ADAS Subroutine xxnbaf

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SUBROUTINE XXNBAF (M, NCAP7 , X, Y, W, LAMDA , B, A, DIAG, C ,
     &
                        SS , IFAIL )
С
С
C-
С
C PURPOSE: Determines a least-square cubic spline approximation s(x)
С
            to the set of data points (x_r, y_r) with weights w_r,
С
      for r=1, 2, ..., m.
С
С
            The value of NCAP7 = ncap+7, where ncap is the number of
      intervals of the spline (number of interior knots + 1),
С
С
            and the values of the knots LAMDA(5), LAMDA(6), ...,
      LAMDA(NCAP7-4), interior to the data interval, are
С
С
      prescribed by the user.
С
С
     s has the property that it minimises ss, the sum of the
С
      squares of the weighted residuals eps(r)
С
С
       eps(r) = w(r) * (s(x(r)) - y(r)).
С
С
      The procedure produces the minimising value of ss and
С
      the coefficients c(1), c(2),...,c(q), where q=ncap+3=NCAP7-4,
С
      in the B-spline representation
С
C s(x) = c(1) * N1(x) + c(2) * N2(x) + ... + c(q) * Nq(x).
С
С
      Here Ni(x) (i=1,2,\ldots,q) denotes the normalised B-spline
С
      of degree 3 defined upon the knots lamda(i-4), lamda(i-3),
С
      lamda(i-2), lamda(i-1), and lamda(i).
С
C CALLING PROGRAM: VARIOUS
С
C SUBROUTINE:
С
C INPUT: (I*4) M
                            = The number of data points.
С
                               CONSTRAINT: M \ge MDIST \ge 4, where
С
                               MDIST is the number of distinct x
С
                               values in the data.
С
C INPUT: (I*4) NCAP7
                            = NBAR+7, where NBAR is the number of
                               intervals of the spline (number
С
С
                               of interior knots +1, i.e. the knots
С
                               strictly in the range X(1) to X(M))
С
                               over which the spline is defined.
С
                               CONSTRAINT: 8<= NCAP7 <= MDIST+4,
С
                               where MDIST is the number of distinct
С
                               x values in the data.
С
C INPUT: (R*8) X()
                            = The values x_r of the independent variable
                               (abscissa), for r=1, 2, \ldots, m.
С
С
                               CONSTRAINT:
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С $X(1) \le X(2) \le \ldots \le X(M)$ С С INPUT: (R*8) Y() = The values y_r of the dependent variable С (ordinate), for $r=1,2,\ldots,m$. С С INPUT: (R*8) W()= The values w_r of the weights, С for r=1, 2, ..., m. С С INPUT: (R*8) LAMDA() = LAMDA(i) must be set to the (i-4)th (interior) knot, $i=5, 6, \ldots, nbar+3$. С С CONSTRAINT: С $X(1) < LAMDA(5) <= LAMDA(6) \dots <=$ С \ldots <=LAMDA (NCAP7-4) < X(M) . С С = 0 : stop if any error INPUT: (I*8) IFAIL С = 1 : continue if non-fatal error. С = Input values are unchanged, and С OUTPUT: (R*8) LAMDA() С LAMDA(i), for i=1,2,3,4,NCAP7-3, С NCAP7-2, NCAP7-1, NCAP7 contains the С additional exterior knots introduced by С the routine. С С С OUTPUT: (R*8) C() = The coefficients of the B-spline N i(x), С for $i=1,2,\ldots$, nbar+3. The remaining С elements (from NBAR+4 to NBAR+7) are not С used. С С = The residual sum of sqaures OUTPUT: (R*8) SS С С OUTPUT: (I*4) IFAIL = 0 : no error detected С = 1 : the knots fail to satisfy the condition С X(1) < LAMDA(5) <= LAMDA(6) <= ...С <= LAMDA (NCAP7-4) < X (M) С = 2 : The weights are not strictly positive С = 3 : The values of X(R), R=1, M are not in С non-decreasing order. С = 4 : NCAP7 < 8 (so that the number of С interior knots is negative) or С NCAP7 > MDIST + 4, where MDIST is the С number of distinct x values in the data С (so that there cannot be unique solution). С = 5 : The conditions specified by Schoenberg С and Whitney fail to hold for at least one subset of the distinct data abscissae. С С That is, there is no subset of NCAP7-4 С strictly increasing values, С $X(R(1)), X(R(2)), \ldots, X(R(NCAP7-4)),$ С among theabscissae such that С С X(R(1)) < LAMDA(1) < X(R(5))С X(R(2)) < LAMDA(2) < X(R(6))

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С
С
                                   X(R(NCAP7-8)) < LAMDA(NCAP7-8) < X(R(NCAP7-4)).
С
С
                                   This means that there is no unique
С
                                   solution: there are regions containing
С
                                   too many knots compared with the
С
                                   number of data points.
С
С
                           = Set of distinct data abscissae
           (R*8) B()
С
С
           (R*8)
                 WORK2()
                           = WORKSPACE
С
С
           (I*4)
                 J
                            = GENERAL INDEX
С
                            = GENERAL INDEX
           (I*4)
                I
С
           (I*4) R
                            = GENERAL INDEX
С
                            = GENERAL INDEX
           (I*4) II
С
           (R*8) BI
                            = GENERAL REAL
С
                           = GENERAL REAL
           (R*8) XI
С
C ROUTINES: NONE
С
C AUTHORS: Alessandro C. Lanzafame, University of Strathclyde
С
С
 REFERENCE: Cox, M.G. and Hayes, J.G. "Curve fitting: A Guide and
С
              Suite of Algorithms for the Non-specialist User."
С
              Report NAC26, National Physical Laboratory, Middlessex,
С
              1973.
С
 DATE: 12 January 1995
С
С
C VERSIION: 1.0a
C Alessandro Lanzafame, 12 January 1995.
C Directly derived from Algol text.
С
  (Error in passing woking variables)
С
C VERSION 1.0b
C Alessandro Lanzafame, 15 January 1995.
C DIAG(1:NCAP7-4) absorbed in matrix A(1:NCAP7-4,1).
C Matrix A(1:NCAP7-4,2:4) becomes A(1:NCAP7-4,1:4). This is to easy
C the passing of workspaces.
C WORK1 identified with B. WORK2 with A.
C Corrected index error in checking remaining Schoennber-Whitney
C conditions.
C COMPILING BUT NOT WORKING.
С
C VERSION 1.0c
C Alessandro Lanzafame, 15 January 1995.
C Knots shifted as in original Algol program text.
С
C UNIX-IDL PORT:
С
C VERSION: 1.1
                                        DATE: 22-1-96
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
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С
            - PUT UNDER SCCS CONTROL
С
                                         DATE: 06-07-2004
C VERSION: 1.2
C MODIFIED: Allan Whiteford
               - Changed name from dxnbaf to xxnbaf.
С
С
C VERSION : 1.3 DATE: 10-04-2007
C MODIFIED : Allan Whiteford
С
                - Modified documentation as part of automated
C subroutine documentation preparation.
С
C-----
С
C------
                         IFAIL, M, NCAP7
A(1:NCAP7-4,2:4), B(M)
      INTEGER

      A(1:NCAP/-4,2:4),
      B(M)

      REAL*8
      C(NCAP7),
      DIAG(1:NCAP7-4)

      REAL*8
      LAMDA(-3:NCAP7-4),
      SS,
      W(M)

      REAL*8
      X(M),
      Y(M)
```