a REAL (DOUBLE PRECISION in the D version) array which must be set by the user to contain the \( x \) coordinates of the points, i.e. set \( X(I), I=1, 2, ..., N+1 \) to the values \( x_i, i=0, 1, 2, ..., n \).

**Y** is a REAL (DOUBLE PRECISION in the D version) array which must be set by the user to contain the \( y \) coordinates of the points, i.e. set \( Y(I), I=1, 2, ..., N+1 \) to the values \( y_i, i=0, 1, 2, ..., n \).

**COE** is a REAL (DOUBLE PRECISION in the D version) array of length at least \( n+1 \) which will be set by the subroutine to contain the coefficients of the polynomial, i.e. \( a_i, i=0, 1, 2, ..., n \) will be returned in \( COE(I), I=1, 2, ..., N+1 \).

**W1** is a REAL (DOUBLE PRECISION in the D version) array of length at least \( n+2 \) which is used by the subroutine as workspace.

**W2** is a REAL (DOUBLE PRECISION in the D version) array of length at least \( n+1 \) which is used by the subroutine as workspace.

**N** is an INTEGER which must be set by the user to \( n \) the degree of the polynomial.
3 GENERAL INFORMATION

Workspace: Provided by the user in the argument arrays W1 and W2.

Use of common: None.

Other routines called directly: PB01 and PC01.

Input/output: None.

Restrictions: None.

4 METHOD

The coefficients of the Lebesgue polynomials $L_i(x)$, i.e. such that $L_i(x_i) = 0$, $i \neq k$ and $L_k(x_k) = 1$, are calculated using PC01 and PB01, the coefficients $a_0, a_1, \ldots, a_n$ are then obtained from

$$P(x) = \sum_{i=0}^{n} v_i L_i(x)$$