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A COMPUTER PROGRAM FOR ESTIMATING THE AERODYNAMIC CHARACTERISTICS OF NACA 16-SERIES AIRFOILS

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SUMMARY

A computer program has been written which provides a comprehensive data base on NACA 16-series airfoils. The geometry covered in the program is limited to cambers for a design-lift coefficient from 0.0 to 0.7 and thickness ratios from 4 to 21 percent. The data include Mach numbers from 0.3 to 1.6, angles of attack from -4 to 8 degrees, and lift coefficients from 0.0 to 0.8. Extrapolation is used to obtain data from Mach numbers, angles of attack, and lift coefficients beyond those for which data were available. A subroutine to adjust the lift and drag coefficients beyond stall is included. The complete listing of the program is provided in the Appendix.

INTRODUCTION

After decades of neglect, propeller research in the United States has been reactivated due to the energy shortage. Most of the general aviation aircraft use propeller designs based on the technology that has not changed significantly since the 1940's and early 1950's. Propeller compressibility losses have caused current propeller-powered general aviation aircraft to be limited to maximum cruise speeds near Mach 0.5. The desire for improvements in swirl recovery and noise control required improved technology. Recent technological developments performed as part of NASA's Advanced Turboprop Project offer the potential of extending the limit to at least Mach 0.8. For advanced high-speed turboprop powered aircraft, compared to equivalent technology high-bypass-ratio turbofans, studies have shown that a large performance advantage may be obtained at cruise speeds up to Mach 0.8. These advantages could result in lower acquisition and reduced life cycle cost, large fuel savings, improved range, swirl recovery, and noise control, or other benefits for both future civil and military aircraft.

Airfoil research has become a major factor in the propeller performance research. The NACA 16-series airfoil sections are low-drag, high-critical-speed airfoils that could be effective in the advanced turboprop designs currently under study. These airfoil sections, which have proven useful for propellers, have relatively sharp leading and trailing edges, and have maximum thickness at mid-chord station. They are designed to work efficiently at high speed by delaying compressibility stall.

A comprehensive and easily accessible data bank on the aerodynamic characteristics of 16-series sections was needed to facilitate the studies performed. A literature survey revealed that data over a large range of cambers, thicknesses, angles of attack, and Mach numbers were not available, so a computer program was written to provide the needed data base. The requirements for the program included complete flexibility of input conditions, section Mach numbers to at least 1.1, easy accessibility, low-cost operation, and the ability to interpolate for nonstandard geometry. To fulfill these requirements, the program was written in a table "look-up" format, so that its only limitations would be the range of its data and the accuracy of the linear interpolation. The most comprehensive source for the aerodynamic characteristics of 16-series airfoils was reference 1, and these values make up the program's data declarations.

The present paper discusses the use and limitations of the program. The program will shortly be made available to outside uses through COSMIC. Langley Research Center uses will find it as the common permanent file system under user number 624435N, with the file name NACA16.

DISCUSSION

A preliminary program was written using values for only the 16-5XX airfoils with thickness ratios from 4 to 18 percent, nine Mach numbers from 0.3 to 1.3, and seven angles of attack from -4.0 to 8 degrees. A linear shift was used to account for other cambers. Extensive computation showed that the program's results were not as accurate as desired. By expanding the data tables in the program, better accuracy could be attained. More points on each curve were entered and more sections were represented. The capability to calculate the drag coefficient was added.

Digitizing equipment was used to enter the values from the graphic form of reference 1 into the data tables. This method was accurate and efficient, enabling many points to be entered in a short time directly from the curve, and allowing complete freedom in representing the curve (i.e., the values f(x) could be entered for any x). A total of 100 graphs were digitized. The values were then used to generate tables corresponding to a standard set of Mach numbers; 26 values of Mach number from .3 to 1.6 are used. These are used as the data declaration in the subroutine and have the following format:

CLXXX (row, column) = a function of angle of attack (row), and Mach number (column)

CDXXX (row, column) = a function of lift coefficient (row), and Mach number (column)

ALPXXX (row, column) = a function of lift coefficient (row), and Mach number (column)

where the first X in XXX notation represents the design lift coefficient in tenths (i.e., 7 = 0.7 design-lift coefficient) and the remaining two XX in this notion represents the airfoil thickness-to-chord ratio (thus, 706 signifies a 0.7 design-lift coefficient and a 0.06 thickness-to-chord ratio). The values for the lift coefficient were tabulated for selected angles of attack and Mach number and the values for drag coefficient and angle of attack (ALP) were tabulated for selected values of lift coefficient and Mach number in the above-mentioned data declarations.

The improvement achieved by augmenting the data is illustrated in figures 1 through 6. Figure 1 shows the points that made up one of the tables in the first version of the program. Figure 2 shows the points that were digitized, and figure 3 presents the points that make up the data table in the upgraded version. In figure 4, the improved representation is demonstrated; it compares the curves represented by the data tables in each version of the program. Clearly, the addition of more data points improved the accuracy of the interpolation. A graph of the points in a representative drag coefficient table is presented in figure 5, and a similar representation of an angle-of-attack curve is shown in figure 6.

The main program controls the input and output. Figure 7 provides a brief flowchart of the program. All of the table look-ups and interpolations are done in the subroutines. The subroutine IBI performs the table look-up and returns the value for

the desired aerodynamic characteristic. A linear interpolation between thickness ratios occurs in the subroutines AER00, AER01, AER02....AER0X (where X represents the camber of the airfoil). Subroutine CAMBER interpolates between design-lift coefficients. Warning messages are printed if the data limits have been exceeded.

An additional subroutine (COMPUT) was written to account for the nonlinear behavior of lift coefficient beyond the stall angle. The method uses the graphs of reference 1, and the procedure is a "table look-up" using first-order interpolation. Essentially, the lift coefficient becomes a function of Reynolds number as well as of Mach number, angle of attack, and geometry. The drag coefficient is also adjusted in this subroutine.

LIMITATIONS AND ERROR

The primary limitation in the use of the program arises from the spareness of data. The geometry for which the program can be used is limited to cambers for design lift coefficients up to 0.7 and thickness ratios between 4 and 21 percent. Data were unavailable for Mach numbers below .3 and above 1.6; angles of attack below -4 degrees and above 8 degrees, and lift coefficients (for drag calculations) below 0.0 and above 0.8; however, the program is capable of extrapolating for conditions beyond these limits and of modifying the coefficients at angles of attack beyond stall. No wind-tunnel data at these conditions were available for comparison, so it is difficult to estimate the accuracy of the program's output.

Some studies were done to evaluate the program in the range for which data were available. First, the program was compared with the graphs of reference 1 from which the program's data were derived. The average error was less than 5 percent for both low and transonic Mach numbers demonstrating that the errors due to linear interpolation and digitizing are minimal. Next, two sources of wind-tunnel data (refs. 2 and 3) were found and compared to each other. Some discrepancies were found. The error ranged from 0 to 68 percent, with the average at approximately 12 percent. The program produced results close to the data from reference 2, particularly at low speed. The lift coefficient was more accurate than the drag coefficient. The error was significantly higher in the comparison between the program and reference 3. The only trend observed in this study was that the drag coefficient was markedly more accurate at low speed while the lift coefficient was more accurate at transonic speed.

CONCLUDING REMARKS

A computer program has been written which provides a comprehensive data base on NACA 16-series airfoils. The geometry covered in the program is limited to cambers for a design-lift coefficient from 0.0 to 0.7 and thickness ratios from 4 to 21 percent. The data include Mach numbers from 0.3 to 1.6, angles of attack from -4 to 8 degrees, and lift coefficients from 0.0 to 0.8. Extrapolation is used to obtain data from Mach numbers, angles of attack, and lift coefficients beyond those for which data were available. A subroutine to adjust the lift and drag coefficients beyond stall is included. The program can be used for airfoils with camber for a design lift coeffient up to 0.7, with thickness ratios from 4 to 21 percent, and for Mach numbers from 0.3 to 1.6. In comparison with wind-tunnel data, it has been shown to give reasonable results.

APPENDIX

```
      PROGRAM AIRFOIL(INPUT,OUTPUT,TAPE3=INPUT,TAPE6=OUTPUT)
C
C  THE SUBROUTINES IN THIS PROGRAM CALCULATE THE AERODYNAMIC
C  CHARACTERISTICS OF NASA 16-SERIES AIRFOILS.  ALL VALUES ARE
C  OBTAINED THROUGH INTERPOLATIONS FROM GRAPHS DRAWN BY HENRY V.
C  BORST (SEE SOURCE).  SUBROUTINE IBI INTERPOLATES BETWEEN MACH
C  NUMBERS AND ALPHAS/CL'S; SUBROUTINE AEROX INTERPOLATES BETWEEN
C  THICKNESS RATIOS; SUBROUTINE CAMBER INTERPOLATES BETWEEN
C  CAMBERS.  SUBROUTINE COMPUT IS USED TO ADJUST THE CD IF THE
C  ANGLE OF ATTACK IS BEYOND STALL.
C
C  ALL LIMITATIONS IN THIS PROGRAM ARE DUE TO THE LACK OF DATA.
C  THE LIMITING CASES ARE:
C  DESIGN CL:  0.0 TO 0.7
C  THICKNESS RATIO:  (FOR 0.0 <= CLDES <= 0.5) 4% TO 21%
C                    (FOR 0.5 < CLDES < 0.6) 4% TO 15%
C                    (FOR 0.6 < CLDES <= 0.7) 6% TO 12%
C  MACH NUMBER:  .3 TO 1.6 (BUT EXTRAPOLATION CAN BE PERFORMED)
C  ANGLE OF ATTACK(PERFORMANCE):  -4.0 TO 8 (BUT EXTRAPOLATION CAN
C  BE PERFORMED)
C  CL(DESIGN):  0.0 TO 0.8 (BUT EXTRAPOLATION CAN BE PERFORMED)
C  WARNING MESSAGES WILL BE PRINTED IF THESE VALUES ARE EXCEEDED.
C  THE PROGRAM HAS BOTH PERFORMANCE ANALYSIS AND DESIGN CAPABILITIES.
C  FOR THE FORMER LET IKEY=1, AND FOR THE LATTER LET IKEY=2.
C
C  IF IKEY=1 INPUT MUST BE:
C  MACH NUMBER, ANGLE OF ATTACK, THICKNESS RATIO, DESIGN CL, ALTITUDE, COR,& D
C  IF IKEY=2 INPUT MUST BE:
C  MACH NUMBER, CL, THICKNESS RATIO, DESIGN CL, ALTITUDE, COR,& D
C
C  SOURCE
C
C  SAND, EDWARD, DOUGLAS A. ELLIOT, JR., AND HENRY BORST, "USAAMRDL
C       TECHNICAL REPORT 73-34C SUMMARY OF PROPELLER DESIGN
C       PROCEDURES AND DATA" VOLUME III HUB ACTUATOR, AND CONTROL
C       DESIGN, FORT EUSTIS, VA., NOV. 1973
C
C
      DIMENSION XM(7),AA(5),CLDES(5),TR(2)
      DATA(XM(I),I=1,7)/.2,.5,.7,.8,.9,1.0,1.1/
      DATA(CLDES(I),I=1,5)/.3,.35,.4,.45,.5/
      DATA(AA(I),I=1,5)/4,8,10,12,16/
      DATA(TR(I),I=1,2)/.06,.12/
      DATA NUMACH,NUMCLD,NUMTR,NUMAA/7,5,2,5/
      COR=.1
      IKEY=1
      D=10.
      ALT=10000.
      DO 50 I=1,NUMCLD
      DO 40 J=1,NUMTR
      DO 30 K=1,NUMAA
      DO 20 L=1,NUMACH
   75 WRITE(6,150)
      WRITE(6,150)
```

```
      CALL CAMBER(CLDES(I),TR(J),AA(K),XM(L),CL,CD,XLD,IKEY,ALT,COR,D)
      CHORD=COR*D/2
      CALL ATMOS(ALT,RHO,SOS,T)
      V=XM(L)*SOS
      XMUU=(.1E-09)*.3170*T**1.5*734.7/(T+216.)
      RN=RHO*V*CHORD/XMUU
      IF(XM(L) .LT. .3 .OR. XM(L) .GT. 1.6) WRITE (6,202) XM(L)
      IF(IKEY .EQ. 1 .AND. AA(K) .LT. -4.0 .OR. IKEY .EQ. 1 .AND.
     &AA(K) .GT. 8.0)
     &WRITE(6,203) AA(K)
      IF(IKEY .EQ. 2 .AND. CL .LT. 0.0 .OR. IKEY .EQ. 2 .AND.
     &CL .GT. 0.8)
     &WRITE(6,208) CL
      IF (IKEY .EQ. 2) GO TO 5000
      WRITE(6,100) RN,CLDES(I),TR(J),XM(L),AA(K),CL,CD,XLD
      GO TO 20
 5000 WRITE(6,125) RN,CLDES(I),TR(J),XM(L),CL,AA(K),CD,XLD
  20  CONTINUE
  30  CONTINUE
  40  CONTINUE
  50  CONTINUE
 150   FORMAT(/36H**************************************)
 125 FORMAT(*0REYNOLDS NUMBER=*,E15.3/*0DESIGN CL=*,F5.3,
     &* THICKNESS RATIO=*,F5.3/*0MACH NUMBER=*,F6.3,
     &* CL=*,F6.3/*0ALPHA=*,F6.3,* CD=*,F6.4,* L/D=*,F6.2)
 100  FORMAT(*0REYNOLDS NUMBER=*,E15.3/*0DESIGN CL=*,F5.3,
     &* THICKNESS RATIO=*,F5.3/*0MACH NUMBER=*,F6.3,* ALPHA=*,F7.3/
     &*0CL=*,F6.3,* CD=*,F6.4,* L/D=*,F7.2/)
 202  FORMAT(*0MACH=*,F6.3,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED*)
 203  FORMAT(*0ALPHA=*,F5.2,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED.*)
 208  FORMAT(*0CL=*,F6.4,* IS OUT OF RANGE OF DATA.
     &*/* EXTRAPOLATION HAS BEEN PERFORMED.*)
      END


      SUBROUTINE CAMBER(CLDES,TR,AA,XM,CL,CD,XLD,IKEY,ALT,COR,D)
C
C  THIS SUBROUTINE USES LINEAR INTERPOLATION BETWEEN CAMBERS
C  TO OBTAIN THE AERODYNAMIC CHARACTERISTICS OF A 16-SERIES AIRFOIL.
C  IT USES THE SUBROUTINES AERO0,AERO1,AERO2,...AERO7.
C
C  THE RANGE OF DESIGN CL'S FOR ACCURATE RETURNS IS FROM 0 TO .7.
C
C  DESCRIPTION OF VARIABLES:
C     CLDES=DESIGN LIFT COEFFICIENT
C     TR=MAXIMUM THICKNESS-TO-CHORD RATIO
C     AA=ANGLE OF ATTACK AT BLADE ELEMENT
C     XM=MACH NUMBER AT BLADE ELEMENT
C     CL=SECTION LIFT COEFFICIENT
C     CD=SECTION DRAG COEFFICIENT
C     XLD=LIFT TO DRAG RATIO
C     IKEY=PARAMETER WHICH INDICATES WHETHER PERFORMANCE OR DESIGN
```

```
C           MODE IS DESIRED.
C
C           IF IKEY=1, PROGRAM RUNS IN PERFORMANCE MODE.
C           INPUT IS ANGLE OF ATTACK, MACH NUMBER, DESIGN CL AND
C           THICKNESS RATIO.
C           OUTPUT IS CL, CD, AND L/D.
C
C           IF IKEY=2, PROGRAM RUNS IN DESIGN MODE.
C           INPUT IS CL, MACH NUMBER, DESIGN CL, AND
C           THICKNESS RATIO
C           OUTPUT IS SECTION ANGLE OF ATTACK, CD, AND L/D.
C      ALT=ALTITUDE
C      COR=CHORD/RADIUS OF PROP BLADE
C      D=DIAMETER OF PROPELLER
C
C
      DIMENSION IORDER(2),IPT(2)
      IORDER(1)=IORDER(2)=1
      IPT(1)=-1
      IF (IKEY .EQ. 2) GO TO 2000
      IF (CLDES .LT. 0.0) GO TO 15
      IF (CLDES .GE. 0.0 .AND. CLDES .LT. 0.1) GO TO 25
      IF (CLDES .GE. 0.1 .AND. CLDES .LT. 0.2) GO TO 35
      IF (CLDES .GE. 0.2 .AND. CLDES .LT. 0.3) GO TO 45
      IF (CLDES .GE. 0.3 .AND. CLDES .LT. 0.4) GO TO 55
      IF (CLDES .GE. 0.4 .AND. CLDES .LT. 0.5) GO TO 65
      IF (CLDES .GE. 0.5 .AND. CLDES .LT. 0.6) GO TO 75
      IF (CLDES .GE. 0.6 .AND. CLDES .LT. 0.7) GO TO 85
      IF (CLDES .GE. 0.7) GO TO 95
   15 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      WRITE(6,176) CLDES
  176 FORMAT(* DESIGN CL=*,F5.2,* IS OUT OF RANGE OF DATA.*/
     &* VALUES FOR CLDES=0.0 HAVE BEEN RETURNED.*)
      GO TO 300
   25 CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL0=CL
      CD0=CD
      IPT(1)=-1
      CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL1=CL
      CD1=CD
      CL=CL0+(CL1-CL0)*((CLDES-0.0)/(.1-0.0))
      CD=CD0+(CD1-CD0)*((CLDES-0.0)/(.1-0.0))
      GO TO 300
   35 CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL1=CL
      CD1=CD
      IPT(1)=-1
      CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL2=CL
      CD2=CD
      CL=CL1+(CL2-CL1)*((CLDES-.1)/(.2-.1))
      CD=CD1+(CD2-CD1)*((CLDES-.1)/(.2-.1))
      GO TO 300
   45 CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
```

```
      CL2=CL
      CD2=CD
      IPT(1)=-1
      CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL3=CL
      CD3=CD
      CL=CL2+(CL3-CL2)*((CLDES-.2)/(.3-.2))
      CD=CD2+(CD3-CD2)*((CLDES-.2)/(.3-.2))
      GO TO 300
 55   CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL3=CL
      CD3=CD
      IPT(1)=-1
      CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL4=CL
      CD4=CD
      CL=CL3+(CL4-CL3)*((CLDES-.3)/(.4-.3))
      CD=CD3+(CD4-CD3)*((CLDES-.3)/(.4-.3))
      GO TO 300
 65   CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL4=CL
      CD4=CD
      IPT(1)=-1
      CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL5=CL
      CD5=CD
      CL=CL4+(CL5-CL4)*((CLDES-.4)/(.5-.4))
      CD=CD4+(CD5-CD4)*((CLDES-.4)/(.5-.4))
      GO TO 300
 75   CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL5=CL
      CD5=CD
      IPT(1)=-1
      CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL6=CL
      CD6=CD
      CL=CL5+(CL6-CL5)*((CLDES-.5)/(.6-.5))
      CD=CD5+(CD6-CD5)*((CLDES-.5)/(.6-.5))
      GO TO 300
85    CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL6=CL
      CD6=CD
      IPT(1)=-1
      CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      CL7=CL
      CD7=CD
      CL=CL6+(CL7-CL6)*((CLDES-.6)/(.7-.6))
      CD=CD6+(CD7-CD6)*((CLDES-.6)/(.7-.6))
      GO TO 300
 95   CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      IF (CLDES .GT. 0.7) WRITE(6,175) CLDES
 175  FORMAT(* DESIGN CL=*,F5.3,* IS OUT OF RANGE OF DATA.*/
     &* VALUES FOR CLDES=.7 HAVE BEEN RETURNED.*)
      GO TO 300
2000  CONTINUE
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```
      IPT(1)=-1
      IF (CLDES .LT. 0.0) GO TO 16
      IF (CLDES .GE. 0.0 .AND. CLDES .LT. 0.1) GO TO 26
      IF (CLDES .GE. 0.1 .AND. CLDES .LT. 0.2) GO TO 36
      IF (CLDES .GE. 0.2 .AND. CLDES .LT. 0.3) GO TO 46
      IF (CLDES .GE. 0.3 .AND. CLDES .LT. 0.4) GO TO 56
      IF (CLDES .GE. 0.4 .AND. CLDES .LT. 0.5) GO TO 66
      IF (CLDES .GE. 0.5 .AND. CLDES .LT. 0.6) GO TO 76
      IF (CLDES .GE. 0.6 .AND. CLDES .LT. 0.7) GO TO 86
      IF (CLDES .GE. 0.7) GO TO 96
16    CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      WRITE(6,178)CLDES
178   FORMAT(* DESIGN CL =*,F5.2,* IS OUT OF RANGE OF DATA.*/
     &* THE VALUES FOR CLDES = 0.0 HAVE BEEN RETURNED.*)
      GO TO 300
26    CALL AERO0(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA0=AA
      CD0=CD
      IPT(1)=-1
      CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA1=AA
      CD1=CD
      AA=AA0+(AA1-AA0)*((CLDES-0.0)/(.1-0.0))
      CD=CD0+(CD1-CD0)*((CLDES-0.0)/(.1-0.0))
      GO TO 300
36    CALL AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA1=AA
      CD1=CD
      IPT(1)=-1
      CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA2=AA
      CD2=CD
      AA=AA1+(AA2-AA1)*((CLDES-.1)/(.2-.1))
      CD=CD1+(CD2-CD1)*((CLDES-.1)/(.2-.1))
      GO TO 300
46    CALL AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA2=AA
      CD2=CD
      IPT(1)=-1
      CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA3=AA
      CD3=CD
      AA=AA2+(AA3-AA2)*((CLDES-.2)/(.3-.2))
      CD=CD2+(CD3-CD2)*((CLDES-.2)/(.3-.2))
      GO TO 300
56    CALL AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA3=AA
      CD3=CD
      IPT(1)=-1
      CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA4=AA
      CD4=CD
      AA=AA3+(AA4-AA3)*((CLDES-.3)/(.4-.3))
      CD=CD3+(CD4-CD3)*((CLDES-.3)/(.4-.3))
      GO TO 300
```

```
 66   CALL AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA4=AA
      CD4=CD
      IPT(1)=-1
      CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA5=AA
      CD5=CD
      AA=AA4+(AA5-AA4)*((CLDES-.4)/(.5-.4))
      CD=CD4+(CD5-CD4)*((CLDES-.4)/(.5-.4))
      GO TO 300
 76   CALL AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA5=AA
      CD5=CD
      IPT(1)=-1
      CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA6=AA
      CD6=CD
      AA=AA5+(AA6-AA5)*((CLDES-.5)/(.6-.5))
      CD=CD5+(CD6-CD5)*((CLDES-.5)/(.6-.5))
      GO TO 300
 86   CALL AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA6=AA
      CD6=CD
      IPT(1)=-1
      CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      AA7=AA
      CD7=CD
      AA=AA6+(AA7-AA6)*((CLDES-.6)/(.7-.6))
      CD=CD6+(CD7-CD6)*((CLDES-.6)/(.6-.7))
      GO TO 300
 96   CALL AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
      IF (CLDES .GT. 0.7) WRITE(6,179) CLDES
 179  FORMAT(* DESIGN CL =*,F5.2,* IS OUT OF RANGE OF DATA.*/
     &* THE VALUES FOR CLDES = .7 HAVE BEEN RETURNED.*)
 300  XLD=CL/CD
      RETURN
      END


      SUBROUTINE AERO0 (XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C  CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-0XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP004(26,9),ALP006(26,9),
     & ALP009(26,9),ALP012(26,9),ALP015(26,9),ALP018(26,9),
     & ALP021(26,9),CLI(9),XMI(26),ALPI(7),CL004(7,26),
     & CL006(7,26),CL009(7,26),CL012(7,26),CL015(7,26),
     & CL018(7,26),CL021(7,26),CD004(5,26),CD006(5,26),
     & CD009(5,26),CD012(5,26),CD015(5,26),CD018(5,26),
     & CD021(5,26),CLII(5)
      DATA((CL004(I,J),J=1,26),I=1,4)/
     1 -.395, -.392, -.390, -.390, -.389, -.391, -.392, -.394, -.394,
     1 -.384, -.373, -.357, -.340, -.334, -.341, -.353, -.353, -.351,
     1 -.348, -.343, -.340, -.340, -.342, -.412, -.418, -.418,
     2 -.193, -.190, -.188, -.186, -.184, -.183, -.181, -.179, -.168,
     2 -.154, -.138, -.121, -.114, -.121, -.126, -.131, -.133, -.130,
     2 -.125, -.120, -.117, -.115, -.126, -.190, -.206, -.212,
     3  .010,  .013,  .024,  .033,  .044,  .052,  .061,  .072,  .084,
     3  .097,  .109,  .109,  .103,  .098,  .095,  .091,  .088,  .088,
     3  .092,  .100,  .108,  .108,  .095,  .036,  .014,  .007,
     4  .206,  .227,  .251,  .264,  .282,  .291,  .299,  .306,  .313,
     4  .323,  .327,  .323,  .319,  .312,  .306,  .302,  .298,  .298,
     4  .300,  .310,  .317,  .315,  .304,  .195,  .143,  .128/
      DATA((CL004(I,J),J=1,26),I=5,7)/
     5  .419,  .439,  .464,  .485,  .515,  .532,  .546,  .555,  .552,
     5  .548,  .541,  .535,  .528,  .522,  .516,  .511,  .506,  .506,
     5  .515,  .522,  .528,  .527,  .519,  .356,  .274,  .235,
     6  .612,  .659,  .722,  .762,  .803,  .812,  .814,  .814,  .804,
     6  .794,  .784,  .774,  .764,  .756,  .751,  .745,  .741,  .739,
     6  .747,  .761,  .772,  .776,  .767,  .571,  .405,  .342,
     7  .773,  .817,  .876,  .918,  .942,  .942,  .939,  .928,  .917,
     7  .906,  .894,  .883,  .875,  .867,  .861,  .855,  .850,  .850,
     7  .860,  .871,  .877,  .878,  .871,  .683,  .539,  .455/
      DATA((CL006(I,J),J=1,26),I=1,4)/
     1 -.399, -.400, -.401, -.401, -.402, -.402, -.402, -.402, -.399,
     1 -.396, -.394, -.391, -.388, -.386, -.395, -.413, -.426, -.421,
     1 -.410, -.399, -.393, -.401, -.410, -.426, -.428, -.428,
     2 -.197, -.201, -.203, -.198, -.194, -.192, -.189, -.185, -.180,
     2 -.175, -.169, -.162, -.155, -.160, -.167, -.174, -.177, -.174,
     2 -.167, -.166, -.173, -.184, -.195, -.226, -.232, -.232,
     3  .002,  .000, -.001,  .003,  .010,  .015,  .019,  .030,  .041,
     3  .052,  .066,  .080,  .078,  .071,  .064,  .059,  .055,  .058,
     3  .062,  .072,  .074,  .066,  .052, -.019, -.044, -.050,
     4  .192,  .202,  .219,  .230,  .241,  .250,  .258,  .266,  .275,
     4  .283,  .292,  .297,  .287,  .278,  .268,  .259,  .255,  .268,
     4  .280,  .291,  .292,  .279,  .265,  .183,  .140,  .105/
      DATA((CL006(I,J),J=1,26),I=5,7)/
     5  .378,  .400,  .424,  .437,  .464,  .477,  .490,  .503,  .516,
     5  .527,  .524,  .521,  .515,  .502,  .489,  .478,  .476,  .482,
     5  .498,  .514,  .508,  .490,  .471,  .356,  .264,  .212,
     6  .573,  .609,  .645,  .693,  .731,  .750,  .765,  .764,  .760,
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6  .743,  .725,  .706,  .686,  .607,  .651,  .646,  .655,  .666,
6  .678,  .685,  .684,  .661,  .638,  .505,  .388,  .326,
7  .766,  .786,  .804,  .846,  .887,  .906,  .909,  .892,  .875,
7  .858,  .841,  .824,  .807,  .789,  .768,  .749,  .753,  .772,
7  .791,  .798,  .793,  .774,  .754,  .637,  .512,  .424/
 DATA((CL009(I,J),J=1,26),I=1,4)/
1 -.364, -.358, -.352, -.350, -.348, -.345, -.343, -.340, -.337,
1 -.335, -.332, -.329, -.326, -.331, -.345, -.338, -.326, -.319,
1 -.319, -.320, -.322, -.326, -.330, -.348, -.356, -.364,
2 -.192, -.173, -.164, -.160, -.151, -.147, -.143, -.140, -.137,
2 -.137, -.137, -.141, -.144, -.145, -.146, -.145, -.133, -.123,
2 -.124, -.129, -.134, -.139, -.144, -.165, -.190, -.215,
3 -.004, -.004,  .002,  .007,  .013,  .016,  .022,  .027,  .032,
3  .040,  .049,  .057,  .054,  .045,  .041,  .045,  .056,  .067,
3  .063,  .057,  .051,  .046,  .041,  .005, -.024, -.047,
4  .181,  .190,  .202,  .211,  .224,  .231,  .237,  .244,  .251,
4  .257,  .264,  .266,  .252,  .233,  .216,  .223,  .238,  .253,
4  .258,  .252,  .245,  .237,  .230,  .184,  .144,  .122/
 DATA((CL009(I,J),J=1,26),I=5,7)/
5  .385,  .393,  .409,  .420,  .439,  .452,  .465,  .478,  .491,
5  .499,  .486,  .461,  .433,  .406,  .385,  .394,  .420,  .448,
5  .459,  .449,  .438,  .426,  .413,  .340,  .276,  .226,
6  .558,  .601,  .641,  .672,  .704,  .723,  .715,  .702,  .680,
6  .655,  .630,  .604,  .579,  .551,  .532,  .544,  .569,  .593,
6  .609,  .596,  .582,  .569,  .555,  .473,  .406,  .341,
7  .698,  .756,  .804,  .832,  .865,  .858,  .847,  .826,  .805,
7  .783,  .749,  .716,  .682,  .648,  .611,  .617,  .643,  .670,
7  .690,  .678,  .666,  .651,  .637,  .558,  .493,  .435/
 DATA((CL012(I,J),J=1,26),I=1,4)/
1 -.400, -.400, -.401, -.402, -.403, -.403, -.403, -.402, -.
1 -.400, -.397, -.394, -.400, -.416, -.406, -.387, -.387, -.
1 -.389, -.390, -.391, -.393, -.394, -.400, -.400, -.397,
2 -.201, -.202, -.203, -.203, -.204, -.203, -.202, -.200, -.197,
2 -.195, -.193, -.192, -.214, -.227, -.211, -.187, -.186, -.184,
2 -.186, -.188, -.189, -.191, -.193, -.203, -.217, -.227,
3 -.004, -.006, -.007, -.007, -.002,  .002,  .006,  .009,  .013,
3  .015,  .015,  .007, -.019, -.036, -.020,  .003,  .015,  [illegible],
3  .012,  .010,  .009,  .007,  .005, -.004, -.019, -.027,
4  .192,  .192,  .195,  .201,  .208,  .211,  .215,  .217,  [illegible],
4  .213,  .204,  .185,  .167,  .161,  .179,  .195,  .206,  [illegible],
4  .202,  .195,  .189,  .182,  .177,  .158,  .139,  .129/
 DATA((CL012(I,J),J=1,26),I=5,7)/
5  .343,  .363,  .379,  .390,  .406,  .415,  .424,  .436,  .445,
5  .442,  .424,  .387,  .341,  .317,  .343,  .379,  .411,  .419,
5  .412,  .397,  .383,  .369,  .356,  .302,  .266,  .233,
6  .510,  .537,  .567,  .587,  .619,  .635,  .643,  .631,  .602,
6  .570,  .536,  .495,  .455,  .441,  .465,  .495,  .524,  .537,
6  .529,  .517,  .504,  .492,  .480,  .425,  .384,  .351,
7  .627,  .672,  .715,  .745,  .777,  .784,  .762,  .739,  .694,
7  .649,  .601,  .549,  .505,  .494,  .522,  .549,  .576,  .586,
7  .578,  .570,  .562,  .556,  .550,  .517,  .488,  .458/
 DATA((CL015(I,J),J=1,26),I=1,4)/
1 -.400, -.402, -.402, -.403, -.403, -.399, -.395, -.390, -.387,
1 -.384, -.386, -.401, -.431, -.417, -.382, -.376, -.379, -.383,
1 -.387, -.388, -.389, -.390, -.391, -.396, -.403, -.420,
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2 -.204, -.207, -.209, -.209, -.209, -.201, -.192, -.183, -.175,
2 -.168, -.178, -.202, -.223, -.221, -.184, -.164, -.166, -.173,
2 -.181, -.183, -.186, -.189, -.191, -.207, -.223, -.243,
3 -.004, -.009, -.006,  .003,  .014,  .020,  .025,  .029,  .032,
3  .031,  .008, -.024, -.045, -.028, -.001,  .032,  .041,  .038,
3  .035,  .032,  .028,  .025,  .022,  .002, -.017, -.040,
4  .179,  .182,  .191,  .196,  .208,  .214,  .219,  .225,  .231,
4  .216,  .181,  .146,  .133,  .151,  .187,  .222,  .226,  .221,
4  .216,  .211,  .205,  .200,  .195,  .169,  .150,  .130/
 DATA((CL015(I,J),J=1,26),I=5,7)/
5  .310,  .325,  .342,  .355,  .371,  .379,  .389,  .401,  .407,
5  .376,  .322,  .270,  .245   .272,  .312,  .351,  .366,  .360,
5  .353,  .346,  .338,  .330,  .323,  .287,  .258,  .238,
6  .444,  .473,  .499,  .517,  .539,  .552,  .566,  .575,  .563,
6  .503,  .427,  .363,  .344,  .374,  .415,  .450,  .467,  .464,
6  .459,  .452,  .444,  .436,  .431,  .400,  .374,  .352,
7  .552,  .581,  .618,  .640,  .668,  .672,  .663,  .637,  .594,
7  .537,  .468,  .405,  .379,  .412,  .461,  .497,  .509,  .505,
7  .501,  .497,  .492,  .486,  .481,  .456,  .442,  .431/
 DATA((CL018(I,J),J=1,26),I=1,4)/
1 -.400, -.399, -.398, -.397, -.397, -.397, -.396, -.391, -.387,
1 -.387, -.409, -.426, -.406, -.381, -.358, -.347, -.344, -.344,
1 -.344, -.344, -.344, -.344, -.345, -.348, -.345, -.344,
2 -.177, -.183, -.184, -.184, -.183, -.181, -.179, -.177, -.181,
2 -.197, -.228, -.253, -.221, -.185, -.149, -.131, -.133, -.134,
2 -.135, -.135, -.135, -.135, -.136, -.135, -.141, -.144,
3  .006,  .004,  .003,  .003,  .006,  .010,  .013,  .019,  .023,
3 -.013, -.051, -.077, -.046,  .007,  .063,  .074,  .072,  .069,
3  .065,  .064,  .063,  .063,  .061,  .047,  .035,  .026,
4  .183,  .183,  .190,  .194,  .198,  .200,  .200,  .200,  .189,
4  .153,  .120,  .105,  .140,  .196,  .241,  .259,  .257,  .250,
4  .245,  .243,  .241,  .235,  .229,  .202,  .176,  .160/
 DATA((CL018(I,J),J=1,26),I=5,7)/
5  .317,  .324,  .332,  .341,  .347,  .347,  .348,  .343,  .314,
5  .274,  .235   .216,  .247,  .299,  .344,  .368,  .366,  .359,
5  .353,  .350,  .346,  .339,  .333,  .307,  .282,  .265,
6  .426,  .444,  .465,  .478,  .494,  .501,  .495,  .463,  .412,
6  .354,  .299,  .273,  .296,  .346,  .398,  .422,  .422,  .417,
6  .412,  .407,  .403,  .400,  .396,  .375,  .354,  .340,
7  .521,  .539,  .566,  .588,  .600,  .599,  .579,  .529,  .465,
7  .398,  .335,  .305,  .331,  .385,  .440,  .458,  .460,  .460,
7  .457,  .454,  .451,  .449,  .447,  .429,  .419,  .413/
 DATA((CL021(I,J),J=1,26),I=1,4)/
1 -.374, -.369, -.367, -.367, -.356, -.346, -.337, -.341, -.355,
1 -.371, -.379, -.366, -.337, -.308, -.286, -.286, -.293, -.302,
1 -.311, -.313, -.316, -.318, -.321, -.325, -.324, -.331,
2 -.185, -.182, -.179, -.174, -.160, -.146, -.139, -.153, -.173,
2 -.194, -.217, -.203, -.169, -.133, -.098, -.077, -.088, -.100,
2 -.112, -.123, -.135, -.141, -.146, -.151, -.157, -.165,
3  .003, -.002,  .006,  .016,  .033,  .029,  .016,  .001, -.014,
3 -.028, -.040, -.027,  .004,  .035,  .075,  .094,  .082,  .069,
3  .056,  .049,  .043,  .036,  .029, -.001, -.013, -.020,
4  .178,  .175,  .191,  .211,  .219,  .204,  .181,  .159,  .136,
4  .108,  .090,  .101,  .134,  .168,  .192,  .194,  .187,  .176,
4  .165   .155,  .148,  .142,  .135,  .106,  .091,  .086/
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 DATA((CL021(I,J),J=1,26),I=5,7)/
5  .290,  .294,  .307,  .323,  .318,  .304,  .275,  .246,  .217,
5  .183,  .158,  .178,  .221,  .270,  .304,  .301,  .289,  .278,
5  .268,  .258,  .247,  .239,  .231,  .194,  .175,  .158,
6  .373,  .373,  .384,  .404,  .401,  .379,  .343,  .307,  .271,
6  .233,  .212,  .229,  .283,  .340,  .377,  .381,  .371,  .361,
6  .351,  .340,  .330,  .320,  .310,  .275,  .248,  .227,
7  .456,  .463,  .498,  .522,  .506,  .467,  .418,  .368,  .319,
7  .270,  .242,  .268,  .320,  .377,  .419,  .424,  .411,  .398,
7  .388,  .377,  .366,  .356,  .346,  .310,  .287,  .267/
 DATA((ALP004(J,N),N=1,9),J=1,13)/
& -4.05, -2.07,  -.10,  1.94,  3.82,  5.88,  8.34, 10.82, 13.30,
& -4.08, -2.10,  -.13,  1.75,  3.63,  5.46,  7.78, 10.32, 12.85,
& -4.10, -2.12,  -.23,  1.55,  3.40,  5.05,  7.01,  9.61, 12.21,
& -4.10, -2.14,  -.30,  1.45,  3.23,  4.83,  6.49,  9.05, 11.62,
& -4.11, -2.16,  -.39,  1.31,  3.01,  4.59,  5.98,  8.83, 11.71,
& -4.09, -2.16,  -.44,  1.24,  2.90,  4.49,  5.91,  8.89, 11.97,
& -4.08, -2.18,  -.50,  1.17,  2.82,  4.40,  5.9[illegible],  8.98, 12.18,
& -4.06, -2.20,  -.57,  1.09,  2.76,  4.35,  5.89,  9.26, 12.77,
& -4.05, -2.28,  -.67,  1.01,  2.73,  4.38,  5.97,  9.47, 13.01,
& -4.14, -2.40,  -.77,   .91,  2.68,  4.42,  6.11,  9.68, 13.25,
& -4.23, -2.53,  -.88,   .83,  2.68,  4.49,  6.29,  9.93, 13.56,
& -4.36, -2.67,  -.95,   .85,  2.73,  4.54,  6.48, 10.15, 13.82,
& -4.53, -2.76,  -.95,   .90,  2.78,  4.61,  6.65, 10.25, 13.86/
 DATA((ALP004(J,N),N=1,9),J=14,26)/
& -4.62, -2.74,  -.89,   .95,  2.84,  4.67,  6.79, 10.40, 14.00,
& -4.55, -2.69,  -.86,  1.00,  2.90,  4.71,  6.89, 10.53, 14.16,
& -4.42, -2.62,  -.82,  1.03,  2.94,  4.76,  7.00, 10.64, 14.27,
& -4.43, -2.61,  -.80,  1.07,  2.98,  4.80,  7.08, 10.75, 14.42,
& -4.44, -2.63,  -.81,  1.07,  2.98,  4.81,  7.10, 10.70, 14.31,
& -4.47, -2.67,  -.85,  1.04,  2.93,  4.73,  6.94, 10.48, 14.02,
& -4.51, -2.72,  -.91,   .95,  2.85,  4.65,  6.71, 10.35, 13.98,
& -4.54, -2.74,  -.96,   .88,  2.79,  4.59,  6.53, 10.34, 14.15,
& -4.53, -2.76,  -.97,   .89,  2.80,  4.59,  6.47, 10.39, 14.31,
& -4.54, -2.69,  -.86,  1.00,  2.80,  4.66,  6.69, 10.39, 14.09,
& -3.89, -2.09,  -.32,  2.06,  4.41,  6.52, 10.09, 13.66, 17.23,
& -3.83, -1.95,  -.13,  2.87,  5.92,  8.91, 11.90, 14.88, 17.87,
& -3.83, -1.89,  -.06,  3.35,  7.03, 10.57, 14.11, 17.65, 21.19/
 DATA((ALP006(J,N),N=1,9),J=1,13)/
& -4.01, -2.03,  -.02,  2.09,  4.23,  6.28,  8.35, 10.42, 12.50,
& -4.00, -1.99,  0.00,  1.98,  4.00,  5.91,  8.16, 10.42, 12.68,
& -3.99, -1.97,   .01,  1.83,  3.77,  5.46,  7.94, 10.82, 13.70,
& -3.99, -2.02,  -.03,  1.74,  3.64,  5.27,  7.40, 10.01, 12.63,
& -3.98, -2.06,  -.10,  1.65,  3.43,  5.02,  6.88,  9.45, 12.01,
& -3.98, -2.08,  -.14,  1.57,  3.32,  4.90,  6.64,  9.21, 11.77,
& -3.98, -2.10,  -.18,  1.51,  3.22,  4.80,  6.49,  9.26, 12.04,
& -3.98, -2.14,  -.28,  1.44,  3.13,  4.74,  6.56,  9.69, 12.81,
& -4.01, -2.18,  -.37,  1.36,  3.04,  4.69,  6.70, 10.17, 13.65,
& -4.04, -2.23,  -.46,  1.28,  2.96,  4.68,  6.99, 10.47, 13.95,
& -4.05, -2.28,  -.56,  1.19,  2.93,  4.76,  7.29, 10.74, 14.19,
& -4.08, -2.33,  -.66,  1.11,  2.92,  4.85,  7.59, 10.98, 14.37,
& -4.10, -2.39,  -.67,  1.17,  2.99,  4.99,  7.88, 11.19, 14.50/
 DATA((ALP006(J,N),N=1,9),J=14,26)/
& -4.12, -2.35,  -.61,  1.25,  3.09,  5.19,  8.18, 11.46, 14.74,
& -4.04, -2.29,  -.55,  1.33,  3.19,  5.37,  8.55, 11.97, 15.38,
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& -3.99, -2.22,  -.51,  1.41,  3.29,  5.45,  8.99, 12.87, 16.76,
& -3.79, -2.18,  -.47,  1.45,  3.31,  5.39,  8.96, 13.04, 17.12,
& -3.83, -2.21,  -.50,  1.35,  3.23,  5.28,  8.53, 12.30, 16.08,
& -3.92, -2.27,  -.54,  1.27,  3.10,  5.13,  8.16, 11.70, 15.24,
& -4.01, -2.29,  -.61,  1.17,  2.98,  5.01,  8.04, 11.58, 15.12,
& -4.06, -2.25,  -.60,  1.16,  3.00,  5.05,  8.13, 11.80, 15.47,
& -3.99, -2.15,  -.53,  1.26,  3.15,  5.29,  8.46, 12.00, 15.54,
& -3.91, -2.05,  -.42,  1.39,  3.31,  5.54,  8.79, 12.24, 15.69,
& -3.74, -1.75,   .19,  2.20,  4.59,  7.44, 10.47, 13.50, 16.53,
& -3.71, -1.66,   .48,  2.97,  6.19,  9.42, 12.65, 15.87, 19.10,
& -3.71, -1.65,   .65,  3.78,  7.51, 11.59, 15.67, 19.76, 23.84/
 DATA((ALP009(J,N),N=1,9),J=1,13)/
& -4.42, -2.09,   .04,  2.19,  4.17,  6.60,  9.46, 12.31, 15.17,
& -4.45, -2.29,   .04,  2.10,  4.07,  5.99,  8.57, 11.15, 13.73,
& -4.51, -2.38,  -.02,  1.98,  3.91,  5.65,  7.95, 10.40, 12.86,
& -4.53, -2.42,  -.08,  1.89,  3.81,  5.43,  7.60, 10.10, 12.60,
& -4.53, -2.50,  -.16,  1.77,  3.64,   .22,  7.19,  9.68, 12.16,
& -4.56, -2.54,  -.20,  1.71,  3.53,  5.09,  7.14, 10.10, 13.07,
& -4.57, -2.57,  -.27,  1.66,  3.43,  5.08,  7.29, 10.32, 13.35,
& -4.60, -2.60,  -.32,  1.59,  3.33,  5.09,  7.58, 10.81, 14.03,
& -4.63, -2.63,  -.39,  1.53,  3.24,  5.15,  7.92, 11.12, 14.32,
& -4.66, -2.64,  -.45,  1.47,  3.18,  5.29,  8.27, 11.39, 14.52,
& -4.70, -2.65,  -.53,  1.40,  3.23,  5.58,  8.86, 12.22, 15.58,
& -4.76, -2.63,  -.58,  1.37,  3.37,  5.94,  9.50, 13.07, 16.64,
& -4.81, -2.62,  -.55,  1.47,  3.64,  6.41, 10.29, 14.17, 18.06/
 DATA((ALP009(J,N),N=1,9),J=14,26)/
& -4.74, -2.59,  -.47,  1.65,  3.93,  7.01, 11.13, 15.26, 19.38,
& -4.55, -2.54,  -.44,  1.82,  4.20,  7.72, 12.78, 17.85, 22.91,
& -4.64, -2.57,  -.47,  1.74,  4.08,  7.53, 13.01, 18.49, 23.97,
& -4.77, -2.69,  -.59,  1.58,  3.78,  6.84, 12.24, 17.65, 23.05,
& -4.83, -2.79,  -.71,  1.43,  3.51,  6.18, 11.39, 16.57, 21.77,
& -4.83, -2.78,  -.67,  1.41,  3.41,  5.88, 10.72, 15.55, 20.59,
& -4.84, -2.74,  -.61,  1.47,  3.50,  6.10, 10.98, 15.85, 20.73,
& -4.83, -2.70,  -.55,  1.54,  3.61,  6.43, 11.19, 15.95, 20.71,
& -4.79, -2.65,  -.50,  1.61,  3.72,  6.76, 11.63, 16.51, 21.39,
& -4.75, -2.60,  -.44,  1.68,  3.86,  7.10, 11.98, 16.85, 21.73,
& -4.57, -2.38,  -.06,  2.21,  4.90,  8.99, 13.69, 18.40, 23.11,
& -4.53, -2.12,   .29,  2.85,  5.91, 10.46, 15.06, 19.66, 24.25,
& -4.48, -1.82,   .56,  3.50,  7.26, 11.51, 15.77, 20.02, 24.28/
 DATA((ALP012(J,N),N=1,9),J=1,13)/
& -4.00, -1.99,   .04,  2.11,  4.68,  7.54, 10.96, 14.38, 17.79,
& -4.00, -1.98,   .06,  2.09,  4.43,  6.93,  9.90, 12.86, 15.82,
& -3.99, -1.97,   .07,  2.05,  4.22,  6.45,  9.15, 11.85, 14.55,
& -3.98, -1.97,   .07,  1.99,  4.10,  6.16,  8.70, 11.23, 13.76,
& -3.97, -1.96,   .02,  1.92,  3.94,  5.82,  8.29, 10.82, 13.35,
& -3.97, -1.97,  -.02,  1.89,  3.85,  5.68,  8.21, 10.90, 13.58,
& -3.97, -1.98,  -.06,  1.86,  3.77,  5.61,  8.64, 12.00, 15.36,
& -3.98, -2.00,  -.09,  1.84,  3.67,  5.68,  9.13, 12.83, 16.54,
& -3.99, -2.03,  -.12,  1.82,  3.60,  5.97, 10.30, 14.65, 19.00,
& -4.00, -2.05,  -.14,  1.87,  3.63,  6.76, 11.82, 16.89, 21.95,
& -4.03, -2.07,  -.14,  1.96,  3.78,  7.97, 14.12, 20.28, 26.43,
& -4.06, -2.08,  -.07,  2.15,  4.24,  9.89, 17.30, 24.70, 32.11,
& -4.00, -1.86,   .20,  2.38,  5.04, 11.80, 19.80, 27.80, 35.80/
 DATA((ALP012(J,N),N=1,9),J=14,26)/
& -3.83, -1.72,   .37,  2.50,  5.34, 12.00, 19.55, 27-09, 34.64,
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& -3.94, -1.88,   .20,  2.26,  4.93, 10.74, 17.75, 24.77, 31.79,
& -4.13, -2.13,  -.03,  2.05,  4.36,  9.89, 17.30, 24.70, 32.11,
& -4.13, -2.14,  -.15,  1.94,  3.89,  8.92, 16.62, 24.31, 32.00,
& -4.12, -2.16,  -.14,  1.91,  3.82-  8.57, 16.73, 24.90, 33.06,
& -4.11, -2.14,  -.12,  1.98,  3.89,  8.90, 17.06, 25.22, 33.39,
& -4.10, -2.12,  -.10,  2.05,  4.05,  9.13, 16.68, 24.23, 31.77,
& -4.09, -2.11,  -.09,  2.11,  4.28,  9.31, 16.21, 23.10, 30.00,
& -4.07, -2.09,  -.07,  2.19,  4.50,  9.38, 15.63, 21.88, 28.13,
& -4.06, -2.07,  -.05,  2.26,  4.71,  9.43, 15.14, 20.86, 26.57,
& -4.00, -1.97,   .05,  2.58,  5.59,  9.80, 14.15, 18.50, 22.85,
& -4.00, -1.83,   .24,  2.96,  6.31, 10.15, 14.00, 17.85, 21.69,
& -4.04, -1.73,   .35,  3.37,  6.92, 10.65, 14.39, 18.13, 21.87/
 DATA((ALP015(J,N),N=1,9),J=1,13)/
& -4.00, -1.96,   .04,  2.32,  5.34,  8.89, 12.59, 16.30, 20.00,
& -3.98, -1.93,   .09,  2.25,  5.01,  8.35, 12.06, 15.76, 19.46,
& -3.98, -1.91,   .06,  2.12,  4.74,  7.70, 11.06, 14.42, 17.78,
& -3.97, -1.92,  -.03,  2.05,  4.56,  7.35, 10.60, 13.85, 17.11,
& -3.97, -1.92,  -.13,  1.92,  4.35,  6.95, 10.05, 13.15, 16.25,
& -4.01, -1.99,  -.18,  1.86,  4.24,  6.80, 10.13, 13.47, 16.80,
& -4.05, -2.08,  -.23,  1.80,  4.12,  6.70, 10.82, 14.95, 19.07,
& -4.10, -2.16,  -.27,  1.74,  3.99,  6.81, 13.26, 19.71, 26.16,
& -4.12, -2.24,  -.31,  1.69,  3.92,  8.39, 21.29, 34.19, 47.10,
& -4.15, -2.30,  -.31,  1.83,  4.38, 11.71, 23.47, 35.24, 47.00,
& -4.13, -2.21,  -.09,  2.27,  5.49, 14.44, 24.20, 33.95, 43.71,
& -3.99, -1.98,   .28,  2.87,  7.76, 17.29, 26.81, 36.33, 45.86,
& -3.70, -1.74,   .51,  3.20,  9.20, 20.63, 32.06, 43.49, 54.91/
 DATA((ALP015(J,N),N=1,9),J=14,26)/
& -3.83, -1.78,   .31,  2.81,  7.37, 17.89, 28.42, 38.95, 49.47,
& -4.18, -2.16,   .01,  2.21,  5.71, 14.04, 22.74, 31.43, 40.13,
& -4.23, -2.34,  -.33,  1.77,  4.99, 12.38, 20.89, 29.40, 37.91,
& -4.20, -2.32,  -.40,  1.72,  4.67, 12.33, 21.86, 31.38, 40.90,
& -4.16, -2.26,  -.36,  1.77,  4.77, 12 .3, 22.39, 32.15, 41.90,
& -4.13, -2.18,  -.32,  1.82,  4.89, 12.71, 22.24, 31.76, 41.29,
& -4.12, -2.17,  -.30,  1.88,  5.02, 12.58, 21.47, 30.36, 39.24,
& -4.11, -2.14,  -.26,  1.94,  5.17, 12.50, 20.83, 29.17, 37.50,
& -4.10, -2.11,  -.23,  2.00,  5.32, 12.56, 20.56, 28.56, 36.56,
& -4.09, -2.09,  -.21,  2.09,  5.43, 12.76, 20.76, 28.76, 36.76,
& -4.04, -1.93,  -.02,  2.53,  6.00, 13.14, 20.29, 27.43, 34.57,
& -3.97, -1.78,   .20,  2.93,  6.76, 12.65, 18.53, 24.41, 30.29,
& -3.77, -1.58,   .47,  3.30,  7.22, 12.28, 17.34, 22.41, 27.47/
 DATA((ALP018(J,N),N=1,9),J=1,13)/
& -4.00, -2.21,  -.07,  2.25,  5.52,  9.66, 13.87, 18.08, 22.29,
& -4.01, -2.16,  -.04,  2.24,  5.27,  9.28, 13.49, 17.71, 21.92,
& -4.02, -2.15,  -.03,  2.14,  5.01,  8.68, 12.68, 16.68, 20.68,
& -4.03, -2.15,  -.03,  2.08,  4.86,  8.22, 11.85, 15.49, 19.13,
& -4.03, -2.16,  -.06,  2.03,  4.72,  8.00, 11.77, 15.55, 19.32,
& -4.03, -2.18,  -.10,  2.00,  4.69,  8.02, 12.10, 16.18, 20.27,
& -4.04, -2.19,  -.14,  2.00,  4.71,  8.50, 13.26, 18.02, 22.79,
& -4.08, -2.21,  -.19,  2.00,  4.95, 10.15, 16.21, 22.27, 28.33,
& -4.13, -2.18,  -.23,  2.18,  5.76, 13.09, 20.64, 28.19, 35.74,
& -4.14, -2.03,   .16,  2.78,  8.09, 17.18, 26.27, 35.36, 44.45,
& -3.90, -1.68,   .60,  3.39, 11.61, 22.72, 33.83, 44.94, 56.06,
& -3.70, -1.40,   .85,  3.71, 13.94, 26.44, 38.94, 51.44, 63.94,
& -3.94, -1.76,   .49,  3.12, 11.94, 23.37, 34.80, 46.23, 57.66/
 DATA((ALP018(J,N),N=1,9),J=14,26)/
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& -4.19, -2.15,  -.07,  2.06,  8.77, 19.03, 29.28, 39.54, 49.79,
& -4.40, -2.49,  -.59,  1.54,  6.10, 15.62, 25.14, 34.67, 44.19,
& -4.49, -2.64,  -.72,  1.36,  5.19, 15.89, 27.00, 38.11, 49.22,
& -4.53, -2.64,  -.70,  1.38,  5.21, 15.37, 25.89, 36.42, 46.95,
& -4.53, -2.63,  -.68,  1.45,  5.41, 14.51, 23.81, 33.12, 42.42,
& -4.54, -2.62,  -.65,  1.50,  5.59, 14.36, 23.24, 32.13, 41.02,
& -4.54, -2.62,  -.64,  1.52,  5.75, 14.21, 22.72, 31.23, 39.74,
& -4.54, -2.62,  -.64,  1.54,  5.89, 14.21, 22.54, 30.88, 39.21,
& -4.54, -2.62,  -.64,  1.59,  6.00, 14.16, 22.33, 30.49, 38.65,
& -4.53, -2.61,  -.62,  1.65,  6.16, 14.00, 21.84, 29.69, 37.53,
& -4.49, -2.61,  -.52,  1.97,  6.93, 14.33, 21.74, 29.15, 36.56,
& -4.54, -2.58,  -.40,  2.45,  7.42, 13.57, 19.72, 25.88, 32.03,
& -4.56, -2.56,  -.31,  2.76,  7.64, 13.12, 18.60, 24.08, 29.56/
 DATA((ALP021(J,N),N=1,9),J=1,13)/
& -4.28, -2.16,  -.03,  2.39,  6.[illegible], 11.47, 16.29, 21.11, 25.93,
& -4.33, -2.19,   .02,  2.42,  6.6[illegible], 11.04, 15.49, 19.93, 24.38,
& -4.35, -2.22,  -.06,  2.16,  6.28,  9.79, 13.30, 16.81, 20.32,
& -4.34, -2.27,  -.17,  1.89,  5.90,  9.32, 12.71, 16.10, 19.49,
& -4.45, -2.41,  -.34,  1.80,  5.98,  9.79, 13.60, 17.41, 21.22,
& -4.54, -2.54,  -.33,  1.95,  6.48, 11.02, 15.57, 20.11, 24.66,
& -4.64, -2.62,  -.21,  2.40,  7.52, 12.85, 18.19, 23.52, 28.85,
& -4.63, -2.50,  -.01,  2.94,  9.05, 15.61, 22.16, 28.72, 35.28,
& -4.49, -2.30,   .19,  3.58, 11.38, 19.71, 28.04, 36.38, 44.71,
& -4.33, -2.07,   .41,  4.68, 15.03, 25.84, 36.65, 47.46, 58.27,
& -4.26, -1.81,   .62,  5.56, 18.53, 31.87, 45.20, 58.53, 71.87,
& -4.42, -1.97,   .42,  4.86, 14.77, 25.03, 35.28, 45.54, 55.79,
& -4.75, -2.37,  -.05,  3.52, 12.32, 23.14, 33.95, 4[illegible] 76, 55.57/
 DATA((ALP021(J,N),N=1,9),J=14,26)/
& -5.05, -2.77,  -.42,  2.63,  9.24, 20.05, 3[illegible].86, 41.68, 52.49,
& -5.21, -3.09,  -.87,  2.14,  7.10, 16.62, 2[illegible] 14, 35.67, 45.19,
& -5.09, -3.18, -1.10,  2.11,  6.88, 16.19, 25.[illegible]9, 34.79, 44.09,
& -5.04, -3.09,  -.96,  2.25,  7.45, 17.45, 27.45, 37.45, 47.45,
& -4.97, -2.99,  -.82,  2.47,  8.11, 18.92, 29.73, 40.54, 51.35,
& -4.89, -2.88,  -.67,  2.68,  8.65, 19.46, 30.27, 41.08, 51.89,
& -4.92, -2.81,  -.57,  2.87,  9.24, 20.05, 30.86, 41.68, 52.49,
& -4.93, -2.72,  -.48,  3.05,  9.89, 21.00, 32.11, 43.22, 54.33,
& -4.93, -2.67,  -.41,  3.20, 10.44, 21.56, 32.67, 43.78, 54.89,
& -4.90, -2.62,  -.33,  3.35, 11.00, 22.11, 33.22, 44.33, 55.44,
& -4.86, -2.56,   .02,  4.15, 13.14, 24.57, 36.00, 47.43, 58.86,
& -4.91, -2.51,   .25,  4.68, 13.79, 24.05, 34.31, 44.56, 54.82,
& -4.83, -2.42,   .38,  5.22, 14.65, 24.65, 34.65, 44.65, 54.65/
 DATA((CD004(I,J),J=1,26),I=1,5)/
1 .0046, .0046, .0046, .0046, .0046, .0046, .0046, .0046, .0046,
1 .0046, .0046, .0046, .0047, .0061, .0111, .0161, .0200, .0221,
1 .0225, .0226, .0226, .0225, .0220, .0185, .0159, .0149,
2 .0066, .0065, .0064, .0064, .0064, .0065, .0065, .0065, .0065,
2 .0065, .0066, .0070, .0077, .0088, .0138, .0196, .0234, .0253,
2 .0264, .0267, .0271, .0274, .0275, .0280, .0278, .0274,
3 .0177, .0144, .0126, .0122, .0117, .0115, .0115, .0116, .0116,
3 .0116, .0118, .0119, .0135, .0181, .0237, .0293, .0340, .0370,
3 .0387, .0405, .0417, .0428, .0430, .0501, .0565, .0632,
4 .0446, .0359, .0305, .0278, .0272, .0293, .0321, .0349, .0377,
4 .0405, .0439, .0482, .0524, .0567, .0609, .0651, .0694, .0736,
4 .0772, .0805, .0838, .0871, .0904, .1047, .1141, .1216,
5 .0877, .0599, .0537, .0569, .0623, .0651, .0691, .0759, .0826,
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5 .0894, .0969, .1051, .1133, .1215, .1282, .1332, .1382, .1432,
5 .1471, .1498, .1526, .1553, .1580, .1707, .1792, .1826/
 DATA((CD006(I,J),J=1,26),I=1,5)/
1 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0045, .0046,
1 .0047, .0049, .0053, .0071, .0142, .0218, .0261, .0287, .0293,
1 .0297, .0301, .0302, .0301, .0300, .0284, .0261, .0238,
2 .0070, .0069, .0069, .0069, .0069, .0068, .0068, .0068, .0068,
2 .0069, .0074, .0084, .0117, .0188, .0244, .0283, .0311, .0330,
2 .0344, .0348, .0352, .0356, .0360, .0365, .0358, .0338,
3 .0149, .0137, .0131, .0128, .0124, .0123, .0121, .0120, .0118,
3 .0119, .0128, .0145, .0185, .0253, .0321, .0375, .0406, .0427,
3 .0444, .0459, .0473, .0488, .0502, .0582, .0662, .0743,
4 .0384, .0314, .0267, .0237, .0217, .0213, .0223, .0244, .0275,
4 .0316, .0388, .0460, .0532, .0525, .0736, .0825, .0897, .0951,
4 .0982, .1013, .1037, .1052, .1066, .1153, .1239, .1326,
5 .0699, .0522, .0515, .0546, .0615, .0650, .0684, .0719, .0753,
5 .0815, .0881, .0947, .1013, .1121, .1265, .1408, .1553, .1711,
5 .1792, .1816, .1839, .1862, .1886, .2025, .2153, .2261/
 DATA((CD009(I,J),J=1,26),I=1,5)/
1 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044,
1 .0044, .0045, .0061, .0096, .0148, .0224, .0312, .0379, .0428,
1 .0457, .0485, .0508, .0527, .0533, .0506, .0464, .0422,
2 .0063, .0064, .0064, .0065, .0066, .0066, .0067, .0067, .0069,
2 .0076, .0092, .0135, .0196, .0266, .0337, .0399, .0450, .0490,
2 .0517, .0539, .0555, .0565, .0569, .0569, .0556, .0542,
3 .0120, .0123, .0124, .0124, .0125, .0125, .0125, .0126, .0126,
3 .0132, .0151, .0223, .0302, .0385, .0460, .0524, .0558, .0592,
3 .0619, .0640, .0661, .0682, .0697, .0773, .0842, .0910,
4 .0251, .0242, .0238, .0236, .0236, .0237, .0237, .0238, .0250,
4 .0298, .0374, .0470, .0575, .0685, .0800, .0905, .0993, .1048,
4 .1102, .1146, .1189, .1232, .1275, .1388, .1422, .1432,
5 .0502, .0466, .0435, .0422, .0439, .0467, .0517, .0602, .0688,
5 .0773, .0865, .0968, .1067, .1161, .1254, .1347, .1439, .1532,
5 .1606, .1669, .1732, .1787, .1842, .1957, .1957, .1957/
 DATA((CD012(I,J),J=1,26),I=1,5)/
1 .0059, .0059, .0059, .0059, .0059, .0059, .0059, .0059, .0059,
1 .0061, .0067, .0139, .0242, .0357, .0468, .0558, .0616, .0666,
1 .0695, .0724, .0738, .0749, .0756, .0768, .0764, .0717,
2 .0085, .0084, .0085, .0085, .0085, .0085, .0085, .0085, .0085,
2 .0094, .0164, .0263, .0365, .0471, .0553, .0614, .0676, .0708,
2 .0737, .0765, .0785, .0795, .0805, .0849, .0854, .0843,
3 .0151, .0149, .0148, .0149, .0149, .0150, .0152, .0154, .0163,
3 .0209, .0297, .0385, .0478, .0582, .0670, .0746, .0803, .0850,
3 .0894, .0927, .0961, .0992, .1008, .1082, .1126, .1160,
4 .0233, .0251, .0260, .0265, .0268, .0270, .0272, .0287, .0323,
4 .0471, .0637, .0790, .0929, .1037, .1114, .1190, .1256, .1314,
4 .1372, .1417, .1448, .1479, .1508, .1637, .1693, .1744,
5 .0347, .0401, .0416, .0422, .0450, .0488, .0542, .0636, .0792,
5 .0947, .1116, .1300, .1484, .1626, .1742, .1859, .1923, .1953,
5 .1982, .2011, .2016, .2016, .2016, .2016, .2016, .2016/
 DATA((CD015(I,J),J=1,26),I=1,5)/
1 .0071, .0065, .0062, .0061, .0060, .0060, .0060, .0061, .0070,
1 .0138, .0219, .0356, .0497, .0633, .0764, .0861, .0958, .1016,
1 .1074, .1119, .1155, .1179, .1187, .1182, .1099, .1009,
2 .0104, .0105, .0107, .0109, .0111, .0112, .0114, .0123, .0148,
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2 .0235, .0331, .0449, .0567, .0685, .0792, .0892, .0967, .1039,
2 .1110, .1163, .1196, .1228, .1248, .1260, .1205, .1119,
3 .0197, .0203, .0206, .0207, .0209, .0209, .0210, .0212, .0235,
3 .0323, .0438, .0558, .0664, .0772, .0881, .0975, .1063, .1135,
3 .1198, .1261, .1305, .1335, .1365, .1463, .1521, .1545,
4 .0275, .0322, .0346, .0358, .0370, .0382, .0398, .0442, .0546,
4 .0684, .0806, .0925, .1048, .1172, .1283, .1376, .1468, .1537,
4 .1598, .1659, .1700, .1735, .1770, .1925, .2025, .2126,
5 .0399, .0476, .0514, .0534, .0553, .0579, .0626, .0751, .0897,
5 .1073, .1266, .1438, .1596, .1753, .1879, .2002, .2124, .2232,
5 .2317, .2403, .2488, .2550, .2598, .2697, .2697, .2697/
 DATA((CD018(I,J),J=1,26),I=1,5)/
1 .0081, .0089, .0097, .0100, .0104, .0106, .0108, .0110, .0112,
1 .0187, .0348, .0526, .0693, .0845, .0983, .1096, .1173, .1232,
1 .1277, .1308, .1339, .1354, .1359, .1358, .1341, .1320,
2 .0112, .0152, .0173, .0183, .0193, .0198, .0205, .0220, .0268,
2 .0421, .0566, .0715, .0845, .0966, .1071, .1165, .1242, .1294,
2 .1346, .1398, .1420, .1442, .1463, .1521, .1553, .1586,
3 .0197, .0267, .0302, .0319, .0337, .0350, .0367, .0392, .0462,
3 .0575, .0695, .0817, .0930, .1037, .1143, .1248, .1344, .1391,
3 .1438, .1486, .1522, .1542, .1563, .1683, .1804, .1925,
4 .0346, .0484, .0538, .0564, .0595, .0614, .0660, .0767, .0923,
4 .1108, .1297, .1489, .1631, .1738, .1808, .1858, .1908, .1945,
4 .1977, .2008, .2040, .2069, .2095, .2250, .2406, .2561,
5 .0553, .0739, .0830, .0876, .0944, .0981, .1051, .1139, .1329,
5 .1562, .1864, .2150, .2351, .2502, .2625, .2713, .2800, .2888,
5 .2976, .3035, .3085, .3135, .3184, .3429, .3535, .3642/
 DATA((CD021(I,J),J=1,26),I=1,5)/
1 .0093, .0113, .0123, .0129, .0135, .0137, .0142, .0167, .0277,
1 .0405, .0535, .0665, .0795, .0915, .1024, .1133, .1242, .1343,
1 .1421, .1500, .1578, .1656, .1714, .1816, .1804, .1775,
2 .0136, .0172, .0190, .0199, .0208, .0213, .0224, .0307, .0401,
2 .0499, .0620, .0741, .0861, .0982, .1103, .1224, .1328, .1424,
2 .1520, .1617, .1713, .1757, .1786, .1857, .1857, .1857,
3 .0280, .0332, .0358, .0371, .0383, .0398, .0421, .0501, .0605,
3 .0719, .0837, .0959, .1087, .1215, .1331, .1446, .1561, .1677,
3 .1793, .1836, .1878, .1919, .1961, .2031, .2021, .2010,
4 .0566, .0668, .0730, .0772, .0814, .0840, .0884, .0973, .1132,
4 .1291, .1449, .1577, .1702, .1826, .1920, .2005, .2089, .2173,
4 .2257, .2320, .2358, .2396, .2433, .2509, .2530, .2551,
5 .1044, .1234, .1329, .1376, .1423, .1446, .1610, .1781, .1953,
5 .2125, .2285, .2444, .2604, .2764, .2898, .2941, .2983, .3026,
5 .3069, .3091, .3088, .3084, .3081, .3062, .3042, .3023/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
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      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,26,XMI,7,CL004,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL004,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL006,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL006,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL009,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL009,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL012,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL012,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL015,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL015,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL018,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL018,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL021,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL021,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP004,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP004,IORDER,IPT,XM,CL,AA04,IERR)
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      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP006,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
 20   CALL IBI (26,XMI,9,CLI,26,ALP006,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP009,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
 30   CALL IBI (26,XMI,9,CLI,26,ALP009,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP012,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
 40   CALL IBI (26,XMI,9,CLI,26,ALP012,IORDER,IPT,XM,CL,AA12,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP015,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP015,IORDER,IPT,XM,CL,AA15,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP018,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
 60   CALL IBI (26,XMI,9,CLI,26,ALP018,IORDER,IPT,XM,CL,AA18,IERR)
      IPT(1)=-1
      CALL IBI (26,XMI,9,CLI,26,ALP021,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP021,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
 400  CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
  91  CALL IBI (5,CLII,26,XMI,5,CD004,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
  11  CALL IBI (5,CLII,26,XMI,5,CD004,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD006,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04+(CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
  21  CALL IBI (5,CLII,26,XMI,5,CD006,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD009,IORDER,IPT,CL,XM,CDRG09,IERR)
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      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD009,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD012,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD012,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD015,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12+(CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD015,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD018,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD018,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT(1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD021,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD021,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE (6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF (CL .GT. .3) GO TO 251
      RETURN
  251 CALL COMPUT(U,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO1(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C  CHARACTERISTIC FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-1XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
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C
C
C
      DIMENSION IORDER(2),IPT(2),ALP104(26,9),ALP106(26,9),
     & ALP109(26,9),ALP112(26,9),ALP115(26,9),ALP118(26,9),
     & ALP121(26,9),CLI(9),XMI(26),ALPI(7),CL104(7,26),
     & CL106(7,26),CL109(7,26),CL112(7,26),CL115(7,26),
     & CL118(7,26),CL121(7,26),CD104(5,26),CD106(5,26),
     & CD109(5,26),CD112(5,26),CD115(5,26),CD118(5,26),
     & CD121(5,26),CLII(5)
      DATA((CL104(I,J),J=1,26),I=1,4)/
     1 -.302, -.302, -.302, -.302, -.304, -.308, -.312, -.315, -.317,
     1 -.318, -.318, -.306, -.294, -.277, -.261, -.247, -.247, -.262,
     1 -.262, -.258, -.256, -.256, -.256, -.317, -.324, -.308,
     2 -.099, -.116, -.125, -.131, -.138, -.144, -.149, -.155, -.161,
     2 -.161, -.155, -.138, -.112, -.085, -.068, -.066, -.082, -.081,
     2 -.079, -.072, -.067, -.069, -.072, -.128, -.133, -.128,
     3  .095,  .098,  .108,  .117,  .126,  .130,  .134,  .141,  .147,
     3  .154,  .161,  .167,  .175,  .183,  .190,  .182,  .165,  .155,
     3  .158,  .168,  .176,  .183,  .175,  .057, -.009, -.014,
     4  .301,  .318,  .339,  .355,  .378,  .389,  .400,  .412,  .424,
     4  .436,  .448,  .459,  .467,  .460,  .450,  .433,  .416,  .407,
     4  .415,  .430,  .445,  .450,  .430,  .246,  .136,  .104/
      DATA((CL104(I,J),J=1,26),I=5,7)/
     5  .504,  .536,  .562,  .585,  .622,  .639,  .656,  .669,  .678,
     5  .681,  .677,  .669,  .661,  .651,  .641,  .634,  .629,  .631,
     5  .642,  .656,  .669,  .675,  .656,  .410,  .255,  .215,
     6  .698,  .744,  .791,  .827,  .864,  .874,  .877,  .874,  .868,
     6  .858,  .848,  .838,  .829,  .821,  .813,  .807,  .803,  .808,
     6  .816,  .832,  .848,  .854,  .828,  .564,  .389,  .321,
     7  .852,  .893,  .971, 1.017, 1.042, 1.037, 1.026, 1.015, 1.003,
     7  .989,  .975,  .961,  .950,  .941,  .933,  .924,  .919,  .918,
     7  .924,  .935,  .955,  .964,  .934,  .697,  .521,  .438/
      DATA((CL106(I,J),J=1,26),I=1,4)/
     1 -.301, -.301, -.301, -.296, -.291, -.290, -.289, -.289, -.288,
     1 -.285, -.283, -.280, -.277, -.272, -.282, -.305, -.320, -.311,
     1 -.299, -.288, -.281, -.282, -.288, -.314, -.321, -.311,
     2 -.083, -.088, -.086, -.083, -.079, -.077, -.074, -.072, -.070,
     2 -.066, -.063, -.060, -.057, -.071, -.103, -.124, -.130, -.111,
     2 -.090, -.070, -.060, -.070, -.084, -.124, -.134, -.132,
     3  .105,  .116,  .129,  .135,  .142,  .147,  .152,  .157,  .162,
     3  .167,  .172,  .178,  .184,  .175,  .151,  .123,  .118,  .131,
     3  .153,  .171,  .168,  .155,  .143,  .072,  .021,  .003,
     4  .313,  .329,  .348,  .359,  .377,  .385,  .395,  .408,  .420,
     4  .433,  .445,  .446,  .431,  .411,  .392,  .377,  .376,  .392,
     4  .415,  .436,  .437,  .421,  .396,  .257,  .159,  .112/
      DATA((CL106(I,J),J=1,26),I=5,7)/
     5  .502,  .529,  .558,  .585,  .614,  .634,  .655,  .669,  .666,
     5  .654,  .641,  .624,  .608,  .592,  .577,  .564,  .565,  .581,
     5  .604,  .625,  .621,  .603,  .571,  .398,  .278,  .221,
     6  .684,  .731,  .782,  .823,  .872,  .877,  .864,  .849,  .831,
     6  .814,  .796,  .779,  .761,  .744,  .729,  .717,  .715,  .731,
     6  .750,  .769,  .769,  .743,  .712,  .529,  .405,  .331,
     7  .820,  .869,  .934,  .989, 1.008, 1.002,  .991,  .971,  .951,
     7  .931,  .911,  .891,  .871,  .851,  .834,  .820,  .829,  .845,
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7  .867,  .885,  .883,  .865,  .837,  .667,  .536,  .440/
 DATA((CL109(I,J),J=1,26),I=1,4)/
1 -.273, -.294, -.310, -.322, -.336, -.344, -.352, -.360, -.370,
1 -.379, -.387, -.394, -.402, -.409, -.422, -.424, -.384, -.349,
1 -.328, -.323, -.323, -.325, -.327, -.336, -.341, -.338,
2 -.077, -.081, -.094, -.103, -.112, -.118, -.124, -.130, -.137,
2 -.145, -.153, -.161, -.170, -.180, -.188, -.178, -.148, -.123,
2 -.108, -.108, -.109, -.111, -.113, -.125, -.136, -.139,
3  .099,  .099,  .099,  .103,  .107,  .110,  .113,  .117,  .120,
3  .124,  .127,  .130,  .118,  .089,  .065,  .071,  .089,  .106,
3  .119,  .119,  .109,  .100,  .090,  .043,  .016,  .008,
4  .298,  .322,  .334,  .337,  .351,  .358,  .365,  .372,  .379,
4  .384,  .387,  .378,  .339,  .298,  .266,  .283,  .310,  .337,
4  .360,  .353,  .339,  .325,  .310,  .225,  .157,  .125/
 DATA((CL109(I,J),J=1,26),I=5,7)/
5  .465,  .492,  .519,  .536,  .557,  .571,  .585,  .598,  .605,
5  .593,  .559,  .524,  .490,  .456,  .430,  .447,  .476,  .505,
5  .528,  .518,  .500,  .481,  .462,  .362,  .283,  .226,
6  .638,  .673,  .708,  .738,  .783,  .812,  .814,  .800,  .776,
6  .741,  .704,  .667,  .627,  .584,  .564,  .588,  .616,  .645,
6  .667,  .655,  .635,  .616,  .596,  .493,  .414,  .346,
7  .762,  .818,  .868,  .906,  .949,  .948,  .929,  .898,  .866,
7  .828,  .788,  .749,  .709,  .671,  .649,  .668,  .694,  .720,
7  .745,  .733,  .717,  .701,  .686,  .596,  .517,  .450/
 DATA((CL112(I,J),J=1,26),I=1,4)/
1 -.276, -.274, -.272, -.274, -.276, -.277, -.278, -.279, -.280,
1 -.281, -.282, -.294, -.340, -.373, -.362, -.306, -.301, -.303,
1 -.305, -.308, -.310, -.313, -.315, -.334, -.349, -.361,
2 -.086, -.094, -.095, -.094, -.093, -.093, -.093, -.094, -.096,
2 -.097, -.099, -.121, -.171, -.203, -.186, -.141, -.098, -.094,
2 -.097, -.099, -.102, -.105, -.109, -.128, -.143, -.148,
3  .084,  .093,  .098,  .101,  .104,  .105,  .107,  .111,  .116,
3  .119,  .103,  .071,  .034,  .014,  .028,  .055,  .082,  .104,
3  .093,  .083,  .073,  .063,  .053,  .013, -.010, -.014,
4  .283,  .287,  .298,  .303,  .311,  .315,  .319,  .324,  .328,
4  .321,  .297,  .255,  .211,  .183,  .204,  .240,  .277,  .298,
4  .287,  .272,  .258,  .243,  .229,  .165,  .125,  .095/
 DATA((CL112(I,J),J=1,26),I=5,7)/
5  .421,  .444,  .467,  .479,  .496,  .504,  .512,  .521,  .528,
5  .509,  .470,  .415,  .360,  .330,  .345,  .382,  .420,  .439,
5  .429,  .415,  .399,  .383,  .367,  .294,  .248,  .207,
6  .581,  .608,  .640,  .663,  .700,  .719,  .734,  .717,  .680,
6  .630,  .579,  .528,  .484,  .454,  .481,  .514,  .556,  .571,
6  .557,  .542,  .526,  .510,  .494,  .415,  .357,  .314,
7  .692,  .712,  .749,  .778,  .831,  .855,  .847,  .824,  .784,
7  .721,  .658,  .595,  .534,  .513,  .527,  .566,  .607,  .629,
7  .618,  .607,  .597,  .586,  .575,  .510,  .461,  .415/
 DATA((CL115(I,J),J=1,26),I=1,4)/
1 -.285, -.285, -.288, -.289, -.291, -.292, -.292, -.292, -.292,
1 -.292, -.305, -.345, -.383, -.361, -.301, -.281, -.280, -.279,
1 -.279, -.280, -.281, -.282, -.282, -.289, -.296, -.302,
2 -.104, -.117, -.128, -.134, -.138, -.140, -.142, -.147, -.152,
2 -.157, -.168, -.217, -.248, -.227, -.165, -.124, -.124, -.124,
2 -.124, -.124, -.124, -.124, -.124, -.135, -.147, -.157,
3  .073,  .070,  .071,  .072,  .075,  .077,  .079,  .082,  .081,
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3  .064,  .023, -.018, -.043, -.023,  .019,  .057,  .069,  .067,
3  .063,  .059,  .054,  .050,  .046,  .026,  .008, -.010,
4  .263,  .265,  .275,  .281,  .291,  .296,  .301,  .308,  .313,
4  .284,  .212,  .146,  .129,  .158,  .204,  .250,  .270,  .261,
4  .250,  .240,  .231,  .222,  .212,  .161,  .125,  .099/
 DATA((CL115(I,J),J=1,26),I=5,7)/
5  .388,  .410,  .428,  .438,  .459,  .471,  .481,  .489,  .474,
5  .410,  .347,  .284,  .250,  .287,  .329,  .372,  .394,  .384,
5  .374,  .364,  .354,  .344,  .334,  .279,  .233,  .204,
6  .516,  .541,  .568,  .589,  .613,  .628,  .645,  .648,  .604,
6  .526,  .448,  .376,  .342,  .366,  .415,  .462,  .480,  .469,
6  .457,  .444,  .432,  .423,  .414,  .365,  .331,  .306,
7  .628,  .657,  .688,  .711,  .741,  .759,  .752,  .722,  .658,
7  .575,  .491,  .415,  .388,  .416,  .466,  .512,  .526,  .516,
7  .506,  .496,  .487,  .477,  .468,  .419,  .382,  .355/
 DATA((CL118(I,J),J=1,26),I=1,4)/
1 -.252, -.255, -.255, -.265, -.280, -.288, -.296, -.310, -.328,
1 -.344, -.359, -.371, -.375, -.344, -.312, -.289, -.278, -.277,
1 -.280, -.283, -.286, -.289, -.289, -.293, -.296, -.298,
2 -.111, -.122, -.135, -.145, -.155, -.161, -.167, -.185, -.205,
2 -.223, -.241, -.250, -.228, -.191, -.151, -.137, -.135, -.135,
2 -.138, -.141, -.144, -.147, -.148, -.151, -.150, -.157,
3  .047,  .040,  .042,  .044,  .055,  .057,  .057,  .053,  .024,
3 -.024, -.071, -.094, -.071, -.024,  .024,  .043,  .040,  .038,
3  .035,  .032,  .029,  .027,  .024,  .009, -.006, -.013,
4  .218,  .226,  .235,  .240,  .246,  .250,  .247,  .226,  .186,
4  .132,  .072,  .047,  .082,  .148,  .209,  .232,  .224,  .217,
4  .209,  .201,  .193,  .185,  .178,  .148,  .119,  .099/
 DATA((CL118(I,J),J=1,26),I=5,7)/
5  .352,  .358,  .371,  .383,  .401,  .405,  .390,  .362,  .311,
5  .248,  .179,  .169,  .208,  .274,  .333,  .344,  .339,  .335,
5  .329,  .321,  .313,  .305,  .298,  .262,  .226,  .203,
6  .454,  .467,  .498,  .516,  .556,  .559,  .529,  .456,  .383,
6  .311,  .253,  .244,  .283,  .341,  .397,  .419,  .411,  .404,
6  .396,  .389,  .381,  .374,  .367,  .326,  .295,  .272,
7  .546,  .569,  .599,  .630,  .669,  .664,  .619,  .543,  .461,
7  .365,  .288,  .272,  .306,  .366,  .424,  .453,  .446,  .438,
7  .431,  .423,  .416,  .410,  .403,  .363,  .329,  .305/
 DATA((CL121(I,J),J=1,26),I=1,4)/
1 -.393, -.391, -.390, -.382, -.374, -.371, -.364, -.376, -.390,
1 -.419, -.438, -.420, -.371, -.305, -.252, -.254, -.259, -.265,
1 -.271, -.277, -.283, -.289, -.295, -.305, -.318, -.328,
2 -.174, -.174, -.170, -.166, -.152, -.145, -.135, -.151, -.179,
2 -.211, -.213, -.189, -.134, -.078, -.042, -.036, -.040, -.048,
2 -.056, -.064, -.072, -.080, -.088, -.127, -.148, -.151,
3  .019,  .019,  .020,  .026,  .032,  .030,  .015, -.015, -.045,
3 -.075, -.090, -.066,  .006,  .093,  .124,  .122,  .120,  .113,
3  .107,  .100,  .093,  .087,  .080,  .046,  .020,  .002,
4  .186,  .186,  .191,  .197,  .211,  .210,  .183,  .130,  .076,
4  .030,  .007,  .035,  .115,  .193,  .220,  .216,  .209,  .202,
4  .196,  .189,  .183,  .176,  .169,  .132,  .101,  .077/
 DATA((CL121(I,J),J=1,26),I=5,7)/
5  .281,  .284,  .286,  .299,  .325,  .332,  .306,  .244,  .172,
5  .113,  .100,  .126,  .207,  .283,  .314,  .309,  .303,  .294,
5  .286,  .277,  .269,  .260,  .252,  .212,  .182,  .160,
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6   386,  .386,  .398,  .414,  .450,  .435,  .398,  .316,  .234,
6  .171,  .159,  .185,  .258,  .333,  .366,  .363,  .359,  .351,
6  .343,  .335,  .328,  .320,  .312,  .269,  .233,  .205,
7  .452,  .472,  .501,  .538,  .553,  .516,  .456,  .384,  .287,
7  .204,  .180,  .205,  .285,  .350,  .389,  .393,  .386,  .380,
7  .3[illegible]3,  .366,  .360,  .353,  .346,  .301,  .265,  .235/
 DATA((ALP104(J,N),N=1,9),J=1,13)/
& -4.97, -3.00,  -.98,  1.02,  2.98,  4.99,  7.32,  9.[illegible], 12.52,
& -5.05, -2.90,  -.92,   .93,  2.75,  4.62,  6.75,  9.44, 12.12,
& -5.11, -2.85,  -.93,   .80,  2.55,  4.33,  6.10,  8.[illegible]2, 10.54,
& -5.15, -2.81,  -.94,   .70,  2.39,  4.12,  5.76,  7.82,  9.93,
& -5.16, -2.75,  -.95,   .59,  2.18,  3.82,  5.4[illegible]  7.53,  9.78,
& -5.12, -2.68,  -.95,   .54,  2.09,  3.69,  5.[illegible]3    7.55, 10.00.
& -5.08, -2.63,  -.95,   .50,  2.00,  3.56,  5.3    7.65, 10.34.
& -5.06, -2.56,  -.95,   .44,  1.91,  3.46,  5.2[illegible]    .79, 10.62,
& -5.06, -2.50,  -.95,   .38,  1.83,  3.39,  5.28,  7.96, 10.92,
& -5.04, -2.50,  -.98,   .33,  1.74,  3.34,  5.34,  8.17, 11.22,
& -5.01, -2.55, -1.02,   .27,  1.67,  3.33,  5.44,  8.39, 11.54,
& -5.12, -2.74, -1.10,   .23,  1.[illegible]0,  3.34,  5.55,  8.63, 11.89,
& -5.16, -2.97, -1.22,   .17,  1.54,  3.37,  5.65,  8.83, 12.13/
 DATA((ALP104(J,N),N=1,9),J=14,26)/
& -5.28, -3.20, -1.37,   .12,  1.57,  3.47,  5.75,  8.98, 12.32,
& -5.44, -3.37, -1.47,   .08,  1.62,  3.57,  5.85,  9.12, 12.45,
& -5.69, -3.48, -1.47,   .14,  1.74,  3.66,  5.92,  9.30, 12.72,
& -5.85, -3.43, -1.34,   .28,  1.87,  3.73,  5.97,  9.40, 12.84,
& -5.52, -3.31, -1.31,   .36,  1.94,  3.72,  5.91,  9.49, 13.13,
& -5.51, -3.32, -1.33,   .33,  1.88,  3.63,  5.82,  9.41, 13.11,
& -5.53, -3.38, -1.40,   .24,  1.77,  3.50,  5.64,  9.26, 13.15,
& -5.52, -3.41, -1.45,   .18,  1.67,  3.38,  5.46,  8.84, 12.58,
& -5.54, -3.40, -1.45,   .13,  1.63,  3.33,  5.40,  8.65, 12.29,
& -5.5[illegible]. -3.39, -1.42,   .20,  1.76,  3.50,  5.67,  9.25, 13.02,
& -4.88, -2.76,  -.62,  1.51,  3.88,  6.54,  9.55, 12.56, 15.56,
& -4.80, -2.70,   .12,  3.08,  6.17,  9.20, 12.23, 15.26, 18.29,
& -5.02, -2.80,   .24,  3.73,  7.35, 10.77, 14.19, 17.61, 21.03/
 DATA((ALP106(J,N),N=1,9),J=1,13)/
& -4.91, -3.07, -1.12,   .91,  2.92,  5.08,  7.71, 10.65, 13.59,
& -4.93, -3.05, -1.14,   .79,  2.71,  4.70,  7.00,  9.90, 12.80,
& -4.92, -3.06, -1.20,   .65,  2.50,  4.38,  6.24,  8.87, 11.50,
& -4.98, -3.10, -1.24,   .58,  2.36,  4.13,  5.81,  8.13, 10.54,
& -5.03, -3.14, -1.29,   .49,  2.19,  3.88,  5.44,  7.88, 10.82,
& -5.03, -3.15, -1.31,   .45,  2.12,  3.73,  5.37,  7.97, 11.17,
& -5.03, -3.17, -1.35,   .40,  2.04,  3.58,  5.39,  8.14, 11.29,
& -5.02, -3.18, -1.37,   .34,  1.94,  3.47,  5.46,  8.48, 11.75,
& -5.03, -3.19, -1.40,   .29,  1.84,  3.46   5.62,  8.82, 12.15,
& -5.05, -3.22, -1.43,   .25,  1.75,  3.51,  5.83,  9.18, 12.60,
& -5.06, -3.25, -1.46,   .21,  1.67,  3.58,  6.07,  9.55, 13.03,
& -5.09, -3.27, -1.50,   .16,  1.66,  3.73,  6.38,  9.95, 13.52,
& -5.12, -3.30, -1.53,   .13,  1.75,  3.91,  6.71, 10.35, 13.98/
 DATA((ALP106(J,N),N=1,9),J=14,26)/
& -5.27, -3.28, -1.42,   .21,  1.91,  4.11,  7.05, 10.79, 14.52,
& -5.32, -3.08, -1.19,   .41,  2.09,  4.30,  7.35, 11.16, 14.97,
& -5.05, -2.84, -1.00,   .61,  2.25,  4.47,  7.61, 11.50, 15.38,
& -4.84, -2.74,  -.95,   .64,  2.25,  4.47,  7.49, 11.00, 14.51,
& -4.89, -2.89, -1.08,   .53,  2.08,  4.25,  7.21, 10.72, 14.23,
& -4.97, -3.05, -1.26,   .36,  1.89,  3.96,  6.85, 10.27, 13.69,
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& -5.03, -3.19, -1.42,   .22,  1.73,  3.74,  6.53,  9.98, 13.43,
& -5.08, -3.27, -1.47,   .24,  1.72,  3.77,  6.54, 10.05, 13.56,
& -5.11, -3.23, -1.38,   .34,  1.84,  3.97,  6.93, 10.21, 13.49,
& -5.10, -3.14, -1.26,   .45,  2.05,  4.41,  7.41, 10.61, 13.81,
& -4.91, -2.80,  -.73,  1.38,  4.03,  7.03,  9.93, 12.83, 15.72,
& -4.84, -2.71,  -.27,  2.69,  5.92,  8.98, 12.03, 15.08, 18.14,
& -4.99, -2.76,  -.04,  3.61,  7.27, 10.94, 14.61, 18.28, 21.94/
 DATA((ALP109(J,N),N=1,9),J=1,13)/
& -5.30, -3.26, -1.13,  1.02,  3.22,  5.56,  8.61, 11.84, 15.06,
& -5.00, -3.12, -1.10,   .91,  2.92,  5.19,  7.75, 10.51, 13.27,
& -4.83, -2.98, -1.03,   .86,  2.71,  4.86,  7.15,  9.65, 12.15,
& -4.71, -2.89, -1.00,   .83,  2.63,  4.63,  6.74,  9.12, 11.50,
& -4.57, -2.79,  -.98,   .76,  2.48,  4.38,  6.20,  8.61, 11.02,
& -4.50, -2.73,  -.96,   .73,  2.39,  4.24,  5.90,  8.76, 11.71,
& -4.42, -2.67,  -.95,   .69,  2.32,  4.13,  5.88,  9.23, 12.71,
& -4.35, -2.61,  -.95,   .65,  2.25,  4.02,  6.00, 10.08, 14.16,
& -4.26, -2.54,  -.93,   .62,  2.19,  3.96,  6.53, 10.98, 15.42,
& -4.18, -2.47,  -.92,   .58,  2.15,  4.09,  7.36, 11.95, 16.55,
& -4.11, -2.40,  -.91,   .56,  2.15,  4.57,  8.29, 13.05, 17.81,
& -4.05, -2.33,  -.89,   .56,  2.30,  5.06,  9.24, 14.12, 19.00,
& -3.98, -2.26,  -.82,   .74,  2.81,  5.61, 10.22, 15.10, 19.98/
 DATA((ALP109(J,N),N=1,9),J=14,26)/
& -3.92, -2.17,  -.66,  1.06,  3.29,  6.37, 10.97, 15.56, 20.16,
& -3.81, -2.10,  -.51,  1.34,  3.63,  6.85, 11.55, 16.26, 20.96,
& -3.80, -2.18,  -.57,  1.22,  3.43,  6.30, 11.30, 16.30, 21.30,
& -4.14, -2.44,  -.75,  1.00,  3.08,  5.77, 10.72, 15.85, 20.97,
& -4.45, -2.68,  -.93,   .81,  2.75,  5.36, 10.13, 15.47, 20.80,
& -4.65, -2.84, -1.05,   .67,  2.48,  5.04,  9.41, 14.54, 19.67,
& -4.72, -2.86, -1.05,   .69,  2.57,  5.20,  9.72, 14.85, 19.97,
& -4.72, -2.85, -1.00,   .79,   .76,  5.48, 10.02, 14.90, 19.78,
& -4.70, -2.83,  -.95,   .89,  2.96,  5.76, 10.33, 15.04, 19.74,
& -4.68, -2.81,  -.89,  1.00,  3.18,  6.09, 10.53, 14.98, 19.42,
& -4.61, -2.71,  -.51,  1.73,  4.58,  8.08, 11.96, 15.84, 19.73,
& -4.58, -2.64,  -.21,  2.68,  5.79,  9.6.., 13.50, 17.38, 21.26,
& -4.62, -2.6.,  -.11,  3.49,  7.04, 10.88, 14.73, 18.58, 22.42/
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& -5.31, -3.20,  -.99,  1.17,  3.70,  6.34,  9.95, 13.55, 17.15,
& -5.40, -3.18,  -.99,  1.10,  3.44,  5.90,  9.69, 13.54, 17.36,
& -5.45, -3.19, -1.02,  1.02,  3.21,  5.54,  8.94, 12.61, 16.28,
& -5.40, -3.18, -1.04,   .98,  3.10,  5.32,  8.38, 11.86, 15.34,
& -5.36, -3.17, -1.06,   .93,  2.96,  5.02,  7.53, 10.58, 13.63,
& -5.34, -3.16, -1.06,   .90,  2.90,  4.89,  7.19, 10.13, 13.07,
& -5.32, -3.16, -1.07,   .88,  2.84,  4.79,  7.17, 10.71, 14.25,
& -5.31, -3.15, -1.08,   .84,  2.77,  4.81,  7.55, 11.29, 15.03,
& -5.30, -3.13, -1.09,   .79,  2.72,  4.95,  8.31, 12.15, 16.00,
& -5.29, -3.12, -1.10,   .80,  2.84,  5.50,  9.74, 14.13, 18.53,
& -5.29, -3.10, -1.02,  1.00,  3.19,  6.53, 11.59, 16.66, 21.72,
& -5.23, -2.91,  -.74,  1.40,  3.81,  8.15, 14.12, 20.09, 26.06,
&    .71, -2.34,  -.33,  1.88,  4.65, 10.64, 18.64, 26.64, 34.64/
 DATA((ALP112(J,N),N=1,9),J=14,26)/
&   .32, -1.97,  -.13,  2.23,  5.13, 10.95, 17.73, 24.51, 31.29,
& -4.43, -2.16,  -.26,  1.95,  4.81, 11.17, 19.87, 28.57, 37.26,
& -5.14, -2.72,  -.56,  1.57,  4.27,  9.31, 17.00, 24.69, 32.38,
& -4.98, -3.00,  -.91,  1.21,  3.72,  7.73, 15.57, 23.41, 31.25,
& -4.93, -3.01, -1.05,   .99,  3.45,  7.00, 13.90, 20.79, 27.69,
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& -4.91, -2.99,  -.98,  1.10,  3.59,  7.41, 13.97, 20.52, 27.08,
& -4.88, -2.97,  -.91,  1.24,  3.79,  7.78, 13.94, 20.09, 26.25,
& -4.87, -2.94,  -.83,  1.37,  4.02,  8.08, 13.72, 19.35, 24.99,
& -4.84, -2.91,  -.75,  1.52,  4.27,  8.37, 13.63, 18.89, 24.16,
& -4.83, -2.88,  -.65,  1.67,  4.52,  8.62, 13.56, 18.49, 23.43,
& -4.64, -2.70,  -.18,  2.54,  5.75,  9.89, 14.11, 18.32, 22.53,
& -4.50, -2.55,   .15,  3.22,  6.83, 10.67, 14.52, 18.37, 22.21,
& -4.37, -2.49,   .26,  3.88,  7.70, 11.66, 15.62, 19.58, 23.54/
 DATA((ALP115(J,N),N=1,9),J=1,13)/
& -5.27, -3.06,  -.82,  1.34,  4.19,  7.50, 11.07, 14.64, 18.21,
& -5.37, -2.99,  -.75,  1.33,  3.86,  7.02, 10.47, 13.91, 17.36,
& -5.40, -2.90,  -.71,  1.26,  3.63,  6.53,  9.87, 13.20, 16.53,
& -5.43, -2.85,  -.70,  1.22,  3.52,  6.18,  9.46, 12.74, 16.02,
& -5.42, -2.81,  -.70,  1.16,  3.30,  5.83,  8.92, 12.05, 15.17,
& -5.42, -2.79,  -.71,  1.12,  3.19,  5.64,  8.63, 11.68, 14.73,
& -5.44, -2.77,  -.71,  1.09,  3.10,  5.45,  8.90, 12.64, 16.37,
& -5.49, -2.73,  -.72,  1.04,  3.02,  5.40, 10.11, 15.51, 20.92,
& -5.54, -2.69,  -.70,  1.03,  3.08,  5.94, 13.26, 20.67, 28.07,
& -5.60, -2.64,  -.58,  1.24,  3.84,  9.02, 17.18, 25.35, 33.51,
& -5.39, -2.47,  -.24,  1.87,  5.05, 13.07, 22.37, 31.67, 40.98,
& -4.86, -1.83,   .22,  2.78,  7.23, 17.49, 27.74, 38.00, 48.26,
& -4.25, -1.53,   .50,  3.17,  8.52, 17.22, 25.91, 34.61, 43.30/
 DATA((ALP115(J,N),N=1,9),J=14,26)/
& -4.58, -1.74,   .25,  2.65,  7.36, 15.36, 23.36, 31.36, 39.36,
& -5.46, -2.51,  -.21,  1.96,  5.65, 13.25, 21.10, 28.94, 36.78,
& -5.52, -2.97,  -.63,  1.48,  4.62, 11.52, 19.52, 27.52, 35.52,
& -5.54, -2.97,  -.72,  1.30,  4.14, 11.22, 19.91, 28.61, 37.30,
& -5.56, -2.98,  -.70,  1.37,  4.38, 11.57, 20.09, 28.60, 37.11,
& -5.56, -2.98,  -.67,  1.47,  4.63, 11.84, 20.00, 28.16, 36.33,
& -5.54, -2.97,  -.64,  1.56,  4.90, 12.00, 19.69, 27.38, 35.08,
& -5.52, -2.97,  -.61,  1.65,  5.18, 12.11, 19.38, 26.65, 33.93,
& -5.49, -2.96,  -.57,  1.74,  5.42, 12.56, 19.96, 27.37, 34.78,
& -5.49, -2.96,  -.54,  1.86,  5.65, 12.89, 20.30, 27.70, 35.11,
& -5.44, -2.84,  -.32,  2.66,  7.30, 14.70, 22.11, 29.52, 36.93,
& -5.40, -2.71,  -.10,  3.39,  8.71, 16.55, 24.39, 32.24, 40.08,
& -5.35, -2.59,   .18,  3.92,  9.84, 18.00, 26.16, 34.33, 42.49/
 DATA((ALP118(J,N),N=1,9),J=1,13)/
& -6.10, -3.26,  -.59,  1.79,  4.94,  9.17, 13.52, 17.87, 22.22,
& -6.18, -3.17,  -.49,  1.72,  4.77,  8.61, 12.53, 16.45, 20.37,
& -6.42, -3.08,  -.47,  1.64,  4.46,  8.02, 11.98, 15.94, 19.90,
& -6.25, -2.92,  -.47,  1.59,  4.26,  7.47, 10.98, 14.49, 18.00,
& -5.94, -2.71,  -.52,  1.52,  3.99,  6.78, 10.32, 13.86, 17.40,
& -5.76, -2.61,  -.52,  1.48,  3.94,  6.78, 10.59, 14.40, 18.21,
& -5.61, -2.51,  -.51,  1.51,  4.14,  7.58, 12.02, 16.47, 20.91,
& -5.44, -2.24,  -.45,  1.70,  4.81,  9.31, 13.91, 18.51, 23.10,
& -5.17, -1.96,  -.21,  2.22,  6.44, 11.56, 16.69, 21.82, 26.95,
& -4.93, -1.77,   .31,  3.17,  9.30, 16.70, 24.11, 31.52, 38.93,
& -4.69, -1.52,   .99,  4.57, 14.40, 25.83, 37.26, 48.69, 60.11,
& -4.48, -1.36,  1.33,  4.83, 17.14, 31.43, 45.71, 60.00, 74.29,
& -4.34, -1.64,   .93,  3.87, 16.17, 33.57, 50.96, 68.35, 85.74/
 DATA((ALP118(J,N),N=1,9),J=14,26)/
& -4.73, -2.12,   [illegible]  2.83, 10.72, 26.72, 42.72, 58.72, 74.72,
& -5.09, -2.61,  -.27,  1.90,  6.22, 21.04, 35.85, 50.67, 65.48,
& -5.46, -2.83,  -.48,  1.[illegible]  [illegible] 15.65, 28.41, 40.18, 51.94,
& -5[illegible]1, -2.91,  -.4[illegible]  [illegible] 16.80, 28.23, 39.66, 51.09,
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& -5.73, -2.92,  -.44,  1.81,  5.88, 17.53, 29.29, 41.06, 52.82,
& -5.69, -2.87,  -.40,  1.90,  6.23, 17.66, 29.09, 40.51, 51.94,
& -5.65, -2.83,  -.37,  1.99,  6.65, 18.41, 30.18, 41.94, 53.71,
& -5.61, -2.79,  -.34,  2.12,  7.09, 18.51, 29.94, 41.37, 52.80,
& -5.56, -2.75,  -.31,  2.25,  7.44, 18.56, 29.67, 40.78, 51.89,
& -5.57, -2.74,  -.28,  2.37,  7.83, 18.94, 30.06, 41.17, 52.28,
& -5.51, -2.69,  -.11,  2.91, 10.00, 20.81, 31.62, 42.43, 53.24,
& -5.42, -2.68,   .10,  3.51, 12.18, 23.94, 35.71, 47.47, 59.24,
& -5.45, -2.61,   .23,  3.94, 13.76, 25.88, 38.00, 50.12, 62.24/
 DATA((ALP121(J,N),N=1,9),J=1,13)/
& -4.06, -2.24,  -.20,  2.29,  6.42, 12.48, 18.55, 24.61, 30.67,
& -4.08, -2.24,  -.20,  2.29,  6.33, 10.98, 15.63, 20.28, 24.93,
& -4.09, -2.27,  -.21,  2.19,  6.04,  9.92, 13.81, 17.69, 21.57,
& -4.17, -2.31,  -.27,  2.06,  5.76,  9.00, 12.23, 15.45, 18.68,
& -4.23, -2.43,  -.35,  1.88,  5.20,  8.91, 12.80, 16.68, 20.56,
& -4.26, -2.49,  -.34,  1.89,  5.32, 10.07, 15.01, 19.95, 24.89,
& -4.31, -2.57,  -.20,  2.28,  6.07, 12.97, 19.86, 26.76, 33.66,
& -4.21, -2.44,   .21,  3.23,  8.47, 14.35, 20.24, 26.12, 32.00,
& -4.09, -2.20,   .74,  4.90, 12.26, 19.81, 27.36, 34.91, 42.45,
& -3.82, -1.84,  1.43,  7.76, 19.88, 32.00, 44.12, 56.24, 68.36,
& -3.66, -1.79,  1.86,  9.90, 28.95, 48.00, 67.05, 86.10,105.14,
& -3.83, -2.10,  1.31,  7.50, 27.50, 47.50, 67.50, 87.50,107.50,
& -4.24, -2.56,  -.09,  3.85, 16.52, 31.33, 46.15, 60.96, 75.78/
 DATA((ALP121(J,N),N=1,9),J=14,26)/
& -4.84, -3.07, -1.09,  2.16, 13.88, 37.41, 60.94, 84.47,108.00,
& -5.41, -3.50, -1.49,  1.58,  8.96, 26.35, 43.74, 61.13, 78.52,
& -5.34, -3.50, -1.54,  1.66,  8.47, 21.80, 35.13, 48.47, 61.80,
& -5.29, -3.46, -1.50,  1.80,  9.04, 23.85, 38.67, 53.48, 68.30,
& -5.24, -3.40, -1.40,  1.96,  9.38, 23.17, 36.97, 50.76, 64.55,
& -5.20, -3.34, -1.31,  2.09,  9.80, 23.13, 36.47, 49.80, 63.13,
& -5.15, -3.28, -1.22,  2.25, 10.19, 23.10, 36.00, 48.90, 61.81,
& -5.11, -3.21, -1.13,  2.40, 10.50, 23.00, 35.50, 48.00, 60.50,
& -5.06, -3.15, -1.04,  2.57, 10.85, 22.97, 35.09, 47.21, 59.33,
& -5.01, -3.08,  -.95,  2.75, 11.18, 22.94, 34.71, 46.47, 58.24,
& -5.07, -2.82,  -.53,  3.70, 14.19, 26.69, 39.19, 51.69, 64.19,
& -4.96, -2.61,  -.24,  4.71, 16.44, 28.94, 41.44, 53.94, 66.44,
& -4.81, -2.55,  -.03,  5.78, 19.00, 32.33, 45.67, 59.00, 72.33/
 DATA((CD104(I,J),J=1,26),I=1,5)/
1 .0049, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
1 .0050, .0051, .0051, .0054, .0073, .0146, .0185, .0224, .0256,
1 .0274, .0285, .0285, .0282, .0275, .0224, .0174, .0149,
2 .0049, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
2 .0050, .0050, .0053, .0067, .0114, .0161, .0190, .0216, .0236,
2 .0252, .0268, .0275, .0280, .0285, .0291, .0275, .0245,
3 .0079, .0075, .0073, .0072, .0072, .0072, .0072, .0072, .0072,
3 .0072, .0073, .0082, .0108, .0169, .0236, .0274, .0301, .0325,
3 .0341, .0356, .0370, .0380, .0390, .0458, .0523, .0585,
4 .0334, .0247, .0199, .0181, .0173, .0172, .0176, .0185, .0211,
4 .0239, .0266, .0309, .0364, .0418, .0475, .0534, .0592, .0651,
4 .0700, .0749, .0798, .0841, .0874, .1019, .1114, .1176,
5 .0569, .0409, .0335, .0306, .0297, .0296, .0302, .0313, .0335,
5 .0401, .0486, .0571, .0669, .0780, .0891, .1002, .1114, .1226,
5 .1306, .1385, .1465, .1526, .1568, .1807, .1979, .2068/
 DATA((CD106(I,J),J=1,26),I=1,5)/
1 .0053, .0053, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
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1 .0055, .0059, .0071, .0094, .0149, .0210, .0269, .0318, .0346,
1 .0355, .0[illegible], .0363, .0363, .0363, .0320, .0282, .0247,
2 .0052, .0[illegible], .0053, .0053, .0053, .0053, .0053, .0053, .0053,
2 .0055, .0060, .0071, .0104, .0163, .0228, .0285, .0327, .0354,
2 .0367, .0380, .0387, .0395, .0399, .0401, .0374, .0343,
3 .0088, .0076, .0075, .0075, .0075, .0075, .0075, .0075, .0075,
3 .0077, .0085, .0104, .0148, .0216, .0283, .0344, .0380, .0410,
3 .0431, .0447, .0463, .0478, .0492, .0573, .0640, .0700,
4 .0282, .0185, .0146, .0128, .0120, .0118, .0122, .0126, .0140,
4 .0169, .0244, .0318, .0392, .0467, .0541, .0627, .0734, .0813,
4 .0871, .0911, .0950, .0989, .1019, .1155, .1226, .1287,
5 .0514, .0370, .0303, .0294, .0290, .0295, .0302, .0324, .0367,
5 .0432, .0545, .0676, .0806, .0968, .1136, .1304, .1415, .1523,
5 .1606, .1668, .1730, .1790, .1842, .2094, .2270, .2449/
 DATA((CD109(I,J),J=1,26),I=1,5)/
1 .0055, .0055, .0055, .0056, .0057, .0058, .0060, .0062, .0064,
1 .0066, .0071, .0081, .0147, .0220, .0286, .0348, .0400, .0434,
1 .0466, .0489, .0512, .0532, .0535, .0539, .0491, .0433,
2 .0061, .0060, .0060, .0060, .0060, .0061, .0063, .0065, .0066,
2 .0070, .0075, .0084, .0155, .0233, .0301, .0364, .0418, .0451,
2 .0482, .0501, .0521, .0538, .0543, .0546, .0527, .0485,
3 .0091, .0089, .0088, .0088, .0088, .0087, .0087, .0089, .0090,
3 .0098, .0118, .0185, .0260, .0342, .0424, .0501, .0538, .0576,
3 .0601, .0627, .0652, .0663, .0674, .0717, .0765, .0788,
4 .0200, .0164, .0146, .0141, .0141, .0147, .0153, .0166, .0188,
4 .0245, .0301, .0365, .0482, .0599, .0714, .0821, .0922, .0985,
4 .1047, .1098, .1149, .1198, .1226, .1307, .1322, .1336,
5 .0384, .0305, .0264, .0249, .0242, .0246, .0260, .0292, .0390,
5 .0489, .0590, .0723, .0856, .0988, .1107, .1226, .1345, .1464,
5 .1533, .1595, .1657, .1719, .1775, .1927, .1987, .1934/
 DATA((CD112(I,J),J=1,26),I=1,5)/
1 .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0060,
1 .0067, .0081, .0143, .0255, .0368, .0481, .0564, .0642, .0694,
1 .0745, .0765, .0786, .0798, .0802, .0814, .0784, .0704,
2 .0072, .0072, .0071, .0071, .0071, .0071, .0071, .0071, .0074,
2 .0081, .0104, .0168, .0268, .0366, .0448, .0521, .0591, .0649,
2 .0695, .0741, .0777, .0797, .0817, .0851, .0839, .0777,
3 .0110, .0111, .0112, .0112, .0113, .0113, .0115, .0120, .0128,
3 .0147, .0220, .0301, .0389, .0475, .0559, .0630, .0695, .0756,
3 .0803, .0851, .0896, .0926, .0957, .1074, .1090, .1102,
4 .0200, .0198, .0197, .0196, .0196, .0196, .0198, .0204, .0243,
4 .0366, .0489, .0616, .0747, .0862, .0977, .1080, .1157, .1234,
4 .1312, .1361, .1398, .1436, .1473, .1597, .1648, .1671,
5 .0324, .0302, .0283, .0283, .0290, .0297, .0318, .0374, .0535,
5 .0712, .0887, .1062, .1225, .1380, .1536, .1688, .1820, .1952,
5 .2084, .2215, .2294, .2373, .2452, .2479, .2759, .2868/
 DATA((CD115(I,J),J=1,26),I=1,5)/
1 .0070, .0070, .0070, .0070, .0070, .0070, .0070, .0070, .0076,
1 .0142, .0242, .0364, .0482, .0595, .0704, .0812, .0920, .1005,
1 .1082, .1158, .1200, .1240, .1252, .1225, .1123, .1023,
2 .0083, .0082, .0081, .0081, .0081, .0082, .0084, .0094, .0114,
2 .0195, .0309, .0412, .0520, .0624, .0723, .0808, .0892, .0974,
2 .1049, .1116, .1168, .1220, .1247, .1259, .1169, .1058,
3 .0153, .0154, .0154, .0153, .0153, .0153, .0154, .0164, .0206,
3 .0295, .0399, .0508, .0610, .0706, .0803, .0900, .0993, .1076,
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3 .1158, .1208, .1257, .1300, .1332, .1380, .1329, .1258,
4 .0220, .0238, .0247, .0251, .0255, .0258, .0274, .0340, .0457,
4 .0579, .0703, .0826, .0949, .1070, .1187, .1283, .1373, .1456,
4 .1533, .1610, .1673, .1713, .1752, .1827, .1785, .1711,
5 .0328, .0334, .0343, .0349, .0362, .0385, .0469, .0603, .0750,
5 .0934, .1108, .1281, .1459, .1638, .1800, .1949, .2098, .2219,
5 .2324, .2429, .2501, .2553, .2604, .2716, .2743, .2771/
 DATA((CD118(I,J),J=1,26),I=1,5)/
1 .0084, .0094, .0099, .0101, .0104, .0105, .0108, .0129, .0202,
1 .0317, .0432, .0542, .0646, .0751, .0848, .0942, .1035, .1129,
1 .1195, .1240, .1284, .1328, .1373, .1443, .1451, .1451,
2 .0085, .0099, .0107, .0111, .0114, .0116, .0120, .0151, .0255,
2 .0358, .0468, .0591, .0712, .0818, .0923, .1023, .1112, .1202,
2 .1292, .1333, .1371, .1410, .1449, .1506, .1512, .1518,
3 .0165, .0192, .0206, .0213, .0219, .0223, .0231, .0257, .0364,
3 .0488, .0610, .0733, .0855, .0959, .1053, .1146, .1240, .1309,
3 .1368, .1427, .1486, .1545, .1605, .1679, .1700, .1700,
4 .0264, .0341, .0380, .0399, .0419, .0430, .0450, .0579, .0715,
4 .0856, .0998, .1139, .1281, .1399, .1507, .1615, .1713, .1791,
4 .1862, .1930, .1976, .2022, .2068, .2171, .2198, .2182,
5 .0396, .0511, .0568, .0597, .0625, .0640, .0679, .0857, .1084,
5 .1308, .1527, .1746, .1964, .2183, .2365, .2515, .2665, .2815,
5 .2965, .3050, .3085, .3120, .3155, .3206, .3244, .3232/
 DATA((CD121(I,J),J=1,26),I=1,5)/
1 .0092, .0107, .0114, .0118, .0123, .0129, .0138, .0164, .0256,
1 .0372, .0500, .0634, .0756, .0862, .1010, .1138, .1246, .1351,
1 .1455, .1530, .1605, .1680, .1717, .1780, .1780, .1780,
2 .0109, .0125, .0133, .0137, .0141, .0146, .0156, .0199, .0295,
2 .0427, .0555, .0681, .0808, .0938, .1069, .1194, .1314, .1434,
2 .1525, .1605, .1685, .1750, .1782, .1842, .1842, .1842,
3 .0211, .0234, .0246, .0252, .0257, .0263, .0282, .0355, .0496,
3 .0626, .0761, .0897, .1027, .1156, .1285, .1401, .1515, .1628,
3 .1715, .1778, .1842, .1905, .1950, .2029, .2047, .2064,
4 .0433, .0485, .0511, .0528, .0560, .0592, .0658, .0777, .0939,
4 .1088, .1225, .1362, .1500, .1639, .1778, .1898, .2001, .2105,
4 .2195, .2269, .2343, .2410, .2461, .2581, .2557, .2533,
5 .0661, .0696, .0714, .0722, .0807, .0988, .1165, .1337, .1508,
5 .1684, .1863, .2041, .2219, .2389, .2554, .2719, .2884, .2982,
5 .3047, .3112, .3177, .3218, .3256, .3390, .3340, .3291/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
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      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,26,XMI,7,CL104,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL104,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL106,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL106,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL109,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL109,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL112,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL112,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL115,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL115,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL118,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL118,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL121,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL121,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP104,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP104,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP106,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
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 20  CALL IBI (26,XMI,9,CLI,26,ALP106,IORDER,IPT,XM,CL,AA06,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP109,IORDER,IPT,XM,CL,AA09,IERR)
     AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
     GO TO 400
 30  CALL IBI (26,XMI,9,CLI,26,ALP109,IORDER,IPT,XM,CL,AA09,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP112,IORDER,IPT,XM,CL,AA12,IERR)
     AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
     GO TO 400
 40  CALL IBI (26,XMI,9,CLI,26,ALP112,IORDER,IPT,XM,CL,AA12,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP115,IORDER,IPT,XM,CL,AA15,IERR)
     AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
     GO TO 400
 50  CALL IBI (26,XMI,9,CLI,26,ALP115,IORDER,IPT,XM,CL,AA15,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP118,IORDER,IPT,XM,CL,AA18,IERR)
     AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
 60  CALL IBI (26,XMI,9,CLI,26,ALP118,IORDER,IPT,XM,CL,AA18,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP121,IORDER,IPT,XM,CL,AA21,IERR)
     AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
     GO TO 400
 70  CALL IBI (26,XMI,9,CLI,26,ALP121,IORDER,IPT,XM,CL,AA21,IERR)
     AA=AA21
400  CONTINUE
     IPT (1)=-1
     IF (TR .LT. .04) GO TO 91
     IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
     IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
     IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
     IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
     IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
     IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
     IF (TR .GE. .21) GO TO 71
 91  CALL IBI (5,CLII,26,XMI,5,CD104,IORDER,IPT,CL,XM,CDRG04,IERR)
     CD=CDRG04
     WRITE (6,201) TR
201  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
    &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
     GO TO 250
 11  CALL IBI (5,CLII,26,XMI,5,CD104,IORDER,IPT,CL,XM,CDRG04,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD106,IORDER,IPT,CL,XM,CDRG06,IERR)
     CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
     GO TO 250
 21  CALL IBI (5,CLII,26,XMI,5,CD106,IORDER,IPT,CL,XM,CDRG06,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD109,IORDER,IPT,CL,XM,CDRG09,IERR)
     CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
     GO TO 250
 31  CALL IBI (5,CLII,26,XMI,5,CD109,IORDER,IPT,CL,XM,CDRG09,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD112,IORDER,IPT,CL,XM,CDRG12,IERR)
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      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD112,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD115,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD115,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD118,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD118,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD121,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD121,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO2(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-2XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP204(26,9),ALP206(26,9),
     & ALP209(26,9),ALP212(26,9),ALP215(26,9),ALP218(26,9),
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& ALP221(26,9),CLI(9),XMI(26),ALPI(7),CL204(7,26),
& CL206(7,26),CL209(7,26),CL212(7,26),CL215(7,26),
& CL218(7,26),CL221(7,26),CD204(5,26),CD206(5,26),
& CD209(5,26),CD212(5,26),CD215(5,26),CD218(5,26),
& CD221(5,26),CLII(5)
 DATA((CL204(I,J),J=1,26),I=1,4)/
1 -.232, -.237, -.238, -.237, -.235, -.234, -.234, -.233, -.232,
1 -.230, -.220, -.203, -.181, -.159, -.144, -.148, -.165, -.176,
1 -.171, -.165, -.160, -.157, -.162, -.256, -.262, -.262,
2 -.019, -.025, -.028, -.031, -.034, -.036, -.037, -.038, -.036,
2 -.032, -.019,  .005,  .029,  .054,  .066,  .056,  .036,  .021,
2  .027,  .035,  .043,  .047,  .036, -.124, -.151, -.153,
3  .188,  .196,  .213,  .224,  .236,  .242,  .250,  .257,  .265,
3  .273,  .281,  .291,  .302,  .310,  .309,  .281,  .255,  .236,
3  .247,  .265,  .285,  .289,  .277,  .098, -.006, -.015,
4  .412,  .427,  .450,  .462,  .479,  .488,  .497,  .507,  .516,
4  .526,  .538,  .550,  .553,  .545,  .529,  .512,  .494,  .489,
4  .499,  .517,  .533,  .540,  .508,  .286,  .137,  .106/
 DATA((CL204(I,J),J=1,26),I=5,7)/
5  .596,  .629,  .668,  .693,  .727,  .744,  .761,  .780,  .791,
5  .791,  .781,  .770,  .757,  .740,  .724,  .714,  .705,  .703,
5  .711,  .725,  .749,  .764,  .730,  .456,  .277,  .214,
6  .784,  .827,  .868,  .894,  .935,  .955,  .973,  .980,  .970,
6  .958,  .945,  .932,  .917,  .902,  .886,  .871,  .856,  .849,
6  .860,  .881,  .905,  .918,  .864,  .609,  .402,  .319,
7  .922,  .973, 1.040, 1.085, 1.111, 1.106, 1.099, 1.085, 1.071,
7 1.057, 1.043, 1.029, 1.014, 1.000,  .987,  .977,  .971,  .971,
7  .977,  .996, 1.022, 1.034,  .999,  .744,  .535,  .430/
 DATA((CL206(I,J),J=1,26),I=1,4)/
1 -.205, -.206, -.206, -.206, -.206, -.206, -.206, -.207, -.208,
1 -.209, -.209, -.211, -.212, -.222, -.258, -.303, -.333, -.307,
1 -.277, -.261, -.249, -.256, -.271, -.323, -.284, -.224,
2 -.015, -.021, -.024, -.025, -.023, -.023, -.022, -.023, -.023,
2 -.024, -.025, -.025, -.025, -.041, -.086, -.135, -.141, -.118,
2 -.094, -.075, -.069, -.082, -.097, -.157, -.136, -.114,
3  .172,  .183,  .200,  .209,  .219,  .224,  .229,  .234,  .239,
3  .249,  .258,  .268,  .266,  .237,  .199,  .164,  .160,  .181,
3  .206,  .226,  .227,  .211,  .191,  .069, -.015, -.025,
4  .376,  .403,  .427,  .447,  .467,  .478,  .489,  .500,  .512,
4  .523,  .535,  .523,  .496,  .462,  .427,  .406,  .406,  .424,
4  .448,  .472,  .474,  .448,  .414,  .220,  .115,  .096/
 DATA((CL206(I,J),J=1,26),I=5,7)/
5  .564,  .617,  .658,  .681,  .711,  .729,  .746,  .758,  .755,
5  .744,  .719,  .694,  .669,  .644,  .619,  .597,  .592,  .610,
5  .640,  .664,  .664,  .635,  .598,  .391,  .255,  .203,
6  .736,  .793,  .840,  .878,  .915,  .931,  .938,  .922,  .899,
6  .875,  .852,  .829,  .805,  .782,  .759,  .737,  .740,  .758,
6  .786,  .804,  .801,  .783,  .749,  .547,  .404,  .315,
7  .864,  .930,  .999, 1.035, 1.071, 1.074, 1.060, 1.041, 1.022,
7 1.003,  .979,  .954,  .929,  .904,  .879,  .854,  .847,  .865,
7  .896,  .920,  .917,  .892,  .862,  .685,  .528,  .430/
 DATA((CL209(I,J),J=1,26),I=1,4)/
1 -.174, -.183, -.183, -.183, -.193, -.199, -.206, -.217, -.229,
1 -.241, -.254, -.268, -.282, -.295, -.306, -.287, -.253, -.231,
1 -.214, -.220, -.226, -.232, -.236, -.258, -.264, -.264,
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2 -.012, -.012, -.012, -.012, -.018, -.022, -.027, -.032, -.037,
2 -.049, -.060, -.072, -.084, -.105, -.120, -.102, -.068, -.035,
2 -.021, -.024, -.038, -.049, -.061, -.107, -.132, -.141,
3  .153,  .159,  .169,  .174,  .183,  .188,  .194,  .202,  .210,
3  .218,  .221,  .201,  .154,  .107,  .060,  .064,  .099,  .140,
3  .162,  .157,  .142,  .124,  .107,  .010, -.025, -.025,
4  .351,  .379,  .403,  .416,  .434,  .442,  .451,  .465,  .478,
4  .474,  .450,  .394,  .339,  .283,  .255,  .269,  .301,  .337,
4  .356,  .342,  .318,  .293,  .269,  .156,  .109,  .092/
 DATA((CL209(I,J),J=1,26),I=5,7)/
5  .522,  .552,  .584,  .603,  .629,  .645,  .661,  .678,  .670,
5  .631,  .591,  .550,  .509,  .468,  .432,  .435,  .479,  .517,
5  .530,  .516,  .490,  .464,  .438,  .316,  .247,  .204,
6  .697,  .736,  .788,  .819,  .855,  .871,  .858,  .828,  .797,
6  .767,  .723,  .678,  .634,  .590,  .567,  .583,  .622,  .657,
6  .676,  .663,  .642,  .618,  .593,  .468,  .377,  .308,
7  .817,  .870,  .930,  .972, 1.007,  .992,  .968,  .935,  .902,
7  .860,  .817,  .775,  .732,  .684,  .653,  .660,  .698,  .737,
7  .758,  .748,  .730,  .710,  .689,  .585,  .498,  .420/
 DATA((CL212(I,J),J=1,26),I=1,4)/
1 -.207, -.203, -.201, -.198, -.195, -.194, -.192, -.192, -.197,
1 -.220, -.258, -.335, -.410, -.443, -.409, -.333, -.280, -.260,
1 -.270, -.280, -.289, -.298, -.306, -.342, -.359, -.364,
2 -.024, -.021, -.021, -.020, -.017, -.015, -.013, -.010, -.011,
2 -.023, -.052, -.123, -.202, -.239, -.212, -.171, -.130, -.098,
2 -.110, -.120, -.130, -.141, -.150, -.197, -.217, -.220,
3  .142,  .149,  .164,  .172,  .182,  .186,  .191,  .196,  .198,
3  .187,  .151,  .081,  .012, -.023,  .001,  .045,  .088,  .115,
3  .106,  .096,  .085,  .075,  .064,  .011, -.020, -.028,
4  .329,  .346,  .359,  .368,  .378,  .387,  .395,  .404,  .399,
4  .361,  .312,  .253,  .196,  .162,  .185,  .230,  .274,  .297,
4  .284,  .269,  .255,  .241,  .227,  .157,  .107,  .080/
 DATA((CL212(I,J),J=1,26),I=5,7)/
5  .476,  .505,  .527,  .540,  .561,  .571,  .584,  .599,  .571,
5  .507,  .444,  .381,  .323,  .302,  .337,  .385,  .429,  .442,
5  .430,  .415,  .401,  .386,  .372,  .292,  .233,  .185,
6  .613,  .653,  .700,  .726,  .758,  .780,  .779,  .739,  .682,
6  .626,  .570,  .514,  .460,  .443,  .476,  .517,  .556,  .573,
6  .562,  .547,  .531,  .515,  .500,  .417,  .349,  .301,
7  .743,  .791,  .839,  .871,  .910,  .903,  .852,  .795,  .738,
7  .680,  .623,  .566,  .514,  .499,  .533,  .578,  .622,  .639,
7  .629,  .619,  .608,  .598,  .588,  .525,  .474,  .424/
 DATA((CL215(I,J),J=1,26),I=1,4)/
1 -.212, -.217, -.227, -.231, -.239, -.243, -.247, -.253, -.284,
1 -.340, -.417, -.505, -.519, -.492, -.419, -.311, -.239, -.248,
1 -.249, -.250, -.251, -.253, -.254, -.260, -.265, -.270,
2 -.046, -.052, -.058, -.062, -.067, -.070, -.073, -.079, -.109,
2 -.166, -.234, -.297, -.321, -.301, -.238, -.118, -.073, -.078,
2 -.083, -.088, -.092, -.095, -.097, -.110, -.120, -.131,
3  .106,  .116,  .121,  .123,  .130,  .135,  .139,  .137,  .124,
3  .088,  .020, -.077, -.114, -.081, -.022,  .034,  .061,  .064,
3  .060,  .055,  .050,  .046,  .041,  .012, -.004, -.011,
4  .288,  .309,  .324,  .334,  .343,  .348,  .353,  .349,  .332,
4  .276,  .174,  .090,  .075,  .109,  .178,  .236,  .249,  .239,
4  .229,  .220,  .212,  .204,  .196,  .154,  .120,  .096/
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 DATA((CL215(I,J),J=1,26),I=5,7)/
5  .431,  .458,  .485,  .503,  .527,  .537,  .524,  .496,  .454,
5  .385,  .307,  .226,  .196,  .230,  .295,  .354,  .378,  .367,
5  .357,  .346,  .335,  .326,  .317,  .268,  .235,  .213,
6  .554,  .584,  .617,  .641,  .685,  .690,  .671,  .627,  .555,
6  .474,  .392,  .313,  .288,  .330,  .397,  .452,  .465,  .457,
6  .448,  .440,  .432,  .424,  .416,  .374,  .347,  .330,
7  .659,  .695,  .735,  .766,  .805,  .798,  .762,  .687,  .606,
7  .525,  .444,  .365,  .347,  .378,  .448,  .508,  .527,  .521,
7  .514,  .508,  .502,  .496,  .490,  .461,  .442,  .434/
 DATA((CL218(I,J),J=1,26),I=1,4)/
1 -.212, -.221, -.240, -.254, -.273, -.283, -.298, -.327, -.374,
1 -.421, -.463, -.490, -.473, -.410, -.339, -.286, -.274, -.273,
1 -.272, -.272, -.273, -.274, -.275, -.282, -.284, -.291,
2 -.058, -.058, -.065, -.072, -.080, -.087, -.101, -.150, -.203,
2 -.254, -.301, -.324, -.278, -.215, -.157, -.117, -.111, -.113,
2 -.114, -.115, -.117, -.118, -.119, -.129, -.137, -.137,
3  .093,  .104,  .112,  .116,  .122,  .125,  .115,  .046, -.022,
3 -.091, -.152, -.182, -.153, -.076,  .003,  .034,  .031,  .028,
3  .025,  .022,  .019,  .017,  .015,  .003, -.008, -.008,
4  .268,  .276,  .287,  .293,  .300,  .299,  .267,  .208,  .147,
4  .086,  .026, -.012,  .016,  .098,  .176,  .208,  .203,  .197,
4  .192,  .187,  .182,  .176,  .171,  .142,  .116,  .100/
 DATA((CL218(I,J),J=1,26),I=5,7)/
5  .413,  .425,  .437,  .445,  .457,  .452,  .408,  .346,  .284,
5  .222,  .160,  .115,  .142,  .229,  .305,  .328,  .321,  .315,
5  .308,  .302,  .296,  .289,  .282,  .244,  .214,  .192,
6  .504,  .537,  .565,  .588,  .623,  .598,  .524,  .450,  .375,
6  .301,  .238,  .203,  .227,  .310,  .382,  .415,  .406,  .398,
6  .390,  .381,  .373,  .366,  .359,  .319,  .288,  .259,
7  .600,  .639,  .683,  .713,  .738,  .685,  .612,  .525,  .438,
7  .351,  .273,  .232,  .255,  .338,  .418,  .449,  .441,  .432,
7  .424,  .415,  .407,  .399,  .392,  .350,  .314,  .281/
 DATA((CL221(I,J),J=1,26),I=1,4)/
1 -.266, -.263, -.253, -.239, -.226, -.226, -.234, -.256, -.312,
1 -.372, -.434, -.421, -.339, -.257, -.213, -.210, -.216, -.223,
1 -.230, -.237, -.243, -.249, -.255, -.263, -.268, -.275,
2 -.111, -.115, -.102, -.086, -.065, -.059, -.072, -.107, -.164,
2 -.239, -.291, -.277, -.203, -.129, -.071, -.076, -.084, -.092,
2 -.101, -.109, -.117, -.126, -.135, -.167, -.167, -.167,
3  .069,  .071,  .072,  .078,  .087,  .083,  .069,  .021, -.039,
3 -.124, -.176, -.154, -.054,  .051,  .084,  .078,  .070,  .062,
3  .054,  .046,  .039,  .031,  .025,  .000, -.006, -.007,
4  .239,  .226,  .233,  .246,  .250,  .237,  .196,  .125,  .054,
4 -.013, -.059, -.050,  .048,  .148,  .178,  .176,  .169,  .160,
4  .151,  .141,  .135,  .128,  .122,  .095,  .082,  .072/
 DATA((CL221(I,J),J=1,26),I=5,7)/
5  .370,  .364,  .374,  .383,  .387,  .379,  .344,  .277,  .185,
5  .101,  .044,  .061,  .151,  .257,  .287,  .286,  .277,  .269,
5  .260,  .252,  .243,  .235,  .228,  .190,  .168,  .157,
6  .420,  .433,  .471,  .498,  .511,  .479,  .417,  .337,  .243,
6  .144,  .115,  .137,  .230,  .323,  .357,  .354,  .344,  .332,
6  .321,  .314,  .306,  .299,  .292,  .256,  .240,  .223,
7  .495,  .533,  .586,  .625,  .622,  .574,  .482,  .385,  .287,
7  .190,  .144,  .159,  .255,  .358,  .385,  .381,  .373,  .366,
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7  .358,  .351,  .343,  .336,  .328,  .288,  .269,  .253/
 DATA((ALP204(J,N),N=1,9),J=1,13)/
& -5.58, -3.70, -1.82,   .11,  1.89,  4.04,  6.23,  9.13, 12.03,
& -5.54, -3.65, -1.77,   .03,  1.77,  3.71,  5.73,  8.37, 11.11,
& -5.54, -3.64, -1.77,  -.11,  1.58,  3.38,  5.32,  7.53,  9.86,
& -5.58, -3.64, -1.76,  -.19,  1.48,  3.19,  5.06,  7.11,  9.20,
& -5.64, -3.65, -1.75,  -.27,  1.35,  2.98,  4.70,  6.74,  9.01,
& -5.68, -3.66, -1.74,  -.30,  1.28,  2.88,  4.53,  6.60,  9.25,
& -5.69, -3.65, -1.74,  -.35,  1.21,  2.78,  4.37,  6.43,  9.6[illegible],
& -5.71, -3.66, -1.74,  -.39,  1.14,  2.68,  4.20,  6.38, 10.19,
& -5.71, -3.67, -1.76,  -.43,  1.08,  2.61,  4.10,  6.59, 10.55,
& -5.72, -3.70, -1.79,  -.48,  1.00,  2.56,  4.11,  6.85, 10.89,
& -5.79, -3.80, -1.87,  -.54,   .93,  2.51,  4.23,  7.12, 11.20,
& -5.89, -3.97, -2.05,  -.64,   .84,  2.45,  4.37,  7.40, 11.53,
& -6.09, -4.18, -2.28,  -.75,   .78,  2.46,  4.54,  7.71, 11.84/
 DATA((ALP204(J,N),N=1,9),J=14,26)/
& -6.26, -4.38, -2.51,  -.86,   .77,  2.56,  4.74,  8.00, 12.08,
& -6.44, -4.53, -2.63,  -.90,   .83,  2.73,  4.94,  8.26, 12.22,
& -6.47, -4.51, -2.55,  -.72,  1.03,  2.87,  5.10,  8.43, 12.21,
& -6.34, -4.35, -2.36,  -.50,  1.21,  3.00,  5.26,  8.50, 11.98,
& -6.27, -4.24, -2.21,  -.33,  1.30,  3.04,  5.33,  8.48, 11.75,
& -6.31, -4.29, -2.27,  -.43,  1.21,  2.95,  5.19,  8.39, 11.81,
& -6.35, -4.35, -2.35,  -.57,  1.07,  2.80,  4.96,  8.07, 11.55,
& -6.36, -4.39, -2.42,  -.70,   .93,  2.62,  4.65,  7.62, 11.07,
& -6.38, -4.42, -2.46,  -.74,   .88,  2.54,  4.47,  7.41, 10.86,
& -6.40, -4.38, -2.36,  -.64,  1.06,  2.83,  4.91,  8.02, 11.50,
& -6.18, -3.15,  -.88,  1.09,  3.34,  5.88,  8.83, 11.79, 14.76,
& -6.49, -2.88,   .08,  2.90,  5.97,  8.98, 11.98, 14.99, 18.00,
& -6.53, -2.86,   .25,  3.74,  7.46, 11.06, 14.67, 18.27, 21.87/
 DATA((ALP206(J,N),N=1,9),J=1,13)/
& -6.03, -3.94, -1.84,   .27,  2.26,  4.42,  7.00, 10.13, 13.25,
& -6.10, -3.94, -1.79,   .15,  1.97,  3.84,  6.10,  9.02, 11.94,
& -6.13, -3.93, -1.79,  0.00,  1.76,  3.50,  5.56,  8.01, 10.53,
& -6.14, -3.93, -1.79,  -.08,  1.61,  3.31,  5.21,  7.55, 10.10,
& -6.12, -3.93, -1.81,  -.16,  1.46,  3.09,  4.87,  7.09,  9.65,
& -6.12, -3.93, -1.81,  -.19,  1.39,  2.97,  4.70,  6.97,  9.76,
& -6.11, -3.93, -1.82,  -.23,  1.32,  2.86,  4.56,  7.02, 10.30,
& -6.10, -3.92, -1.82,  -.26,  1.25,  2.78,  4.51,  7.31, 10.67,
& -6.08, -3.91, -1.82,  -.30,  1.18,  2.72,  4.63,  7.64, 10.89,
& -6.06, -3.90, -1.82,  -.36,  1.10,  2.70,  4.85,  7.95, 11.08,
& -6.08, -3.90, -1.82,  -.41,  1.03,  2.71,  5.22,  8.33, 11.48,
& -6.03, -3.88, -1.83,  -.46,  1.04,  2.90,  5.57,  8.74, 11.94,
& -6.01, -3.87, -1.83,  -.45,  1.17,  3.20,  5.93,  9.15, 12.37/
 DATA((ALP206(J,N),N=1,9),J=14,26)/
& -5.97, -3.76, -1.71,  -.27,  1.45,  3.52,  6.30,  9.57, 12.85,
& -5.65, -3.33, -1.40,   .01,  1.76,  3.80,  6.68, 10.02, 13.35,
& -5.15, -2.77, -1.10,   .30,  1.95,  4.04,  7.08, 10.50, 13.91,
& -4.70, -2.61, -1.06,   .33,  1.95,  4.11,  7.12, 10.86, 14.60,
& -4.98, -2.87, -1.21,   .16,  1.80,  3.89,  6.79, 10.52, 14.26,
& -5.34, -3.16, -1.37,  -.04,  1.60,  3.58,  6.25,  9.89, 13.53,
& -5.49, -3.34, -1.50,  -.17,  1.41,  3.33,  5.94,  9.38, 12.83,
& -5.68, -3.46, -1.53,  -.18,  1.40,  3.33,  5.99,  9.43, 12.88,
& -5.66, -3.36, -1.44,  -.08,  1.59,  3.63,  6.31,  9.98, 13.65,
& -5.48, -3.18, -1.33,   .08,  1.87,  4.03,  6.90, 10.44, 13.98,
& -4.93, -2.52,  -.61,  1.74,  4.12,  6.77,  9.67, 12.57, 15.46,
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& -5.57, -2.86,   .23,  3.21,  5.95,  9.16, 12.39, 15.61, 18.84,
& -7.20, -3.56,   .41,  3.94,  7.48, 10.96, 14.43, 17.91, 21.39/
 DATA((ALP209(J,N),N=1,9),J=1,13)/
& -6.79, -4.32, -1.85,   .47,  2.57,  4.89,  7.72, 11.05, 14.38,
& -6.54, -4.20, -1.86,   .37,  2.24,  4.52,  6.96,  9.94, 12.93,
& -6.54, -4.20, -1.87,   .26,  1.97,  4.16,  6.17,  8.99, 11.80,
& -6.54, -4.20, -1.87,   .21,  1.87,  3.97,  5.82,  8.37, 10.98,
& -6.37, -4.08, -1.82,   .14,  1.73,  3.70,  5.51,  7.91, 10.54,
& -6.27, -4.01, -1.79,   .09,  1.67,  3.56,  5.37,  8.13, 11.44,
& -6.17, -3.93, -1.76,   .05,  1.60,  3.42,  5.41,  8.58, 12.22,
& -5.98, -3.82, -1.73,  -.02,  1.51,  3.27,  5.63,  9.21, 12.95,
& -5.78, -3.70, -1.70,  -.08,  1.42,  3.27,  6.06,  9.87, 13.68,
& -5.66, -3.57, -1.63,  -.13,  1.42,  3.61,  6.71, 11.01, 15.31,
& -5.51, -3.44, -1.57,  -.15,  1.56,  4.14,  7.64, 11.89, 16.15,
& -5.35, -3.31, -1.47,  -.01,  2.08,  4.78,  8.52, 12.64, 16.76,
& -5.19, -3.17, -1.29,   .50,  2.72,  5.46,  9.39, 13.47, 17.55/
 DATA((ALP209(J,N),N=1,9),J=14,26)/
& -5.11, -3.00, -1.01,  1.06,  3.26,  6.21, 10.47, 14.72, 18.98,
& -5.01, -2.86,  -.67,  1.44,  3.64,  6.77, 11.42, 16.07, 2[illegible].72,
& -5.22, -3.06,  -.77,  1.33,  3.58,  6.44, 11.64, 16.83, 22.03,
& -5.59, -3.43, -1.19,  1.00,  3.11,  5.69, 10.68, 15.95, 21.21,
& -5.72, -3.68, -1.60,   .61,  2.70,  5.19,  9.58, 14.58, 19.58,
& -5.93, -3.85, -1.77,   .39,  2.51,  4.96,  9.02, 13.90, 18.78,
& -5.84, -3.80, -1.73,   .46,  2.67,  5.14,  9.22, 13.93, 18.64,
& -5.85, -3.72, -1.58,   .66,  2.95,  5.45,  9.59, 14.14, 18.68,
& -5.84, -3.65, -1.43,   .90,  3.25,  5.77,  9.96, 14.30, 18.65,
& -5.87, -3.59, -1.27,  1.15,  3.55,  6.15, 10.31, 14.48, 18.65,
& -5.88, -3.23,  -.17,  2.55,  5.11,  8.26, 11.68, 15.09, 18.51,
& -6.06, -3.03,   .37,  3.32,  6.38,  9.69, 12.99, 16.30, 19.60,
& -6.21, -2.96,   .43,  3.93,  7.64, 11.21, 14.79, 18.36, 21.93/
 DATA((ALP212(J,N),N=1,9),J=1,13)/
& -6.11, -3.92, -1.71,   .62,  2.97,  5.81,  8.88, 11.95, 15.03,
& -6.16, -3.97, -1.75,   .52,  2.68,  5.28,  8.13, 11.03, 13.93,
& -6.21, -3.99, -1.77,   .37,  2.49,  4.84,  7.44, 10.32, 13.19,
& -6.27, -4.02, -1.79,   .29,  2.37,  4.65,  7.02,  9.78, 12.54,
& -6.30, -4.06, -1.83,   .18,  2.24,  4.40,  6.55,  9.18, 11.82,
& -6.30, -4.07, -1.85,   .14,  2.14,  4.28,  6.33,  9.58, 12.83,
& -6.32, -4.09, -1.87,   .09,  2.05,  4.16,  6.58, 12.05, 17.53,
& -6.29, -4.09, -1.90,   .04,  1.96,  4.01,  8.18, 15.32, 22.46,
& -6.18, -4.03, -1.89,   .02,  2.01,  4.52, 10.21, 17.36, 24.50,
& -5.83, -3.80, -1.78,   .15,  2.53,  5.56, 12.44, 19.85, 27.26,
& -5.38, -3.44, -1.49,   .61,  3.33,  7.13, 14.68, 22.23, 29.77,
& -4.61, -2.73,  -.79,   .38,  4.29,  9.31, 17.00, 24.69, 32.38,
& -3.90, -1.98,  -.11,  2.06,  5.12, 11.19, 18.59, 26.00, 33.41/
 DATA((ALP212(J,N),N=1,9),J=14,26)/
& -3.58, -1.64,   .25,  2.54,  5.39, 11.61, 18.75, 25.89, 33.04,
& -3.91, -1.89,  -.01,  2.20,  4.91, 10.35, 17.37, 24.39, 31.40,
& -4.83, -2.36,  -.42,  1.68,  4.23,  8.72, 15.28, 21.84, 28.39,
& -5.60, -2.93,  -.81,  1.20,  3.63,  7.33, 13.39, 19.45, 25.52,
& -5.73, -3.26, -1.08,   .93,  3.42,  6.82, 12.88, 18.94, 25.00,
& -5.63, -3.13,  -.98,  1.06,  3.59,  7.13, 13.10, 19.07, 25.04,
& -5.50, -3.00,  -.89,  1.20,  3.79,  7.47, 13.03, 18.58, 24.14,
& -5.40, -2.88,  -.79,  1.35,  3.99,  7.79, 12.99, 18.18, 23.38,
& -5.30, -2.75,  -.69,  1.51,  4.22,  8.05, 12.87, 17.69, 22.51,
& -5.21, -2.64,  -.60,  1.67,  4.44,  8.27, 12.82, 17.36, 21.91,
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& -4.80, -2.04,  -.11,  2.64,  5.73,  9.39, 13.09, 16.80, 20.50,
& -4.58, -1.83,   .31,  3.48,  6.82, 10.02, 13.22, 16.42, 19.62,
& -4.50, -1.79,   .52,  4.26,  7.61, 10.86, 14.11, 17.37, 20.62/
 DATA((ALP215(J,N),N=1,9),J=1,13)/
& -6.27, -3.86, -1.39,  1.03,  3.57,  6.88, 10.69, 14.50, 18.30,
& -6.22, -3.79, -1.36,   .87,  3.22,  6.29,  9.89, 13.50, 17 10,
& -6.05, -3.68, -1.35,   .78,  2.94,  5.74,  9.10, 12.49, 15.88,
& -6.00, -3.63, -1.33,   .73,  2.78,  5.41,  8.54, 11.74, 14.94,
& -5.87, -3.55, -1.32,   .66,  2.62,  4.92,  7.92, 11.25, 14.58,
& -5.82, -3.50, -1.32,   .61,  2.55,  4.82,  8.04, 11.74, 15.44,
& -5.76, -3.46, -1.31,   .57,  2.55,  5.03,  8.84, 13.23, 17.63,
& -5.69, -3.39, -1.27,   .59,  2.69,  5.59, 11.77, 18.43, 25.10,
& -5.33, -3.04, -1.06,   .73,  3.11,  7.76, 15.61, 23.45, 31.29,
& -4.69, -2.39,  -.69,  1.19,  4.34, 10.94, 18.78, 26.63, 34.47,
& -3.81, -1.73,  -.16,  2.39,  6.31, 14.00, 21.69, 29.38, 37.08,
& -2.99, -1.12,   .92,  3.62,  9.35, 17.04, 24.73, 32.42, 40.12,
& -2.80,  -.83,  1.21,  4.09,  9.80, 16.58, 23.36, 30.14, 36.92/
 DATA((ALP215(J,N),N=1,9),J=14,26)/
& -3.04, -1.08,   .85,  3.50,  8.92, 17.25, 25.58, 33.92, 42.25,
& -3.79, -1.65,   .22,  2.38,  6.12, 13.96, 21.80, 29.65, 37.49,
& -4.92, -2.85,  -.45,  1.64,  4.94, 11.29, 18.43, 25.57, 32.71,
& -5.94, -3.53,  -.91,  1.48,  4.51, 10.35, 16.81, 23.26, 29.71,
& -5.79, -3.44,  -.90,  1.55,  4.73, 10.47, 16.72, 22.97, 29.22,
& -5.32, -3.41,  -.84,  1.66,  4.95, 10.61, 16.67, 22.73, 28.79,
& -5.85, -3.38,  -.77,  1.76,  5.15, 10.71, 16.59, 22.47, 28.35,
& -5.87, -3.36,  -.70,  1.85,  5.34, 10.80, 16.51, 22.23, 27.94,
& -5.86, -3.33,  -.65,  1.95,  5.51, 10.89, 16.44, 22.00, 27.56,
& -5.86, -3.31,  -.59,  2.07,  5.68, 10.97, 16.38, 21.78, 27.19,
& -5.87, -3.20,  -.20,  2.81,  6.60, 11.20, 15.79, 20.39, 24.99,
& -5.86, -3.10,   .06,  3.39,  7.12, 11.33, 15.54, 19.75, 23.96,
& -5.87, -2.99,   .21,  3.78,  7.35, 11.19, 15.04, 18.88, 22.73/
 DATA((ALP218(J,N),N=1,9),J=1,13)/
& -6.44, -3.84, -1.23,  1.22,  3.82,  8.00, 12.17, 16.33, 20.50,
& -6.20, -3.74, -1.28,  1.12,  3.66,  7.24, 11.16, 15.08, 19.00,
& -5.83, -3.54, -1.27,  1.01,  3.51,  6.59,  9.98, 13.37, 16.76,
& -5.60, -3.41, -1.23,   .95,  3.41,  6.19,  9.39, 12.59, 15.79,
& -5.32, -3.24, -1.21,   .88,  3.27,  5.72,  9.08, 12.56, 16.03,
& -5.19, -3.15, -1.18,   .86,  3.32,  6.05, 10.64, 15.24, 19.84,
& -5.04, -3.01, -1.06,  1.12,  3.89,  7.73, 12.27, 16.82, 21.36,
& -4.82, -2.56,  -.47,  1.90,  5.04, 10.00, 15.33, 20.67, 26.00,
& -4.30, -1.97,   .26,  2.77,  6.79, 13.14, 19.49, 25.84, 32.19,
& -3.75, -1.34,  1.03,  3.68,  9.96, 17.96, 25.96, 33.96, 41.96,
& -3.22,  -.64,  1.71,  5.03, 15.26, 26.69, 38.11, 49.54, 60.97,
& -2.92,  -.25,  2.19,  5.93, 19.59, 33.38, 47.17, 60.97, 74.76,
& -3.25,  -.75,  1.81,  5.36, 18.36, 32.64, 46.93, 61.21, 75.50/
 DATA((ALP218(J,N),N=1,9),J=14,26)/
& -3.90, -1.78,   .87,  3.56, 12.43, 26.71, 41.00, 55.29, 69.57,
& -4.67, -2.47,  -.04,  2.37,  7.00, 18.11, 29.22, 40.33, 51.44,
& -5.35, -2.98,  -.45,  1.91,  5.66, 16.88, 28.65, 40.41, 52.18,
& -5.55, -3.09,  -.44,  1.97,  5.86, 17.09, 28.51, 39.94, 51.37,
& -5.59, -3.09,  -.40,  2.05,  6.12, 17.88, 29.65, 41.41, 53.18,
& -5.62, -3.09,  -.36,  2.14,  6.59, 18.35, 30.12, 41.88, 53.65,
& -5.63, -3.08,  -.32,  2.23,  7.12, 18.88, 30.65, 42.41, 54.18,
& -5.63, -3.06,  -.28,  2.32,  7.59, 19.35, 31.12, 42.88, 54.65,
& -5.62, -3.05,  -.25,  2.42,  8.06, 20.18, 32.30, 44.42, 56.55,
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& -5.60, -3.04,  -.22,  [illegible].52,  8.48, 20.61, 32.73, 44.85, 56.97,
& -5.54, -2.93,  -.05,  3.14, 11.23, 24.13, 37.03, 49.94, 62.8[illegible],
& -5.58, -2.86,   .13,  3.71, 14.62, 30.00, 45.38, 60.[illegible]7, 76.15,
& -5.42, -2.82,   .15,  4.24, 18.82, 37.00, 55.18, 73.36, 91.55/
 DATA((ALP221(J,N),N=1,9),J=1,13)/
& -5.73, -3.15,  -.77,  1.54,  5.20, 10.80, 16.13, 21.47, 26.80,
& -5.85, -3.15,  -.76,  1.66,  5.04,  9.34, 13.34, 17.34, 21.34,
& -5.95, -3.30,  -.83,  1.59,  4.54,  8.24, 11.72, 15.20, 18.68,
& -6.10, -3.49,  -.95,  1.45,  4.30,  7.61, 10.76, 13.91, 17.06,
& -6.16, -[illegible] 68, -1.14,  1.39,  4.21,  7.60, 11.21, 14.81, 18.41,
& -6.08, -3.69, -1.17,  1.52,  4.42,  8.55, 12.76, 16.97, 21.18-
& -6.05, -3.58,  -.98,  2.05,  5.53, 11.63, 17.78, 23.94, 30.09,
& -5.93, -3.25,  -.33,  2.99,  8.63, 16.96, 25.29, 33.63, 41.96,
& -5.19, -2.49,   .84,  4.52, 13.14, 22.23, 31.32, 40.41, 49.50,
& -4.42, -1.32,  2.23,  8.43, 17.13, 25.83, 34.52, 43.22, 51.91,
& -3.52,  -.42,  3.15, 11.86, 25.66, 39.45, 53.24, 67.03, 80.83,
& -3.71,  -.75,  2.90, 11.73, 29.91, 48.09, 66.27, 84.45,102.64,
& -4.90, -1.96,  1.06,  5.24, 19.60, 35.60, 51.60, 67.60, 83.60/
 DATA((ALP221(J,N),N=1,9),J=14,26)/
& -6.23, -3.11,  -.57,  2.95, 10.40, 21.83, 33.26, 44.[illegible], 56.11,
& -6.63, -3.82, -1.08,  2.40,  9.07, 23.36, 37.64, 51.9[illegible], [illegible].21,
& -6.84, -3.85, -1.01,  2.44,  9.41, 24.22, 39.04, 53.85  [illegible].67,
& -6.79, -3.76,  -.91,  2.57,  9.86, 23.66, 37.45, 51.24, 65.03,
& -6.70, -3.65,  -.81,  2.73, 10.00, 21.76, 33.53, 45.29, 57.06,
& -6.64, -3.53,  -.70,  2.90, 10.27, 21.08, 31.89, 42.70, 53.51,
& -6.55, -3.42,  -.59,  3.00, 10.65, 21.46, 32.27, 43.08, 53.89,
& -6.49, -3.32,  -.50,  3.20, 11.08, 21.[illegible], 32.70, 43.[illegible], 54.32,
& -6.46, -3.20,  -.39,  3.35, 11.46, 22.27, 33.08, 4[illegible].89, 54.70,
& -6.42, -3.08,  -.31,  3.47, 12.00, 23.11, 34.22, 45.33, 56.44,
& -6.85, -2.69,  0.00,  4.30, 15.00, 27.50, 40.00, 52.50, 65.00,
& -6.61, -2.65,   .1[illegible], 4.89, 17.03, 30.83, 44.[illegible]2, 58.41, 72.21,
& -6.31, -2.61,   .18,  5.30, 17.80, 31.13, 44.47, 57.80, 71.13/
 DATA((CD204(I,J),J=1,26),I=1,5)/
1 .0061, .0061, .0061, .0061, .0061, .0062, .0062, .0062, .0062,
1 .0062, .0063, .0064, .0076, .0113, .0169, .0211, .0245, .0270,
1 .0296, .0310, .0320, .0329, .0332, .0292, .0221, .0170,
2 .0047, .0046, .0046, .0045, .0045, .0045, .0045, .0045, .0045,
2 .0045, .0045, .0047, .0055, .0098, .0152, .0192, .0225, .0249,
2 .0270, .0290, .0303, .0316, .0325, .0317, .0299, .0283,
3 .0065, .0058, .0055, .0055, .0054, .0054, .0054, .0054, .0055,
3 .0055, .0057, .0066, .0096, .0153, .0210, .0250, .0284, .0304,
3 .0324, .0344, .0361, .0375, .0389, .0469, .0546, .0619,
4 .0219, .0168, .0144, .0133, .0128, .0126, .0128, .0130, .0138,
4 .0154, .0187, .0220, .0264, .0321, .0377, .0434, .0496, .0559,
4 .0623, .0686, .0750, .0788, .0823, .0979, .1077, .1194,
5 .0575, .0328, .0227, .0202, .0188, .0182, .0184, .0189, .0205,
5 .0236, .0317, .0403, .0489, .0586, .0701, .0817, .0928, .1036,
5 .1143, .1220, .1284, .1348, .1412, .1692, .1842, .1890/
 DATA((CD206(I,J),J=1,26),I=1,5)/
1 .0059, .0059, .0060, .0060, .0061, .0061, .0061, .0061, .0061,
1 .0062, .0062, .0067, .0112, .0173, .0235, .0289, .0333, .0364,
1 .0385, .0397, .0405, .0406, .0407, .0370, .0313, .0253,
2 .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044, .0044,
2 .0045, .0046, .0055, .0101, .0162, .0222, .0275, .0312, .0340,
2 .0360, .0377, .0387, .0396, .0400, .0398, .0365, .0325,
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3 .0068, .0055, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
3 .0053, .0057, .0082, .0132, .0209, .0273, .0319, .0354, .0375,
3 .0394, .0413, .0430, .0446, .0462, .0547, .0611, .0657,
4 .0173, .0125, .0095, .0085, .0082, .0082, .0083, .0087, .0090,
4 .0099, .0121, .0169, .0224, .0334, .0448, .0549, .0639, .0711,
4 .0772, .0834, .0877, .0918, .0958, .1116, .1178, .1234,
5 .0377, .0292, .0227, .0185, .0182, .0183, .0184, .0188, .0202,
5 .0229, .0267, .0304, .0395, .0666, .0956, .1136, .1271, .1380,
5 .1474, .1568, .1654, .1737, .1820, .2120, .2260, .2238/
 DATA((CD209(I,J),J=1,26),I=1,5)/
1 .0064, .0064, .0063, .0063, .0063, .0063, .0063, .0063, .0063,
1 .0063, .0068, .0089, .0138, .0201, .0278, .0356, .0426,  )481,
1 .0529, .0561, .0577, .0577, .0577, .0573, .0516, .0449,
2 .0055, .0053, .0054, .0056, .0058, .0059, .0059, .0060. .0062,
2 .0065, .0073, .0106, .0156, .0213, .0269, .0322, .0373, .0423,
2 .0471, .0515, .0560, .0582, .0598, .0601, .0567, .0526,
3 .0074, .0070, .0066, .0065, .0066, .0066, .0066, .0067, .0070,
3 .0072, .0088, .0143, .0213, .0287, .0359, .0432, .0496, . 555,
3 .0603, .0645, .0675, .0702, .0719, .0769, .0817, .0866,
4 .0124, .0109, .0101, .0098, .0097, .0097, .0101, .0105, .0113,
4 .0135, .0188, .0241, .0348, .0514, .0648, .0764, .0861, .0948,
4 .1022, .1087, .1135, .1183, .1231, .1335, .1384, .1432,
5 .0285, .0214, .0178, .0162, .0156, .0156, .0159, .0168, .0190,
5 .0241, .0371, .0537, .0706, .0863, .1003, .1126, .1245, .1354,
5 .1464, .1565, .1641, .1716, .1785, .1939, .1971, .2003/
 DATA((CD212(I,J),J=1,26),I=1,5)/
1 .0073, .0073, .0073, .0072, .0072, .0072, .0072, .0072, .0073,
1 .0081, .0127, .0228, .0329, .0416, .0506, .0585, .0658, .0727,
1 .0793, .0833, .0862, .0877, .0887, .0889, .0816, .0704,
2 .0060, .0057, .0057, .0056, .0056, .0056, .0058, .0059, .0064,
2 .0075, .0118, .0189, .0272, .0361, .0448, .0530, .0599, .0667,
2 .0734, .0789, .0831, .0865, .0880, .0903, .0845, .0746,
3 .0081, .0078, .0078, .0078, .0080, .0081, .0083, .0090, .0104,
3 .0129, .0173, .0262, .0353, .0437, .0520, .0606, .0693, .0772,
3 .0843, .0902, .0952, .0986, .1013, .1051, .1046, .1040,
4 .0136, .0131, .0129, .0128, .0129, .0131, .0133, .0146, .0172,
4 .0247, .0348, .0472, .0590, .0703, .0829, .0940, .1035, .1125,
4 .1208, .1280, .1336, .1392, .1430, .1543. .1560, .1505,
5 .0215, .0205, .0201, .0201, .0204, .0212, .0239, .0305, .0403,
5 .0559, .0753, .0955, .1132, .1295, .1455, .1615, .1713, .1780,
5 .1841, .1891, .1940, .1989, .2027, .2213, .2368, .2420/
 DATA((CD215(I,J),J=1,26),I=1,5)/
1 .0074, .0076, .0077, .0078, .0078, .0078, .0080, .0087, .0109,
1 .0200, .0300, .0403, .0507, .0613, .0718, .0809, .0900, .0992,
1 .1062, .1130, .1199, .1267, .1301, .1302, .1187, .1041,
2 .0074, .0076, .0077, .0078, .0078, .0078, .0080, .0087, .0108,
2 .0198, .0300, .0404, .0507, .0612, .0718, .0824, .0909, .0986,
2 .1063, .1134, .1198, .1261, .1324, .1315, .1228, .1103,
3 .0099, .0099, .0100, .0103, .0109, .0112, .0118, .0128, .0173,
3 .0268. .0369, .0474, .0584, .0701, .0806, .0893, .0981, .1062,
3 .1142, .1221, .1299, .1334, .1369, .1433, .1409, .1373,
4 .0159, .0170, .0175, .0178, .0182, .0195, .0218, .0273, .0370,
4 .0494, .0618, .0741, .0863, .0979, .1086, .1193, .1299, .1383,
4 .1458, .1534, .1609, .1675, .1711, .1838, .1864, .1890,
5 .0260, .0245, .0248, .0246, .0262, .0281, .0315, .0433, .0618,
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5 .0822, .1021, .1194, .1363, .1526, .1689, .1847, .1992, .2138,
5 .2283, .2359, .2429, .2499, .2570, .2727, .2772, .2816/
 DATA((CD218(I,J),J=1,26),I=1,5)/
1 .0096, .0101, .0103, .0104, .0108, .0112, .0122, .0144, .0207,
1 .0335, .0493, .0630, .0743, .0847, .0951, .1043, .1122, .1200,
1 .1273, .1322, .1370, .1418, .1450, .1525, .1524, .1482,
2 .0084, .0085, .0085, .0086, .0086, .0088, .0094, .0114, .0223,
2 .0354, .0514, .0655, .0777, .0891, .0994, .1083, .1173, .1248,
2 .1305, .1361, .1414, .1459, .1503, .1589, .1559, .1516,
3 .0130, .0141, .0147, .0150, .0154, .0159, .0175, .0208, .0308,
3 .0454, .0611, .0758, .0868, .0978, .1088, .1178, .1263, .1349,
3 .1416, .1468, .1520, .1572, .1601, .1677, .1710, .1742,
4 .0222, .0262, .0282, .0292, .0302, .0307, .0323, .0414, .0630,
4 .0793, .0966, .1118, .1246, .1375, .1486, .1589, .1692, .1760,
4 .1816, .1871, .1926, .1969, .2002, .2161, .2230, .2265,
5 .0358, .0414, .0441, .0455, .0495, .0565, .0661, .0841, .1029,
5 .1219, .1492, .1758, .1958, .2158, .2321, .2471, .2621, .2717,
5 .2812, .2908, .3003, .3008, .3008, .3028, .3071, .3114/
 DATA((CD221(I,J),J=1,26),I=1,5)/
1 .0098, .0137, .0146, .0153, .0159, .0165, .0174, .0199, .0267,
1 .0388, .0521, .0660, .0801, .0942, .1069, .1186, .1304, .1421,
1 .1526, .1625, .1724, .1793, .1834, .1860, .1868, .1876,
2 .0111, .0111, .0111, .0114, .0117, .0123, .0130, .0196, .0321,
2 .0443, .0569, .0697, .0832, .0963, .1083, .1203, .1331, .1470,
2 .1608, .1706, .1793, .1878, .1918, .1926, .1945, .1964,
3 .0154, .0164, .0169, .0172, .0176, .0180, .0202, .0305, .0450,
3 .0601, .0752, .0902, .1045, .1188, .1325, .1455, .1586, .1688,
3 .1772, .1856, .1940, .2024, .2064, .2181, .2191, .2202,
4 .0369, .0324, .0332, .0350, .0375, .0434, .0577, .0719, .0862,
4 .1012, .1169, .1326, .1463, .1597, .1732, .1849, .1959, .2069,
4 .2165, .2245, .2325, .2405, .2479, .2562, .2572, .2583,
5 .0670, .0511, .0528, .0547, .0607, .0771, .0969, .1168, .1348,
5 .1527, .1705, .1893, .2084, .2276, .2461, .2643, .2825, .3007,
5 .3055, .3084, .3113, .3136, .3138, .3149, .3160, .3172/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
 IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL204,IORDER,IPT,AA,XM,CLFT04,IERR)
 CL=CLFT04
 GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL204,IORDER,IPT,AA,XM,CLFT04,IERR)
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      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7  L206,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL206,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL209,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL209,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL212,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL212,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL215,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL215,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL218,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL218,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL221,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL221,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP204,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP204,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP206,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP206,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP209,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
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 30  CALL IBI (26,XMI,9,CLI,26,ALP209,IORDER,IPT,XM,CL,AA09,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP212,IORDER,IPT,XM,CL,AA12,IERR)
     AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
     GO TO 400
 40  CALL IBI (26,XMI,9,CLI,26,ALP212,IORDER,IPT,XM,CL,AA12,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP215,IORDER,IPT,XM,CL,AA15,IERR)
     AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
     GO TO 400
 50  CALL IBI (26,XMI,9,CLI,26,ALP215,IORDER,IPT,XM,CL,AA15,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP218,IORDER,IPT,XM,CL,AA18,IERR)
     AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
     GO TO 400
 60  CALL IBI (26,XMI,9,CLI,26,ALP218,IORDER,IPT,XM,CL,AA18,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP221,IORDER,IPT,XM,CL,AA21,IERR)
     AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
     GO TO 400
 70  CALL IBI (26,XMI,9,CLI,26,ALP221,IORDER,IPT,XM,CL,AA21,IERR)
     AA=AA21
400  CONTINUE
     IPT (1)
     IF (TR       .04) GO TO 91
     IF (TR -   , .04 .AND. TR .LT. .06) GO TO 11
     IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
     IF (TR .GE.  09 .AND. TR .LT. .12) GO TO 31
     IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
     IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
     IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
     IF (TR .GE. .21) GO TO 71
 91  CALL IBI (5,CLII,26,XMI,5,CD204,IORDER,IPT,CL,XM,CDRG04,IEPR)
     CD=CDRG04
     WRITE (6,201) TR
201  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
    &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
     GO TO 250
11   CALL IBI (5,CLII,26,XMI,5,CD204,IORDER,IPT,CL,XM,CDRG04,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD206,IORDER,IPT,CL,XM,CDRG06,IERR)
     CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
     GO TO 250
 21  CALL IBI (5,CLII,26,XMI,5,CD206,IORDER,IPT,CL,XM,CDRG06,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD209,IORDER,IPT,CL,XM,CDRG09,IERR)
     CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
     GO TO 250
 31  CALL IBI (5,CLII,26,XMI,5,CD209,IORDER,IPT,CL,XM,CDRG09,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD212,IORDER,IPT,CL,XM,CDRG12,IERR)
     CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
     GO TO 250
 41  CALL IBI (5,CLII,26,XMI,5,CD212,IORDER,IPT,CL,XM,CDRG12,IERR)
     IPT (1)=-1
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      CALL IBI (5,CLII,26,XMI,5,CD215,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD215,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD218,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD218,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD221,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD221,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO3(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-3XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP304(26,9),ALP306(26,9),
     & ALP309(26,9),ALP312(26,9),ALP315(26,9),ALP318(26,9),
     & ALP321(26,9),CLI(9),XMI(26),ALPI(7),CL304(7,26),
     & CL306(7,26),CL309(7,26),CL312(7,26),CL315(7,26),
     & CL318(7,26),CL321(7,26),CD304(5,26),CD306(5,26),
     & CD309(5,26),CD312(5,26),CD315(5,26),CD318(5,26),
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& CD321(5,26),CLII(5)
 DATA((CL304(I,J),J=1,26),I=1,4)/
1 -.184, -.211, -.232, -.245, -.265, -.276, -.287, -.301, -.316,
1 -.327, -.325, -.314, -.289, -.263, -.242, -.226, -.215, -.210,
1 -.212, -.219, -.232, -.244, -.255, -.281, -.294, -.295,
2  .052,  .055,  .061,  .064,  .067,  .069,  .073,  .077,  .080,
2  .084,  .090,  .096,  .102,  .107,  .103,  .078,  .027, -.002,
2  .021,  .050,  .065,  .077,  .070, -.038, -.116, -.141,
3  .262,  .284,  .305,  .319,  .334,  .341,  .349,  .357,  .368,
3  .378,  .390,  .407,  .407,  .381,  .345,  .308,  .272,  .258,
3  .273,  .300,  .327,  .330,  .306,  .154,  .028, -.024,
4  .492,  .514,  .533,  .547,  .561,  .569,  .580,  .590,  .601,
4  .613,  .628,  .643,  .637,  .606,  .575,  .543,  .511,  .499,
4  .521,  .544,  .568,  .569,  .534,  .320,  .148,  .084/
 DATA((CL304(I,J),J=1,26),I=5,7)/
5  .656,  .696,  .735,  .761,  .794,  .810,  .831,  .853,  .869,
5  .875,  .866,  .846,  .826,  .797,  .768,  .739,  .717,  .708,
5  .734,  .759,  .780,  .781,  .740,  .464,  .266,  .200,
6  .831,  .888,  .930,  .958,  .991, 1.015, 1.036, 1.035, 1.023,
6 1.011,  .994,  .977,  .960,  .943,  .925,  .903,  .881,  .870,
6  .893,  .924,  .957,  .945,  .900,  .608,  .393,  .306,
7  .977, 1.028, 1.069, 1.097, 1.137, 1.149, 1.155, 1.156, 1.151,
7 1.138, 1.126, 1.109, 1.090, 1.070, 1.051, 1.031, 1.011, 1.006,
7 1.026, 1.050, 1.072, 1.077, 1.038,  .746,  .524,  .415/
 DATA((CL306(I,J),J=1,26),I=1,4)/
1 -.184, -.180, -.178, -.173, -.168, -.165, -.159, -.152, -.146,
1 -.139, -.131, -.123, -.119, -.171, -.246, -.320, -.374, -.346,
1 -.301, -.256, -.221, -.223, -.232, -.287, -.322, -.305,
2  .073,  .071,  .075,  .078,  .084,  .089,  .096,  .102,  .109,
2  .119,  .129,  .137,  .115,  .056, -.003, -.063, -.087, -.063,
2 -.025,  .012,  .023,  .010, -.003, -.080, -.134, -.129,
3  .276,  .292,  .312,  .325,  .338,  .348,  .357,  .367,  .377,
3  .387,  .397,  .395,  .355,  .304,  .252,  .201,  .182,  .200,
3  .238,  .275,  .295,  .282,  .259,  .120,  .020, -.015,
4  .501,  .514,  .537,  .554,  .572,  .581,  .590,  .599,  .618,
4  .636,  .645,  .608,  .565,  .521,  .477,  .433,  .413,  .447,
4  .483,  .520,  .523,  .495,  .462,  .266,  .129,  .093/
 DATA((CL306(I,J),J=1,26),I=5,7)/
5  .655,  .691,  .737,  .763,  .789,  .803,  .821,  .838,  .843,
5  .828,  .797,  .761,  .725,  .689,  .653,  .620,  .606,  .635,
5  .667,  .699,  .714,  .691,  .647,  .385,  .249,  .208,
6  .815,  .867,  .919,  .952,  .985, 1.001, 1.004,  .989,  .963,
6  .936,  .909,  .882,  .848,  .813,  .779,  .744,  .728,  .749,
6  .782,  .814,  .837,  .821,  .782,  .553,  .396,  .322,
7  .955, 1.003, 1.054, 1.087, 1.126, 1.134, 1.125, 1.113, 1.083,
7 1.053, 1.023,  .993,  .963,  .932,  .902,  .875,  .854,  .873,
7  .908,  .944,  .968,  .949,  .921,  .700,  .534,  .417/
 DATA((CL309(I,J),J=1,26),I=1,4)/
1 -.146, -.146, -.134, -.127, -.120, -.116, -.113, -.109, -.105,
1 -.095, -.140, -.232, -.341, -.416, -.416, -.385, -.322, -.279,
1 -.273, -.274, -.274, -.275, -.275, -.283, -.287, -.281,
2  .058,  .062,  .069,  .073,  .079,  .082,  .085,  .089,  .097,
2  .103,  .071, -.013, -.112, -.184, -.181, -.132, -.087, -.057,
2 -.056, -.061, -.066, -.071, -.077, -.107, -.127, -.132,
3  .253,  .265,  .282,  .291,  .305,  .312,  .320,  .328,  .336,
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3  .328,  .286,  .216,  .134,  .059,  .055,  .097,  .150,  .176,
3  .166,  .152,  .139,  .125,  .112,  .042, -.003, -.028,
4  .461,  .487,  .512,  .529,  .552,  .563,  .574,  .580,  .575,
4  .526,  .449,  .372,  .303,  .256,  .260,  .306,  .355,  .378,
4  .368,  .349,  .330,  .311,  .291,  .195,  .131,  .086/
 DATA((CL309(I,J),J=1,26),I=5,7)/
5  .615,  .659,  .700,  .721,  .746,  .765,  .776,  .761,  .724,
5  .665,  .602,  .539,  .475,  .429,  .434,  .474,  .527,  .542,
5  .529,  .511,  .488,  .466,  .443,  .331,  .253,  .201,
6  .758,  .815,  .861,  .853,  .930,  .942,  .926,  .892,  .837,
6  .781,  .726,  .670,  .618,  .581,  .596,  .639,  .681,  .699,
6  .683,  .658,  .633,  .608,  .583,  .459,  .366,  .296,
7  .907,  .956, 1.012, 1.048, 1.040, 1.016,  .979,  .933,  .838,
7  .843,  .797,  .752,  .708,  .670,  .679,  .718,  .758,  .772,
7  .757,  .737,  .716,  .696,  .675,  .553,  .472,  .407/
 DATA((CL312(I,J),J=1,26),I=1,4)/
1 -.109, -.115, -.130, -.142, -.156, -.163, -.173, -.182, -.204,
1 -.240, -.280, -.328, -.394, -.412, -.386, -.285, -.211, -.187,
1 -.191, -.200, -.209, -.218, -.226, -.262, -.275, -.273,
2  .057,  .061,  .071,  .079,  .088,  .093,  .103,  .112,  .096,
2  .036, -.033, -.116, -.207, -.233, -.203, -.143, -.080, -.058,
2 -.066, -.076, -.085, -.093, -.102, -.141, -.153, -.155,
3  .214,  .227,  .242,  .250,  .261,  .266,  .272,  .279,  .282,
3  .232,  .143,  .054, -.031, -.059, -.036,  .034,  .094,  .114,
3  .098,  .082,  .069,  .057,  .045, -.008, -.027, -.041,
4  .410,  .426,  .442,  .452,  .465,  .476,  .488,  .479,  .424,
4  .355,  .287,  .218,  .154,  .127,  .151,  .213,  .276,  .305,
4  .291,  .267,  .245,  .229,  .212,  .140,  .093,  .073/
 DATA((CL312(I,J),J=1,26),I=5,7)/
5  .553,  .585,  .613,  .632,  .654,  .669,  .649,  .593,  .538,
5  .483,  .423,  .361,  .299,  .274,  .305,  .364,  .423,  .449,
5  .434,  .414,  .394,  .375,  .360,  .278,  .219,  .184,
6  .687,  .738,  .780,  .810,  .842,  .856,  .833,  .775,  .717,
6  .649,  .578,  .507,  .441,  .414,  .444,  .499,  .559,  .585,
6  .575,  .554,  .533,  .511,  .490,  .403,  .337,  .295,
7  .828,  .871,  .903,  .928,  .968,  .945,  .895,  .838,  .772,
7  .707,  .641,  .575,  .513,  .489,  .518,  .569,  .635,  .655,
7  .640,  .625,  .610,  .596,  .582,  .505,  .448,  .406/
 DATA((CL315(I,J),J=1,26),I=1,4)/
1 -.124, -.119, -.119, -.121, -.122, -.123, -.124, -.137, -.212,
1 -.287, -.362, -.435, -.458, -.435, -.352, -.250, -.194, -.191,
1 -.190, -.190, -.190, -.190, -.190, -.197, -.213, -.225,
2  .023,  .026,  .033,  .037,  .042,  .044,  .046,  .043,  .007,
2 -.083, -.180, -.276, -.303, -.264, -.192, -.125, -.099, -.100,
2 -.101, -.103, -.104, -.106, -.107, -.116, -.119, -.121,
3  .197,  .194,  .198,  .202,  .211,  .215,  .217,  .200,  .144,
3  .055, -.042, -.135, -.180, -.145, -.070,  .003,  .028,  .027,
3  .023,  .020,  .016,  .012,  .009, -.009, -.022, -.023,
4  .374,  .386,  .401,  .410,  .422,  .430,  .425,  .398,  .329,
4  .251,  .153,  .058,  .017,  .052,  .130,  .205,  .231,  .222,
4  .214,  .206,  .199,  .192,  .185,  .147,  .116,  .092/
 DATA((CL315(I,J),J=1,26),I=5,7)/
5  .515,  .538,  .562,  .583,  .605,  .604,  .576,  .525,  .464,
5  .381,  .285,  .196,  .169,  .210,  .285,  .356,  .380,  .374,
5  .364,  .355,  .345,  .336,  .326,  .274,  .229,  .197,
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6  .633,  .661,  .695,  .725,  .758,  .753,  .714,  .661,  .569,
6  .478,  .387,  .285,  .263,  .304,  .372,  .430,  .453,  .450,
6  .441,  .433,  .424,  .416,  .408,  .365,  .328,  .292,
7  .742,  .777,  .813,  .842,  .874,  .857,  .802,  .730,  .641,
7  .553,  .464,  .353,  .319,  .357,  .432,  .503,  .530,  .525,
7  .519,  .512,  .506,  .499,  .492,  .452,  .422,  .393/
 DATA((CL318(I,J),J=1,26),I=1,4)/
1 -.157, -.175, -.196, -.213, -.236, -.269, -.319, -.388, -.457,
1 -.527, -.599, -.650, -.631, -.555, -.473, -.385, -.371, -.379,
1 -.386, -.394, -.402, -.408, -.410, -.412, -.411, -.410,
2 -.007, -.011, -.014, -.015, -.023, -.052, -.096, -.153, -.227,
2 -.313, -.404, -.492, -.473, -.347, -.239, -.204, -.210, -.215,
2 -.221, -.227, -.229, -.232, -.235, -.244, -.248, -.256,
3  .148,  .155,  .161,  .167,  .173,  .155,  .104,  .017, -.072,
3 -.161, -.243, -.288, -.243, -.140, -.048, -.004, -.006, -.009,
3 -.013, -.016, -.020, -.023, -.027, -.042, -.053, -.063,
4  .318,  .331,  .337,  .339,  .341,  .305,  .248,  .162,  .076,
4 -.010, -.079, -.109, -.070,  .033,  .123,  .147,  .144,  .140,
4  .135,  .130,  .125,  .119,  .114,  .086,  .066,  .048/
 DATA((CL318(I,J),J=1,26),I=5,7)/
5  .456,  .470,  .486,  .494,  .485,  .443,  .382,  .310,  .225,
5  .140,  .069,  .039,  .096,  .188,  .263,  .294,  .289,  .283,
5  .274,  .264,  .254,  .246,  .239,  .201,  .170,  .143,
6  .552,  .598,  .637,  .656,  .642,  .589,  .508,  .427,  .347,
6  .262,  .165,  .150,  .195,  .295,  .381,  .400,  .395,  .387,
6  .379,  .371,  .363,  .355,  .347,  .301,  .264,  .232,
7  .653,  .706,  .753,  .782,  .744,  .661,  .572,  .483,  .394,
7  .305,  .204,  .179,  .235,  .337,  .416,  .433,  .429,  .419,
7  .409,  .400,  .392,  .383,  .376,  .339,  .303,  .271/
 DATA((CL321(I,J),J=1,26),I=1,4)/
1 -.239, -.242, -.237, -.232, -.226, -.236, -.264, -.323, -.389,
1 -.454, -.480, -.457, -.378, -.298, -.243, -.243, -.245, -.247,
1 -.249, -.252, -.254, -.256, -.258, -.272, -.285, -.295,
2 -.065, -.063, -.062, -.052, -.046, -.053, -.091, -.175, -.259,
2 -.333, -.360, -.332, -.269, -.166, -.082, -.082, -.085, -.087,
2 -.090, -.092, -.095, -.097, -.100, -.116, -.133, -.151,
3  .095,  .095,  .098,  .105,  .117,  .113,  .093,  .012, -.102,
3 -.216, -.264, -.242, -.161, -.035,  .020,  .020,  .017,  .014,
3  .012,  .009,  .006,  .004,  .001, -.012, -.024, -.033,
4  .243,  .255,  .263,  .281,  .295,  .291,  .255,  .176,  .033,
4 -.110, -.162, -.149, -.070,  .071,  .124,  .122,  .117,  .111,
4  .106,  .100,  .095,  .089,  .084,  .062,  .044,  .026/
 DATA((CL321(I,J),J=1,26),I=5,7)/
5  .381,  .397,  .405,  .429,  .451,  .440,  .403,  .309,  .161,
5  .012, -.035, -.001,  .089,  .200,  .258,  .251,  .243,  .236,
5  .230,  .223,  .217,  .210,  .204,  .165,  .136,  .108,
6  .450,  .471,  .492,  .537,  .560,  .544,  .498,  .379,  .243,
6  .106,  .056,  .071,  .161,  .289,  .336,  .332,  .326,  .320,
6  .313,  .306,  .299,  .293,  .286,  .246,  .207,  .170,
7  .506,  .538,  .592,  .643,  .678,  .655,  .597,  .482,  .311,
7  .139,  .081,  .104,  .187,  .332,  .365,  .364,  .358,  .351,
7  .344,  .337,  .330,  .323,  .316,  .278,  .242,  .206/
 DATA((ALP304(J,N),N=1,9),J=1,13)/
& -5.83, -4.14, -2.44,  -.59,  1.20,  3.32,  5.65,  8.32, 11.05,
& -5.42, -3.92, -2.41,  -.73,  1.01,  2.95,  5.08,  7.60, 10.46,
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& -5.15, -3.78, -2.42,  -.86,   .83,  2.66,  4.67,  7.01,  9.88,
& -5.00, -3.71, -2.41,  -.93,   .71,  2.50,  4.40,  6.60,  9.48,
& -4.81, -3.61, -2.40, -1.00,   .58,  2.33,  4.06,  5.12,  8.86,
& -4.72, -3.56, -2.40, -1.04,   .52,  2.26,  3.92,  5.85,  8.76,
& -4.63, -3.52, -2.41, -1.08,   .44,  2.16,  3.75,  5.65,  8.76,
& -4.52, -3.47, -2.41, -1.12,   .37,  2.08,  3.60,  5.62,  8.73,
& -4.42, -3.41, -2.40, -1.17,   .27,  1.99,  3.49,  5.70,  8.77,
& -4.36, -3.38, -2.41, -1.21,   .19,  1.39,  3.43,  5.84,  8.98,
& -4.36, -3.40, -2.43, -1.27,   .08,  1.76,  3.45,  6.09,  9.12,
& -4.42, -3.44, -2.47, -1.33,  -.05,  1.64,  3.55,  6.35,  9.38,
& -4.57, -3.54, -2.52, -1.36,  -.05,  1.68,  3.72,  6.62,  9.69/
 DATA((ALP304(J,N),N=1,9),J=14,26)/
& -4.74, -3.66, -2.58, -1.32,   .17,  1.95,  4.04,  6.90, 10.05,
& -4.92, -3.76, -2.60, -1.20,   .48,  2.26,  4.41,  7.19, 10.37,
& -5.14, -3.83, -2.51,  -.94,   .78,  2.58,  4.74,  7.52, 10.64,
& -5.53, -3.88, -2.22,  -.59,  1.07,  2.86,  5.01,  7.83, 10.91,
& -5.83, -3.90, -1.98,  -.45,  1.18,  2.97,  5.14,  7.91, 10.85,
& -5.61, -3.90, -2.18,  -.58,  1.02,  2.74,  4.93,  7.61, 10.62,
& -5.35, -3.86, -2.37,  -.80,   .82,  2.52,  4.50,  7.21, 10.38,
& -5.13, -3.78, -2.44,  -.97,   .61,  2.30,  4.23,  6.75, 10.23,
& -4.97, -3.73, -2.48, -1.03,   .59,  2.29,  4.23,  6.83,  9.86,
& -4.89, -3.66, -2.43,  -.90,   .82,  2.64,  4.75,  7.45, 10.35,
& -4.98, -3.33, -1.60,   .55,  3.11,  5.89,  8.78, 11.68, 14.58,
& -5.19, -2.94,  -.39,  2.88,  6.11,  9.16, 12.21, 15.27, 18.32,
& -5.36, -2.77,   .44,  4.00,  7.72, 11.39, 15.06, 18.73, 22.40/
 DATA((ALP306(J,N),N=1,9),J=1,13)/
& -5.68, -4.12, -2.57,  -.75,  1.10,  3.29,  5.81,  8.64, 11.50,
& -5.75, -4.16, -2.57,  -.83,   .97,  2.97,  5.24,  7.96, 10.90,
& -5.75, -4.17, -2.59,  -.95,   .78,  2.63,  4.69,  7.20, 10.16,
& -5.81, -4.22, -2.62, -1.01,   .66,  2.44,  4.39,  6.71,  9.67,
& -5.84, -4.25, -2.67, -1.09,   .53,  2.26,  4.11,  6.21,  9.05,
& -5.85, -4.28, -2.70, -1.14,   .45,  2.17,  3.97,  5.99,  8.99,
& -5.89, -4.32, -2.75, -1.20,   .37,  2.09,  3.82,  5.96,  9.24,
& -5.95, -4.38, -2.80, -1.26,   .28,  2.01,  3.68,  6.18,  9.40,
& -5.99, -4.42, -2.85, -1.32,   .19,  1.85,  3.62,  6.62,  9.95,
& -6.02, -4.47, -2.92, -1.40,   .10,  1.71,  3.71,  7.09, 10.51,
& -6.07, -4.53, -2.99, -1.47,   .02,  1.64,  4.05,  7.60, 11.11,
& -6.13, -4.59, -3.05, -1.51,   .05,  1.92,  4.64,  8.13, 11.73,
& -6.40, -4.69, -2.98, -1.29,   .43,  2.44,  5.22,  8.64, 12.12/
 DATA((ALP306(J,N),N=1,9),J=14,26)/
& -6.02, -4.26, -2.49,  -.84,   .88,  2.94,  5.79,  9.14, 12.50,
& -5.27, -3.62, -1.98,  -.41,  1.32,  3.40,  6.34,  9.59, 12.85,
& -4.62, -3.07, -1.52,  -.01,  1.72,  3.79,  6.85,  9.91, 12.96,
& -4.18, -2.79, -1.35,   .16,  1.89,  3.94,  7.14, 10.32, 13.49,
& -4.38, -2.97, -1.52,  0.00,  1.62,  3.63,  6.82, 10.05, 13.27,
& -4.72, -3.27, -1.81,  -.29,  1.32,  3.27,  6.29,  9.46, 12.63,
& -5.07, -3.58, -2.09,  -.57,  1.02,  2.89,  5.76,  8.86, 11.94,
& -5.47, -3.83, -2.19,  -.70,   .92,  2.81,  5.40,  8.49, 11.54,
& -5.52, -3.80, -2.09,  -.60,  1.11,  3.07,  5.68,  8.80, 11.92,
& -5.47, -3.72, -1.98,  -.45,  1.39,  3.49,  6.26,  9.14, 12.01,
& -5.09, -3.16, -1.20,  1.10,  4.18,  6.64,  9.36, 12.08, 14.80,
& -4.83, -2.70,  -.26,  3.18,  6.06,  8.96, 11.86, 14.75, 17.65,
& -5.08, -2.81,   .28,  3.86,  7.64, 11.85, 16.06, 20.27, 24.48/
 DATA((ALP309(J,N),N=1,9),J=1,13)/
& -6.49, -4.53, -2.57,  -.54,  1.41,  3.81,  6.56,  9.25, 11.93,
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& -6.44, -4.52, -2.60,  -.64,  1.22,  3.31,  5.81,  8.62, 11.46,
& -6.62, -4.65, -2.68,  -.77,  1.03,  2.94,  5.24,  7.84, 10.49,
& -6.73, -4.73, -2.73,  -.83,   .92,  2.74,  4.92,  7.38,  9.96,
& -6.81, -4.80, -2.79,  -.93,   .77,  2.49,  4.59,  7.27, 10.91,
& -6.87, -4.85, -2.83,  -.97,   .70,  2.37,  4.40,  7.57, 12.97,
& -6.90, -4.88, -2.86, -1.02,   .63,  2.26,  4.32,  8.79, 16.34,
& -6.94, -4.92, -2.90, -1.07,   .57,  2.22,  4.60, 11.27, 21.02,
& -6.92, -4.94, -2.96, -1.14,   .54,  2.34,  5.35, 12.39, 20.24,
& -7.08, -5.06, -3.04, -1.14,   .73,  3.06,  6.61, 13.06, 19.52,
& -6.46, -4.57, -2.67,  -.80,  1.40,  3.97,  8.08, 13.72, 19.35,
& -5.53, -3.71, -1.89,  -.14,  2.34,  4.93,  9.17, 14.05, 18.93,
& -4.52, -2.77, -1.09,   .78,  3.13,  5.75, 10.04, 14.49, 18.93/
 DATA((ALP309(J,N),N=1,9),J=14,26)/
& -3.86, -2.14,  -.49,  1.43,  3.66,  6.43, 10.92, 15.42, 19.91,
& -3.86, -2.16,  -.47,  1.41,  3.61,  6.10, 10.92, 15.73, 20.55,
& -4.12, -2.54,  -.85,   .99,  3.12,  5.53, 10.08, 15.14, 20.20,
& -4.66, -2.96, -1.27,   .49,  2.52,  4.95,  9.09, 14.29, 19.48,
& -5.09, -3.29, -1.51,   .24,  2.27,  4.74,  8.77, 14.25, 19.73,
& -5.17, -3.33, -1.50,   .34,  2.40,  4.92,  9.16, 14.57, 19.97,
& -5.18, -3.31, -1.43,   .49,  2.63,  5.21,  9.59, 14.66, 19.72,
& -5.21, -3.29, -1.36,   .64,  2.89,  5.54, 10.02, 14.84, 19.66,
& -5.23, -3.26, -1.28,   .81,  3.15,  5.89, 10.36, 14.91, 19.45,
& -5.26, -3.24, -1.19,   .98,  3.43,  6.37, 10.72, 15.07, 19.41,
& -5.33, -3.06,  -.56,  2.07,  5.08,  9.00, 13.26, 17.51, 21.77,
& -5.41, -2.91,   .04,  3.13,  6.64, 10.42, 14.19, 17.96, 21.74,
& -5.60, -2.91,   .49,  3.98,  7.87, 11.48, 15.08, 18.68, 22.29/
 DATA((ALP312(J,N),N=1,9),J=1,13)/
& -7.51, -5.10, -2.69,  -.18,  1.90,  4.70,  7.60, 10.44, 13.28,
& -7.24, -4.97, -2.69,  -.33,  1.74,  4.20,  6.93,  9.94, 12.95,
& -6.69, -4.70, -2.71,  -.49,  1.58,  3.85,  6.33,  9.58, 12.83,
& -6.33, -4.52, -2.71,  -.58,  1.49,  3.64,  5.89,  9.22, 12.61,
& -6.00, -4.36, -2.72,  -.71,  1.36,  3.43,  5.55,  8.51, 11.68,
& -5.85, -4.29, -2.73,  -.76,  1.28,  3.28,  5.40,  9.24, 13.73,
& -5.64, -4.20, -2.75,  -.85,  1.19,  3.39,  5.64, 11.39, 17.84,
& -5.48, -4.12, -2.76,  -.95,  1.21,  4.08,  6.79, 13.14, 19.49,
& -5.31, -3.97, -2.64,  -.88,  1.66,  4.69,  9.02, 16.29, 23.56,
& -5.16, -3.71, -2.26,  -.33,  2.70,  5.41, 11.21, 18.10, 25.00,
& -4.97, -3.35, -1.63,   .79,  3.66,  6.70, 13.05, 19.40, 25.75,
& -4.68, -2.79,  -.64,  1.78,  4.53,  8.74, 14.62, 20.50, 26.38,
& -4.06, -1.92,   .34,  2.63,  5.42, 10.42, 15.97, 21.53, 27.08/
 DATA((ALP312(J,N),N=1,9),J=14,26)/
& -3.87, -1.62,   .63,  2.99,  5.80, 10.96, 16.29, 21.63, 26.96,
& -4.15, -1.96,   .39,  2.64,  5.37, 10.22, 15.62, 21.03, 26.43,
& -5.62, -2.80,  -.38,  1.85,  4.53,  8.89, 14.60, 20.31, 26.03,
& -6.89, -3.83, -1.08,  1.16,  3.69,  7.08, 12.34, 17.61, 22.87,
& -7.30, -4.20, -1.33,   .90,  3.32,  6.43, 12.14, 17.86, 23.57,
& -7.34, -4.14, -1.20,  1.06,  3.52,  6.77, 12.92, 19.08, 25.23,
& -7.23, -4.00, -1.04,  1.28,  3.81,  7.30, 12.93, 18.56, 24.20,
& -7.08, -3.85,  -.90,  1.49,  4.09,  7.74, 12.94, 18.13, 23.32,
& -6.91, -3.71,  -.76,  1.66,  4.37,  8.09, 12.80, 17.51, 22.21,
& -6.81, -3.58,  -.61,  1.86,  4.62,  8.39, 12.74, 17.09, 21.43,
& -6.28, -2.98,   .11,  2.87,  5.95,  9.86, 13.78, 17.71, 21.63,
& -6.05, -2.77,   .45,  3.70,  7.14, 10.74, 14.34, 17.95, 21.55,
& -6.15, -2.76,   .72,  4.29,  7.89, 11.50, 15.10, 18.70, 22.31/
 DATA((ALP315(J,N),N=1,9),J=1,13)/
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& -7.76, -5.03, -2.31,   .03,  2.37,  5.44,  9.06, 12.73, 16.40,
& -7.88, -5.12, -2.36,   .06,  2.18,  5.01,  8.40, 11.84, 15.29,
& -7.70, -5.07, -2.43,   .02,  1.99,  4.57,  7.78, 11.17, 14.56,
& -7.53, -5.00, -2.47,  -.02,  1.90,  4.24,  7.28, 10.70, 14.12,
& -7.39, -4.95, -2.51,  -.13,  1.79,  3.95,  6.72, 10.17, 13.62,
& -7.32, -4.92, -2.53,  -.18,  1.72,  3.95,  6.90, 10.75, 14.60,
& -7.25, -4.89, -2.54,  -.20,  1.76,  4.35,  7.95, 12.50, 17.05,
& -6.92, -4.70, -2.48,  0.00,  2.03,  5.10, 10.03, 15.83, 21.62,
& -5.72, -3.89, -2.06,   .61,  3.05,  6.86, 12.42, 17.97, 23.53,
& -5.11, -3.15,  -.80,  1.48,  4.39,  9.25, 14.59, 19.92, 25.25,
& -4.42, -2.22,   .43,  2.71,  6.34, 11.53, 16.73, 21.92, 27.12,
& -3.56,  -.92,  1.40,  4.09,  9.38, 15.26, 21.15, 27.03, 32.91,
& -3.25,  -.33,  1.83,  4.66, 10.89, 18.04, 25.18, 32.32, 39.46/
 DATA((ALP315(J,N),N=1,9),J=14,26)/
& -3.59,  -.92,  1.47,  3.87,  9.62, 17.17, 24.72, 32.26, 39.81,
& -4.60, -2.10,   .70,  2.90,  6.93, 13.60, 20.27, 26.93, 33.60,
& -6.40, -3.20,  -.05,  1.95,  5.19, 10.66, 16.14, 21.62, 27.10,
& -8.34, -4.13,  -.44,  1.69,  4.55,  9.82, 15.01, 20.21, 25.40,
& -8.59, -4.20,  -.43,  1.77,  4.68, 10.00, 15.33, 20.67, 26.00,
& -6.72, -4.22,  -.37,  1.85,  4.94, 10.08, 15.21, 20.33, 25.46,
& -8.83, -4.23,  -.33,  1.94,  5.15, 10.23, 15.29, 20.35, 25.42,
& -8.88, -4.23,  -.27,  2.01,  5.39, 10.29, 15.17, 20.05, 24.93,
& -9.00, -4.24,  -.20,  2.11,  5.60, 10.43, 15.25, 20.07, 24.89,
& -9.06, -4.24,  -.16,  2.21,  5.80, 10.57, 15.33, 20.10, 24.86,
& -9.01, -4.07,   .12,  2.83,  6.80, 11.40, 16.00, 20.60, 25.20,
& -7.98, -3.72,   .32,  3.49,  7.53, 11.79, 16.04- 20.30, 24.55,
& -7.31, -3.50,   .40,  4.06,  8.14, 12.10, 16.06, 20.02, 23.98/
 DATA((ALP318(J,N),N=1,9),J=1,13)/
& -7.24, -4.57, -1.91,   .61,  3.19,  6.95, 10.91, 14.87, 18.83,
& -6.74, -4.30, -1.87,   .51,  2.99,  6.04,  9.74, 13.44, 17.15,
& -6.24, -4.04, -1.84,   .44,  2.85,  5.51,  8.81, 12.26, 15.71,
& -5.89, -3.87, -1.84,   .38,  2.79,  5.31,  8.29, 11.46, 14.63,
& -5.54, -3.66, -1.77,   .32,  2.82,  5.46,  9.10, 13.02, 16.94,
& -5.21, -3.36, -1.50,   .60,  3.38,  6.31, 11.86, 17.42, 22.97,
& -4.73, -2.93, -1.04,  1.33,  4.29,  8.88, 15.13, 21.38, 27.63,
& -4.10, -2.40,  -.20,  2.51,  5.54, 12.18, 19.32, 26.46, 33.61,
& -3.50, -1.65,   .97,  3.66,  8.26, 16.77, 25.28, 33.79, 42.30,
& -2.81,  -.51,  2.13,  4.98, 12.42, 21.72, 31.02, 40.33, 49.63,
& -1.95,   .52,  3.07,  7.79, 18.05, 28.31, 38.56, 48.82, 59.08,
& -1.10,   .98,  3.47,  9.45, 23.24, 37.03, 50.83, 64.62, 78.41,
& -1.37,   .50,  2.84,  6.25, 16.25, 26.25, 36.25, 46.25, 56.25/
 DATA((ALP318(J,N),N=1,9),J=14,26)/
& -2.51,  -.58,  1.62,  4.22, 11.00, 20.52, 30.05, 39.57, 49.10,
& -3.38, -1.59,   .56,  3.10,  7.09, 18.51, 29.94, 41.37, 52.80,
& -4.17, -1.96,   .05,  2.72,  6.00, 18.12, 30.24, 42.36, 54.48,
& -4.36, -1.90,   .08,  2.77,  6.29, 18.06, 29.82, 41.59, 53.35,
& -4.26, -1.85,   .12,  2.84,  6.81, 19.31, 31.81, 44.31, 56.81,
& -4.17, -1.80,   .18,  2.94,  7.40, 20.73, 34.07, 47.40, 60.73,
& -4.07, -1.74,   .22,  3.04,  8.00, 21.79, 35.59, 49.38, 63.17,
& -3.98, -1.72,   .28,  3.16,  8.55, 22.34, 36.14, 49.93, 63.72,
& -3.91, -1.69,   .32,  3.28,  9.21, 23.50, 37.79, 52.07, 66.36,
& -3.89, -1.66,   .38,  3.38,  9.66, 23.45, 37.24, 51.03, 64.83,
& -3.86, -1.56,   .66,  3.98, 11.21, 21.74, 32.26, 42.79, 53.32,
& -3.87, -1.51,   .89,  4.64, 12.97, 23.23, 33.49, 43.74, 54.00,
& -3.87, -1.42,  1.14,  5.28, 14.62, 24.87, 35.13, 45.38, 55.64/
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 DATA((ALP321(J,N),N=1,9),J=1,13)/
& -5.85, -3.55, -1.19,  1.42,  4.55, 11.36, 18.50, 25.64, 32.79,
& -5.77, -3.53, -1.20,  1.31,  4.08,  9.85, 15.82, 21.79, 27.76,
& -5.86, -3.58, -1.23,  1.24,  3.93,  8.16, 12.16, 16.16, 20.16,
& -5.87, -3.64, -1.34,  1.08,  3.61,  7.19, 10.96, 14.74, 18.51,
& -5.93, -3.71, -1.44,   .93,  3.35,  6.68, 10.07, 13.46, 16.85,
& -5.79, -3.61, -1.36,   .98,  3.46,  7.01, 10.61, 14.22, 17.82,
& -5.57, -3.26, -1.01,  1.32,  3.96,  8.06, 12.10, 16.14, 20.18,
& -5.04, -2.34,  -.13,  2.36,  6.41, 10.29, 14.17, 18.06, 21.94,
& -4.17, -1.25,  1.51,  4.95, 10.62, 16.50, 22.38, 28.26, 34.15,
& -3.11,   .30,  3.80, 11.70, 23.82, 35.94, 48.06, 60.18, 72.30,
& -2.67,  1.25,  4.77, 17.52, 33.52, 49.52, 65.52, 81.52, 97.52,
& -3.09,   .90,  4.03, 13.82, 25.94, 38.06, 50.18, 62.30, 74.42,
& -4.40,  -.72,  2.88,  9.00, 24.38, 39.77, 55.15, 70.54, 85.92/
 DATA((ALP321(J,N),N=1,9),J=14,26)/
& -5.55, -2.52,   .66,  4.00, 11.16, 20.47, 29.77, 39.07, 48.37,
& -5.95, -3.47,  -.39,  3.13, 10.41, 24.21, 38.00, 51.79, 65.59,
& -5.95, -3.47,  -.39,  3.21, 10.25, 22.75, 35.25, 47.75, 60.25,
& -5.94, -3.44,  -.33,  3.32, 10.63, 23.13, 35.63, 48.13, 60.63,
& -5.91, -3.41,  -.28,  3.42, 11.16, 24.06, 36.97, 49.87, 62.77,
& -5.90, -3.38,  -.24,  3.52, 11.61, 24.52, 37.42, 50.32, 63.23,
& -5.85, -3.35,  -.18,  3.63, 12.06, 24.97, 37.87, 50.77, 63.68,
& -5.84, -3.32,  -.12,  3.72, 12.52, 25.42, 38.32, 51.23, 64.13,
& -5.81, -3.30,  -.08,  3.83, 13.13, 26.47, 39.80, 53.13, 66.47,
& -5.80, -3.27,  -.02,  3.93, 13.60, 26.93, 40.27, 53.60, 66.93,
& -5.64, -3.08,   .32,  4.86, 15.63, 28.13, 40.63, 53.13, 65.63,
& -5.51, -2.86,   .71,  5.80, 17.03, 28.46, 39.89, 51.31, 62.74,
& -5.46, -2.68,  1.12,  7.67, 18.78, 29.89, 41.00, 52.11, 63.22/
 DATA((CD304(I,J),J=1,26),I=1,5)/
1 .0095, .0093, .0092, .0092, .0091, .0091, .0091, .0091, .0091,
1 .0094, .0096, .0102, .0115, .0147, .0192, .0237, .0273, .0295,
1 .0318, .0332,  345, .0357, .0365, .0319, .0240, .0193,
2 .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049,
2 .0049, .0049, .0054, .0080, .0120, .0167, .0207, .0237, .0265,
2 .0290, .0311, .0324, .0333, .0337, .0339, .0314, .0284,
3 .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049, .0049,
3 .0049, .0049, .0059, .0094, .0152, .0213, .0263, .0292, .0317,
3 .0336, .0354, .0367, .0380, .0393, .0469, .0549, .0629,
4 .0084, .0083, .0083, .0080, .0075, .0074, .0073, .0073, .0075,
4 .0078, .0085, .0121, .0176, .0237, .0309, .0383, .0459, .0532,
4 .0597, .0662, .0713, .0758, .0802, .0974, .1106, .1227,
5 .0435, .0220, .0150, .0133, .0121, .0116, .0116, .0118, .0124,
5 .0151, .0212, .0282, .0369, .0478, .0598, .0724, .0837, .0947,
5 .1046, .1130, .1215, .1292, .1349, .1574, .1728, .1843/
 DATA((CD306(I,J),J=1,26),I=1,5)/
1 .0095, .0094, .0094, .0093, .0093, .0093, .0093, .0093, .0092,
1 .0092, .0096, .0108, .0159, .0218, .0277, .0336, .0390, .0431,
1 .0465, .0478, .0488, .0488, .0482, .0424, .0353, .0280,
2 .0044, .0045, .0045, .0045, .0045, .0045, .0045, .0045, .0045,
2 .0050, .0060, .0092, .0136, .0179, .0222, .0270, .0319, .0350,
2 .0378, .0407, .0420, .0426, .0432, .0433, .0397, .0350,
3 .0046, .0046, .0045, .0046, .0046, .0046, .0046, .0046, .0051,
3 .0058, .0097, .0138, .0180, .0221, .0262, .0308, .0361, .0398,
3 .0428, .0457, .0472, .0487, .0501, .0579, .0648, .0705,
4 .0073, .0073, .0073, .0072, .0067, .0065, .0065, .0067, .0076,
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4 .0110, .0171, .0231, .0292, .0353, .0414, .0478, .0559, .0641,
4 .0706, .0760, .0815, .0869, .0909, .1080, .1109, .1142,
5 .0292, .0207, .0161, .0144, .0137, .0134, .0139, .0145, .0166,
5 .0192, .0280, .0408, .0536, .0664, .0799, .0991, .1170, .1271,
5 .1373, .1472, .1555, .1639, .1722, .2071, .2243, .2266/
 DATA((CD309(I,J),J=1,26),I=1,5)/
1 .0094, .0093, .0092, .0092, .0092, .0092, .0092, .0092, .0092,
1 .0099, .0129, .0171, .0217, .0274, .0331, .0387, .0447, .0509,
1 .0569, .0617, .0663, .0693, .0696, .0636, .0569, .0498,
2 .0059, .0059, .0059, .0058, .0058, .0059, .0059, .0061, .0065,
2 .0078, .0113, .0155, .0202, .0249, .0307, .0365, .0422, .0482,
2 .0542, .0601, .0640, .0680, .0707, .0691, .0642, .0583,
3 .0059, .0058, .0057, .0058, .0058, .0059, .0060, .0064, .0068,
3 .0083, .0121, .0175, .0234, .0299, .0367, .0442, .0516, .0582,
3 .0647, .0688, .0729, .0770, .0786, .0857, .0890, .0915,
4 .0114, .0094, .0080, .0076, .0077, .0079, .0083, .0091, .0114,
4 .0137, .0183, .0241, .0350, .0460, .0576, .0698, .0816, .0897,
4 .0977, .1058, .1100, .1142, .1185, .1300, .1353, .1353,
5 .0230, .0172, .0142, .0133, .0128, .0133, .0143, .0181, .0218,
5 .0273, .0361, .0473, .0620, .0773, .0934, .1089, .1222, .1354,
5 .1462, .1550, .1637, .1683, .1699, .1772, .1835, .1894/
 DATA((CD312(I,J),J=1,26),I=1,5)/
1 .0099, .0099, .0098, .0098, .0098, .0098, .0097, .0097, .0098,
1 .0114, .0182, .0261, .0352, .0448, .0547, .0649, .0746, .0829,
1 .0908, .0955, .1001, .1011, .1009, .0973, .0872, .0736,
2 .0061, .0060, .0060, .0060, .0060, .0060, .0060, .0060, .0066,
2 .0095, .0156, .0235, .0327, .0429, .0526, .0619, .0707, .0784,
2 .0851, .0919, .0968, .1013, .1046, .0996, .0906, .0793,
3 .0061, .0061, .0061, .0060, .0060, .0060, .0061, .0073, .0098,
3 .0144, .0200, .0284, .0375, .0473, .0573, .0672, .0766, .0857,
3 .0936, .0996, .1057, .1098, .1135, .1135, .1110, .1082,
4 .0125, .0106, .0096, .0097, .0100, .0101, .0104, .0117, .0168,
4 .0226, .0320, .0423, .0525, .0647, .0780, .0903, .1011, .1109,
4 .1193, .1278, .1349, .1410, .1471, .1646, .1718, .1749,
5 .0204, .0180, .0169, .0168, .0168, .0170, .0185, .0242, .0365,
5 .0528, .0724, .0906, .1070, .1213, .1351, .1487, .1622, .1753,
5 .1879, .2004, .2130, .2226, .2309, .2661, .2646, .2631/
 DATA((CD315(I,J),J=1,26),I=1,5)/
1 .0084, .0088, .0089, .0090, .0091, .0091, .0091, .0094, .0116,
1 .0206, .0319, .0438, .0563, .0688, .0803, .0912, .1016, .1117,
1 .1209, .1292, .1353, .1397, .1437, .1382, .1223, .1063,
2 .0078, .0078, .0078, .0078, .0082, .0086, .0093, .0104, .0141,
2 .0234, .0346, .0458, .0577, .0696, .0800, .0903, .0992, .1082,
2 .1172, .1234, .1291, .1348, .1390, .1393, .1330, .1236,
3 .0091, .0082, .0082, .0083, .0089, .0092, .0099, .0115, .0173,
3 .0276, .0394, .0511, .0630, .0749, .0853, .0953, .1053, .1152,
3 .1240, .1310, .1381, .1451, .1470, .1518, .1521, .1521,
4 .0090, .0115, .0128, .0134, .0140, .0149, .0169, .0204, .0275,
4 .0422, .0581, .0717, .0835, .0962, .1092, .1218, .1341, .1444,
4 .1533, .1623, .1688, .1743, .1799, .1975, .2035, .2095,
5 .0235, .0206, .0203, .0207, .0215, .0228, .0262, .0384, .0564,
5 .0782, .0993, .1199, .1383, .1548, .1699, .1836, .1974, .2101,
5 .2215, .2330, .2425, .2491, .2556, .2677, .2715, .2753/
 DATA((CD318(I,J),J=1,26),I=1,5)/
1 .0106, .0136, .0151, .0158, .0166, .0169, .0173, .0186, .0228,
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     1 .0337, .0486, .0633, .0765, .0887, .1008, .1129, .1203, .1272,
     1 .1340, .1401, .1448, .1495, .1520, .1519, .1490, .1449,
     2 .0082, .0081, .0080, .0080, .0081, .0083, .0090, .0148, .0267,
     2 .0386, .0516, .0693, .0851, .0994, .1112, .1228, .1316, .1367,
     2 .1418, .1468, .1503, .1537, .1571, .1606, .1577, .1533,
     3 .0096, .0096, .0097, .0097, .0097, .0102, .0117, .0195, .0313,
     3 .0431, .0579, .0752, .0912, .1049, .1184, .1263, .1341, .1420,
     3 .1498, .1563, .1627, .1670, .1723, .1752, .1765, .1779,
     4 .0169, .0176, .0179, .0180, .0191, .0205, .0261, .0411, .0562,
     4 .0713, .0877, .1044, .1181, .1305, .1430, .1554, .1663, .1735,
     4 .1807, .1879, .1950, .2007, .2058, .2196, .2280, .2365,
     5 .0282, .0331, .0355, .0367, .0392, .0419, .0489, .0651, .0887,
     5 .1122, .1365, .1619, .1860, .2085, .2298, .2470, .2642, .2767,
     5 .2863, .2959, .3022, .3083, .3118, .3252, .3386, .3520/
      DATA((CD321(I,J),J=1,26),I=1,5)/
     1 .0119, .0126, .0125, .0125, .0128, .0133, .0148, .0178, .0269,
     1 .0411, .0565, .0721, .0879, .1038, .1179, .1304, .1428, .1545,
     1 .1618, .1691, .1764, .1822, .1836, .1886, .1894, .1903,
     2 .0095, .0094, .0094, .0094, .0094, .0101, .0121, .0221, .0320,
     2 .0454, .0601, .0781, .0965, .1123, .1251, .1378, .1505, .1622,
     2 .1700, .1779, .1857, .1936, .1956, .2014, .2014, .2014,
     3 .0111, .0113, .0113, .0114, .0114, .0120, .0174, .0273, .0383,
     3 .0542, .0703, .0874, .1044, .1191, .1322, .1452, .1583, .1713,
     3 .1843, .1961, .2030, .2099, .2168, .2207, .2219, .2231,
     4 .0269, .0213, .0208, .0211, .0231, .0264, .0368, .0533, .0705,
     4 .0878, .1046, .1214, .1382, .1534, .1686, .1838, .1990, .2098,
     4 .2186, .2274, .2362, .2450, .2538, .2649, .2663, .2676,
     5 .0439, .0387, .0388, .0400, .0448, .0549, .0735, .0921, .1132,
     5 .1344, .1548, .1750, .1969, .2210, .2450, .2664, .2843, .3022,
     5 .3068, .3069, .3071, .3072, .3074, .3083, .3092, .3102/
      DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
     & .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
     &1.1,1.125,1.15,1.3,1.45,1.6/
      DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
      DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
      DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
      IORDER(1)=IORDER(2)=1
      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .04) GO TO 9
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
      IF (TR .GE. .21) GO TO 7
    9 CALL IBI (7,ALPI,26,XMI,7,CL304,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL304,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7 ALPI,26,XMI,7,CL306,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
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    2 CALL IBI (7,ALPI,26,XMI,7,CL306,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL309,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL309,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL312,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL312,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL315,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL315,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL318,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL318,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL321,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL321,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP304,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP304,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP306,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP306,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP309,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP309,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP312,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
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      GO TO 400
 40   CALL IBI (26,XMI,9,CLI,26,ALP312,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP315,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP315,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP318,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
 60   CALL IBI (26,XMI,9,CLI,26,ALP318,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP321,IORDER IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP321,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
 400  CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
 91   CALL IBI (5,CLII,26,XMI,5,CD304,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
 11   CALL IBI (5,CLII,26,XMI,5,CD304,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD306,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
 21   CALL IBI (5,CLII,26,XMI,5,CD306,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD309,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
 31   CALL IBI (5,CLII,26,XMI,5,CD309,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD312,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
 41   CALL IBI (5,CLII,26,XMI,5,CD312,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD315,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
 51   CALL IBI (5,CLII,26,XMI,5,CD315,IORDER,IPT,CL,XM,CDRG15,IERR)
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      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD318,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD318,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD321,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD321,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO4(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-4XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP404(26,9),ALP406(26,9),
     & ALP409(26,9),ALP412(26,9),ALP415(26,9),ALP418(26,9),
     & ALP421(26,9),CLI(9),XMI(26),ALPI(7),CL404(7,26),
     & CL406(7,26),CL409(7,26),CL412(7,26),CL415(7,26),
     & CL418(7,26),CL421(7,26),CD404(5,26),CD406(5,26),
     & CD409(5,26),CD412(5,26),CD415(5,26),CD418(5,26),
     & CD421(5,26),CLII(5)
      DATA((CL404(I,J),J=1,26),I=1,4)/
     1 -.107, -.122, -.130, -.132, -.131, -.129, -.126, -.124, -.120,
     1 -.116, -.108, -.095, -.083, -.061, -.058, -.086, -.193, -.245,
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1 -.219, -.194, -.173, -.164, -.182, -.262, -.277, -.258,
2  .123,  .129,  .140,  .150,  .160,  .165,  .171,  .177,  .182,
2  .196,  .211,  .225,  .239,  .234,  .208,  .145,  .035,  .002,
2  .033,  .075,  .108,  .113,  .094, -.035, -.115, -.123,
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& -7.61, -5.58, -3.55, -1.53,   .44,  2.35,  4.60,  7.14,  9.90,
& -7.83, -5.75, -3.67, -1.61,   .32,  2.16,  4.29,  6.75,  9.40,
& -8.00, -5.91, -3.81, -1.74,   .17,  1.94,  3.97,  6.39,  9.31,
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& -8.09, -5.99, -3.88, -1.80,   .10,  1.83,  3.85,  6.22,  9.82,
& -8.19, -6.07, -3.96, -1.86,   .03,  1.71,  3.71,  6.20, 11.20,
& -8.32, -6.18, -4.04, -1.92,  -.06,  1.62,  3.62,  6.76, 12.65,
& -8.40, -6.26, -4.12, -1.98,  -.14,  1.56,  3.78,  8.39, 14.95,
& -8.31, -6.24, -4.17, -2.09,  -.15,  1.71,  4.69, 10.06, 15.94,
& -9.22, -6.70, -4.19, -1.77,  0.00,  2.33,  6.11, 11.44, 16.77,
&-10.46, -7.07, -3.68, -1.10,   .90,  3.89,  7.68, 12.56, 17.44,
&-10.76, -6.31, -1.94,  -.09,  2.11,  5.06,  9.00, 13.44, 17.89/
 DATA((ALP409(J,N),N=1,9),J=14,26)/
& -7.72, -3.76,  -.86,  1.11,  3.41,  6.00, 10.17, 14.33, 18.50,
& -3.80, -1.94,  -.10,  1.77,  4.16,  6.99, 11.03, 15.07, 19.11,
& -3.53, -1.85,  -.09,  1.82,  4.15,  6.84, 10.92, 15.00, 19.08,
& -3.80, -2.24,  -.54,  1.33,  3.54,  5.87,  9.74, 13.70, 17.66,
& -4.46, -2.78, -1.05,   .77,  2.85,  5.22,  8.53, 12.30, 16.08,
& -5.15, -3.30, -1.45,   .39,  2.38,  4.70,  7.75, 11.56, 15.37,
& -5.20, -3.34, -1.48,   .37,  2.35,  4.76,  8.00, 12.12, 16.25,
& -5.20, -3.26, -1.36,   .50,  2.58,  5.02,  8.43, 12.51, 16.59,
& -5.20, -3.18, -1.24,   .66,  2.86,  5.31,  8.84, 12.84, 16.84,
& -5.20, -3.11, -1.13,   .84,  3.15,  5.59,  9.22, 13.11, 16.99,
& -5.07, -2.80,  -.50,  2.07,  4.77,  7.77, 11.28, 14.79, 18.30,
& -5.13, -2.65,   .22,  3.31,  6.26,  9.71, 13.16, 16.60, 20.05,
& -5.40, -2.52,   .51,  4.08,  7.75, 11.26, 14.77, 18.28, 21.79/
 DATA((ALP412(J,N),N=1,9),J=1,13)/
& -8.13, -5.75, -3.37, -1.00,  1.25,  3.90,  7.00, 10.23, 13.45,
& -7.81, -5.66, -3.51, -1.28,   .99,  3.36,  5.97,  9.41, 12.86,
& -7.35, -5.42, -3.49, -1.44,   .84,  3.03,  5.43,  8.49, 11.74,
& -7.10, -5.29, -3.48, -1.55,   .74,  2.81,  5.10,  7.88, 10.93,
& -6.84, -5.16, -3.49, -1.72,   .64,  2.61,  4.79,  7.50, 10.81,
& -6.68, -5.08, -3.48, -1.81,   .56,  2.53,  4.80,  7.96, 11.81,
& -6.45, -4.94, -3.43, -1.87,   .50,  2.56,  5.22,  8.81, 12.65,
& -6.32, -4.85, -3.37, -1.83,   .51,  3.22,  6.17, 10.33, 14.50,
& -6.59, -4.89, -3.18, -1.38,   .83,  4.50,  7.77, 11.98, 16.19,
& -5.78, -4.17, -2.56,  -.77,  1.84,  5.50,  9.35, 13.52, 17.69,
& -5.00, -3.41, -1.76,   .43,  3.88,  6.77, 10.94, 15.10, 19.27,
& -4.27, -2.49,  -.46,  2.02,  4.90,  8.38, 12.59, 16.80, 21.01,
& -3.22, -1.11,   .88,  3.25,  5.85,  9.98, 14.19, 18.40, 22.61/
 DATA((ALP412(J,N),N=1,9),J=14,26)/
& -2.36,  -.61,  1.34,  3.71,  6.34, 11.16, 15.98, 20.80, 25.61,
& -2.75,  -.87,   .96,  3.24,  5.70, 10.24, 15.06, 19.88, 24.70,
& -3.78, -1.62,   .10,  2.34,  4.80,  8.54, 13.25, 17.95, 22.66,
& -5.03, -2.58,  -.58,  1.50,  3.90,  6.89, 11.43, 15.98, 20.52,
& -5.84, -3.01,  -.83,  1.18,  3.55,  6.12, 10.94, 15.76, 20.58,
& -5.74, -3.04,  -.83,  1.26,  3.71,  6.28, 11.28, 16.28, 21.28,
& -5.68, -3.01,  -.77,  1.40,  3.87,  6.66, 11.72, 16.78, 21.85,
& -5.65, -2.97,  -.67,  1.53,  4.04,  7.05, 12.05, 17.05, 22.05,
& -5.65, -2.93,  -.58,  1.67,  4.20,  7.45, 12.45, 17.45, 22.45,
& -5.62, -2.88,  -.51,  1.80,  4.37,  7.83, 12.77, 17.70, 22.64,
& -5.49, -2.59,  -.08,  2.66,  5.58,  9.55, 13.67, 17.79, 21.92,
& -5.38, -2.21,   .41,  3.47,  6.88, 10.88, 14.88, 18.88, 22.88,
& -5.10, -2.05,   .91,  4.45,  8.11, 11.81, 15.52, 19.22, 22.93/
 DATA((ALP415(J,N),N=1,9),J=1,13)/
& -8.62, -5.82, -3.02,  -.48,  1.76,  4.75,  8.63, 12.71, 16.80,
& -8.19, -5.63, -3.06,  -.56,  1.60,  4.24,  7.82, 11.90, 15.98,
& -7.55, -5.32, -3.08,  -.69,  1.47,  3.91,  7.07, 11.03, 14.99,
& -7.25, -5.17, -3.08,  -.76,  1.40,  3.74,  6.52, 10.13, 13.73,
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& -7.00, -5.04, -3.08,  -.82,  1.34,  3.58,  6.15,  9.51, 12.87,
& -6.90, -4.98, -3.06,  -.84,  1.30,  3.62,  6.37,  9.70, 13.03,
& -6.68, -4.82, -2.97,  -.82,  1.44,  4.00,  7.02, 10.47, 13.91,
& -5.99, -4.35, -2.71,  -.54,  1.86,  5.01,  8.58, 12.47, 16.35,
& -5.34, -3.80, -2.26,   .20,  3.29,  6.63, 11.63, 16.63, 21.63,
& -4.60, -3.06, -1.19,  1.23,  5.04,  9.67, 15.15, 20.63, 26.11,
& -3.78, -2.05,   .48,  3.45,  7.31, 13.28, 19.25, 25.22, 31.19,
& -2.52,  -.05,  2.23,  5.05, 10.74, 17.19, 23.65, 30.10, 36.55,
& -1.96,   .63,  2.74,  6.16, 11.49, 16.83, 22.16, 27.49, 32.83/
 DATA((ALP415(J,N),N=1,9),J=14,26)/
& -2.15,   .26,  2.17,  5.14, 10.47, 15.95, 21.42, 26.90, 32.38,
& -3.27,  -.83,  1.20,  3.49,  7.97, 13.77, 19.57, 25.36, 31.16,
& -4.53, -1.72,   .36,  2.58,  5.53, 11.87, 18.53, 25.20, 31.87,
& -5.79, -2.02,   .13,  2.26,  4.95, 10.92, 17.69, 24.47, 31.25,
& -5.92, -2.11,   .15,  2.31,  5.07, 11.32, 18.46, 25.61, 32.75,
& -5.92, -2.11,   .17,  2.39,  5.24, 11.45, 18.34, 25.24, 32.14,
& -5.92, -2.11,   .19,  2.46,  5.40, 11.76, 18.66, 25.55, 32.45,
& -5.91, -2.13,   .22,  2.55,  5.56, 12.18, 19.19, 26.21, 33.23,
& -5.91, -2.13,   .24,  2.64,  5.73, 12.61, 19.75, 26.89, 34.04,
& -5.91, -2.13,   .27,  2.72,  5.91, 12.72, 19.62, 26.52, 33.41,
& -5.89, -2.11,   .45,  3.28,  7.34, 13.06, 18.77, 24.49, 30.20,
& -6.00, -1.93,   .62,  3.83,  8.36, 14.33, 20.30, 26.27, 32.24,
& -6.18, -1.80,   .75,  4.35,  9.07, 14.87, 20.67, 26.46, 32.26/
 DATA((ALP418(J,N),N=1,9),J=1,13)/
& -7.92, -5.32, -2.73,  -.05,  2.30,  5.51,  9.67, 13.83, 18.00,
& -7.86, -5.28, -2.70,  -.16,  2.18,  5.15,  8.70, 12.27, 15.84,
& -7.22, -4.92, -2.62,  -.25,  2.03,  4.74,  7.87, 11.23, 14.59,
& -6.88, -4.76, -2.63,  -.31,  1.96,  4.53,  7.34, 10.73, 14.12,
& -6.40, -4.49, -2.57,  -.30,  2.04,  4.99,  8.08, 11.11, 14.14,
& -5.86, -3.95, -2.05,   .20,  3.07,  6.36,  9.05, 11.73, 14.42,
& -4.91, -3.05, -1.02,  1.37,  4.62,  7.61, 10.30, 12.98, 15.66,
& -4.02, -2.01,   .22,  2.86,  6.18,  9.24, 12.29, 15.34, 18.40,
& -2.97,  -.80,  1.58,  4.36,  8.08, 12.04, 16.00, 19.96, 23.92,
& -1.77,   .45,  2.96,  5.97, 11.74, 17.54, 23.33, 29.13, 34.93,
&  -.63,  1.66,  3.95, 10.16, 20.37, 31.78, 42.59, 53.41, 64.22,
&  -.11,  2.13,  4.55, 13.03, 26.83, 40.62, 54.41, 68.21, 82.00,
&  -.49,  1.72,  3.91,  9.05, 18.14, 27.23, 36.32, 45.41, 54.50/
 DATA((ALP418(J,N),N=1,9),J=14,26)/
& -1.[illegible],   .37,  2.46,  5.05, 12.95, 22.95, 32.95, 42.95, 52.95,
& -2.88,  -.87,  1.21,  3.36,  7.33, 17.59, 27.85, 38.10, 48.36,
& -3.94, -1.43,   .92,  3.14,  5.94, 18.65, 31.55, 44.45, 57.35,
& -4.33, -1.44,   .91,  3.14,  5.98, 17.71, 29.47, 41.24, 53.00,
& -4.35, -1.43,   .94,  3.21,  6.47, 18.24, 30.00, 41.76, 53.53,
& -4.33, -1.43,   .97,  3.29,  6.97, 19.09, 31.21, 43.33, 55.45,
& -4.32, -1.43,  1.01,  3.37,  7.44, 19.94, 32.44, 44.94, 57.44,
& -4.32, -1.42,  1.05,  3.45,  7.94, 20.44, 32.94, 45.44, 57.94,
& -4.30, -1.41,  1.08,  3.54,  8.36, 20.48, 32.61, 44.73, 56.85,
& -4.30, -1.41,  1.11,  3.62,  8.88, 21.38, 33.88, 46.38, 58.88,
& -4.25, -1.37,  1.30,  4.20, 11.74, 24.65, 37.55, 50.45, 63.35,
& -4.43, -1.37,  1.45,  4.72, 15.41, 30.22, 45.04, 59.85, 74.67,
& -4.70, -1.36,  1.61,  5.31, 18.15, 32.96, 47.78, 62.59, 77.41/
 DATA((ALP421(J,N),N=1,9),J=1,13)/
& -4.73, -2.95, -1.11,   .88,  3.28,  7.70, 15.25, 22.79, 30.34,
& -4.78, -3.05, -1.24,   .80,  3.14,  6.57, 11.77, 16.96, 22.16,
& -4.89, -3.16, -1.35,   .69,  2.92,  5.91,  9.15, 12.37, 15.60,
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& -5.00, -3.23, -1.38,   .66,  2.85,  5.67,  8.77, 11.85, 14.92,
& -5.00, -3.13, -1.18,   .87,  3.08,  6.20, 10.16, 14.12, 18.08,
& -4.74, -2.77,  -.83,  1.23,  3.62,  7.56, 11.73, 15.90, 20.06,
& -4.17, -2.27,  -.28,  2.14,  5.06, 10.53, 16.41, 22.29, 28.18,
& -3.47, -1.36,  1.12,  3.64,  8.16, 13.49, 18.83, 24.16, 29.49,
& -2.57,  -.17,  2.96,  6.25, 12.60, 18.95, 25.30, 31.65, 38.00,
& -1.27,  2.26,  4.77, 11.23, 18.92, 26.62, 34.31, 42.00, 49.69,
&  -.54,  2.82,  5.86, 15.14, 24.67, 34.19, 43.71, 53.24, 62.76,
& -1.19,  2.29,  5.06, 14.85, 26.97, 39.09, 51.21, 63.33, 75.45,
& -2.36,  -.13,  2.85,  7.05, 16.57, 26.10, 35.62, 45.14, 54.67/
 DATA((ALP421(J,N),N=1,9),J=14,26)/
& -3.44, -1.37,  1.16,  4.06, 11.32, 21.84, 32.37, 42.89, 53.42,
& -4.32, -2.28,   .54,  3.64,  8.93, 18.23, 27.53, 36.84, 46.14,
& -4.34, -2.49,   .58,  3.66,  9.29, 18.81, 28.33, 37.86, 47.38,
& -4.26, -2.39,   .65,  3.68,  9.57, 19.10, 28.62, 38.14, 47.67,
& -4.18, -2.29,   .73,  3.76,  9.95, 19.71, 29.46, 39.22, 48.98,
& -4.08, -2.21,   .81,  3.85, 10.24, 20.00, 29.76, 39.51, 49.27,
& -4.00, -2.17,   .92,  3.93, 10.54, 20.29, 30.05, 39.80, 49.56,
& -3.90, -2.11,  1.00,  4.04, 10.76, 20.29, 29.81, 39.33, 48.86,
& -3.80, -2.05,  1.08,  4.17, 11.05, 20.57, 30.10, 39.62, 49.14,
& -3.72, -2.00,  1.13,  4.27, 11.33, 20.86, 30.38, 39.90, 49.43,
& -3.62, -1.79,  1.58,  4.95, 13.10, 22.62, 32.14, 41.67, 51.19,
& -3.64, -1.69,  1.95,  5.51, 15.89, 27.00, 38.11, 49.22, 60.33,
& -3.68, -1.60,  2.20,  6.61, 15.30, 24.00, 32.70, 41.39, 50.09/
 DATA((CD404(I,J),J=1,26),I=1,5)/
1 .0134, .0132, .0131, .0131, .0130, .0130, .0130, .0130, .0129,
1 .0129, .0129, .0136, .0158, .0204, .0261, .0329, .0401, .0434,
1 .0465, .0489, .0501, .0505, .0501, .0409, .0299, .0241,
2 .0063, .0061, .0053, .0053, .0053, .0053, .0053, .0053, .0053,
2 .0056, .0059, .0083, .0116, .0154, .0212, .0268, .0315, .0340,
2 .0365, .0384, .0397, .0410, .0423, .0403, .0360, .0339,
3 .0049, .0049, .0048, .0048, .0048, .0048, .0048, .0049, .0050,
3 .0053, .0061, .0077, .0112, .0175, .0254, .0306, .0348, .0387,
3 .0406, .0424, .0442, .0459, .0470, .0531, .0596, .0692,
4 .0068, .0066, .0058, .0057, .0056, .0056, .0056, .0057, .0058,
4 .0061, .0069, .0093, .0154, .0230, .0325, .0408, .0482, .0539,
4 .0591, .0644, .0698, .0752, .0803, .0963, .1089, .1298,
5 .0231, .0143, .0105, .0096, .0091, .0091, .0091, .0093, .0096,
5 .0108, .0153, .0237, .0337, .0460, .0568, .0686, .0817, .0927,
5 .1019, .1112, .1205, .1298, .1379, .1722, .1959, .2106/
 DATA((CD406(I,J),J=1,26),I=1,5)/
1 .0126, .0124, .0124, .0123, .0123, .0123, .0122, .0122, .0122,
1 .0122, .0125, .0139, .0183, .0235, .0299, .0365, .0432, .0478,
1 .0516, .0543, .0570, .0583, .0589, .0523, .0393, .0291,
2 .0057, .0056, .0056, .0056, .0057, .0057, .0057, .0059, .0062,
2 .0072, .0093, .0124, .0158, .0203, .0251, .0299, .0350, .0400,
2 .0434, .0467, .0483, .0499, .0506, .0493, .0439, .0403,
3 .0049, .0049, .0047, .0046, .0046, .0046, .0046, .0047, .0050,
3 .0059, .0074, .0110, .0151, .0192, .0253, .0318, .0379, .0429,
3 .0460, .0489, .0512, .0532, .0551, .0635, .0697, .0759,
4 .0059, .0056, .0055, .0055, .0054, .0053, .0052, .0052, .0056,
4 .0067, .0097, .0130, .0177, .0257, .0358, .0455, .0543, .0624,
4 .0695, .0757, .0820, .0867, .0903, .1088, .1225, .1313,
5 .0205, .0133, .0113, .0107, .0104, .0106, .0108, .0111, .0123,
5 .0147, .0181, .0268, .0422, .0610, .0798, .0979, .1106, .1233,
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5 .1348, .1458, .1568, .1663, .1744, .2053, .2201, .2248/
 DATA((CD409(I,J),J=1,26),I=1,5)/
1 .0106, .0106, .0106, .0106, .0106, .0107, .0107, .0107, .0110,
1 .0122, .0147, .0192, .0245, .0305, .0379, .0459, .0537, .0614,
1 .0693, .0772, .0832, .0869, .0891, .0829, .0635, .0493,
2 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0063, .0066,
2 .0085, .0121, .0165, .0220, .0283, .0349, .0416, .0483, .0546,
2 .0607, .0664, .0717, .0746, .0768, .0741, .0681, .0579,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
3 .0062, .0062, .0062, .0062, .0062, .0062, .0062, .0062,
4 .0054, .0055, .0055, .0056, .0056, .0056, .0058, .0059, .0069,
4 .0093, .0131, .0177, .0240, .0306, .0403, .0499, .0588, .0661,
4 .0710, .0754, .0792, .0830, .0846, .0890, .0907, .0924,
5 .0084, .0071, .0064, .0063, .0063, .0065, .0068, .0072, .0087,
5 .0127, .0189, .0251, .0314, .0405, .0541, .0690, .0814, .0891,
5 .0966, .1038, .1092, .1135, .1177, .1336, .1443, .1516/
 DATA((CD412(I,J),J=1,26),I=1,5)/
1 .0058, .0058, .0058, .0058, .0058, .0058, .0058, .0058, .0058,
1 .0061, .0068, .0129, .0235, .0348, .0456, .0547, .0607, .0649,
1 .0684, .0706, .0723, .0741, .0751, .0754, .0752, .0700,
2 .0083, .0083, .0083, .0083, .0083, .0083, .0084, .0084, .0084,
2 .0091, .0146, .0241, .0340, .0444, .0539, .0614, .0670, .0708,
2 .0738, .0759, .0775, .0787, .0794, .0820, .0826, .0812,
3 .0150, .0150, .0150, .0150, .0150, .0151, .0152, .0153, .0158,
3 .0187, .0262, .0354, .0454, .0556, .0650, .0721, .0784, .0839,
3 .0882, .0912, .0942, .0965, .0986, .1058, .1100, .1142,
4 .0233, .0251, .0259, .0264, .0268, .0270, .0272, .0283, .0312,
4 .0428, .0598, .0776, .0917, .1023, .1106, .1188, .1251, .1309,
4 .1356, .1381, .1406, .1431, .1459, .1583, .1664, .1710,
5 .0338, .0390, .0416, .0427, .0447, .0462, .0509, .0592, .0715,
5 .0894, .1082, .1263, .1432, .1581, .1707, .1799, .1864, .1900,
5 .1934, .1935, .1936, .1937, .1938, .1944, .1950, .1956/
 DATA((CD415(I,J),J=1,26),I=1,5)/
1 .0107, .0138, .0153, .0161, .0169, .0173, .0176, .0190, .0219,
1 .0266, .0376, .0501, .0642, .0750, .0858, .0967, .1062, .1152,
1 .1242, .1306, .1368, .1430, .1445, .1400, .1245, .1071,
2 .0093, .0093, .0094, .0094, .0096, .0100, .0107, .0120, .0169,
2 .0271, .0388, .0515, .0655, .0784, .0906, .1009, .1107, .1193,
2 .1267, .1328, .1382, .1436, .1464, .1380, .1291, .1177,
3 .0084, .0083, .0083, .0083, .0085, .0091, .0104, .0130, .0198,
3 .0310, .0432, .0550, .0689, .0820, .0948, .1048, .1147, .1244,
3 .1330, .1416, .1500, .1532, .1563, .1623, .1560, .1497,
4 .0096, .0096, .0096, .0096, .0102, .0108, .0124, .0158, .0224,
4 .0351, .0497, .0657, .0797, .0926, .1056, .1183, .1308, .1433,
4 .1557, .1634, .1706, .1777, .1849, .2016, .2093, .2158,
5 .0192, .0163, .0158, .0162, .0178, .0193, .0215, .0350, .0543,
5 .0771, .0977, .1154, .1352, .1561, .1724, .1858, .1993, .2114,
5 .2205, .2297, .2388, .2455, .2510, .2702, .2753, .2803/
 DATA((CD418(I,J),J=1,26),I=1,5)/
1 .0122, .0154, .0170, .0180, .0190, .0200, .0219, .0253, .0369,
1 .0555, .0737, .0897, .1011, .1118, .1199, .1279, .1360, .1419,
1 .1469, .1518, .1557, .1574, .1590, .1624, .1569, .1480,
2 .0100, .0099, .0098, .0097, .0101, .0107, .0131, .0210, .0420,
2 .0601, .0772, .0939, .1071, .1176, .1282, .1386, .1420, .1453,
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2 .1487, .1520, .1554, .1587, .1621, .1720, .1660, .1530,
3 .0102, .0104, .0105, .0106, .0113, .0124, .0150, .0217, .0419,
3 .0624, .0822, .1017, .1148, .1275, .1387, .1475, .1563, .1652,
3 .1710, .1755, .1799, .1843, .1888, .1904, .1887, .1772,
4 .0162, .0137, .0131, .0135, .0147, .0159, .0194, .0278, .0459,
4 .0681, .0902, .1111, .1276, .1420, .1564, .1669, .1766, .1864,
4 .1936, .2002, .2068, .2122, .2154, .2299, .2336, .2336,
5 .0231, .0287, .0315, .0329, .0352, .0378, .0444, .0588, .0839,
5 .1165, .1453, .1712, .1945, .2177, .2329, .2480, .2630, .2723,
5 .2809, .2895, .2981, .3024, .3055, .3204, .3284, .3364/
 DATA((CD421(I,J),J=1,26),I=1,5)/
1 .0141, .0150, .0154, .0156, .0159, .0166, .0204, .0316, .0471,
1 .0636, .0797, .0950, .1109, .1273, .1437, .1563, .1687, .1781,
1 .1842, .1903, .1935, .1956, .1977, .1994, .2002, .2010,
2 .0123, .0127, .0129, .0130, .0134, .0146, .0216, .0350, .0507,
2 .0694, .0857, .1019, .1178, .1337, .1501, .1667, .1798, .1891,
2 .1985, .2047, .2098, .2149, .2178, .2178, .2178, .2178,
3 .0138, .0143, .0146, .0147, .0151, .0167, .0243, .0400, .0584,
3 .0766, .0945, .1141, .1331, .1503, .1676, .1801, .1921, .2041,
3 .2122, .2185, .2247, .2310, .2352, .2428, .2449, .2470,
4 .0152, .0159, .0163, .0165, .0171, .0187, .0244, .0356, .0550,
4 .0788, .1033, .1260, .1472, .1670, .1836, .2003, .2169, .2279,
4 .2386, .2492, .2599, .2657, .2706, .2809, .2821, .2833,
5 .0329, .0321, .0337, .0355, .0382, .0417, .0606, .0877, .1144,
5 .1406, .1662, .1919, .2139, .2359, .2578, .2743, .2896, .3049,
5 .3203, .3260, .3310, .3360, .3402, .3389, .3376, .3363/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
 IPT (1) = -1
 IF (IKEY .EQ. 2) GO TO 1000
 IF (TR .LT. .04) GO TO 9
 IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
 IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
 IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
 IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
 IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
 IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
 IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL404,IORDER,IPT,AA,XM,CLFT04,IERR)
 CL=CLFT04
 GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL404,IORDER,IPT,AA,XM,CLFT04,IERR)
 IPT (1)=-1
 CALL IBI (7,ALPI,26,XMI,7,CL406,IORDER,IPT,AA,XM,CLFT06,IERR)
 CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
 GO TO 400
2 CALL IBI (7,ALPI,26,XMI,7,CL406,IORDER,IPT,AA,XM,CLFT06,IERR)
 IPT (1)=-1
 CALL IBI (7,ALPI,26,XMI,7,CL409,IORDER,IPT,AA,XM,CLFT09,IERR)
 CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
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      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL409,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL412,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL412,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL415,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL415,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL418,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL418,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL421,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL421,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP404,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP404,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP406,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP406,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,(    26,ALP409,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA    *((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP409,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP412,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP412,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP415,IORDER,IPT,XM,CL,AA15,IERR)
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      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
 50   CALL IBI (26,XMI,9,CLI,26,ALP415,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP418,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
 60   CALL IBI (26,XMI,9,CLI,26,ALP418,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP421,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
 70   CALL IBI (26,XMI,9,CLI,26,ALP421,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
400   CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
 91   CALL IBI (5,CLII,26,XMI,5,CD404,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
201   FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
 11   CALL IBI (5,CLII,26,XMI,5,CD404,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD406,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
 21   CALL IBI (5,CLII,26,XMI,5,CD406,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD409,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
 31   CALL IBI (5,CLII,26,XMI,5,CD409,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD412,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
 41   CALL IBI (5,CLII,26,XMI,5,CD412,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD415,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
 51   CALL IBI (5,CLII,26,XMI,5,CD415,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD418,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
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   51 CALL IBI (5,CLII,26,XMI,5,CD418,IORDE ,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD421,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD421,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO5(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-5XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C        XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP504(26,9),ALP506(26,9),
     & ALP509(26,9),ALP512(26,9),ALP515(26,9),ALP518(26,9),
     & ALP521(26,9),CLI(9),XMI(26),ALPI(7),CL504(7,26),
     & CL506(7,26),CL509(7,26),CL512(7,26),CL515(7,26),
     & CL518(7,26),CL521(7,26),CD504(5,26),CD506(5,26),
     & CD509(5,26),CD512(5,26),CD515(5,26),CD518(5,26),
     & CD521(5,26),CLII(5)
      DATA((CL504(I,J),J=1,26),I=1,4)/
     1 -.046, -.056, [illegible]62, -.067, -.072, -.075, -.078, -.081, -.082,
     1 -.082, -.077, [illegible]8, -.059, -.053, -.084, -.163, -.277, -.327,
     1 -.289, -.248, -.213, -.195, -.223, -.284, -.302, -.302,
     2  .177,  .185,  .199,  .210,  .225,  .233,  .241,  .249,  .263,
     2  .278,  .292,  .307,  .310,  .269,  .177,  .086,  .004, -.009,
     2  .028,  .074,  .112,  .121,  .096, -.041, -.138, -.154,
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3  .407,  .431,  .453,  .464,  .478,  .485,  .492,  .499,  .509,
3  .519,  .530,  .539,  .529,  .469,  .396,  .322,  .256,  .230,
3  .259,  .306,  .345,  .354,  .328,  .148,  .012, -.033,
4  .620,  .651,  .676,  .693,  .709,  .717,  .730,  .742,  .754,
4  .770,  .779,  .767,  .728,  .665,  .602,  .539,  .482,  .449,
4  .479,  .526,  .573,  .586,  .550,  .314,  .139,  .075/
 DATA((CL504(I,J),J=1,26),I=5,7)/
5  .755,  .807,  .845,  .871,  .898,  .916,  .935,  .954,  .974,
5  .996, 1.000,  .973,  .920,  .866,  .812,  .759,  .711,  .687,
5  .723,  .775,  .820,  .828,  .788,  .477,  .265,  .182,
6  .912,  .971, 1.016, 1.042, 1.069, 1.086, 1.102, 1.119, 1.134,
6 1.141, 1.118, 1.078, 1.037,  .995,  .953,  .911,  .869,  .848,
6  .880,  .923,  .967,  .985,  .946,  .614,  .389,  .290,
7 1.069, 1.123, 1.163, 1.192, 1.229, 1.256, 1.273, 1.289, 1.307,
7 1.289, 1.250, 1.212, 1.169, 1.126, 1.083, 1.0[illegible]0, 1.002,  .983,
7 1.022, 1.074, 1.115, 1.127, 1.089,  .757,  .512,  .406/
 DATA((CL506(I,J),J=1,26),I=1,4)/
1  .002, -.006, -.018, -.026, -.037, -.043, -.050, -.064, -.088,
1 -.121, -.168, -.216, -.273, -.339, -.406, -.472, -.486, -.440,
1 -.383, -.326, -.315, -.315, -.316, -.316, -.317, -.318,
2  .210,  .214,  .221,  .224,  .235,  .240,  .244,  .248,  .248,
2  .242,  .212,  .146,  .069, -.008, -.084, -.160, -.185, -.146,
2 -.092, -.038, -.021, -.039, -.047, -.090, -.118, -.123,
3  .413,  .446,  .474,  .489,  .504,  .513,  .524,  .534,  .544,
3  .554,  .537,  .463,  .384,  .304,  .225,  .146,  .125,  .166,
3  .223,  .278,  .287,  .266,  .240,  .099,  .008, -.012,
4  .625,  .667,  .697,  .713,  .731,  .742,  .754,  .766,  .778,
4  .751,  .717,  .664,  .612,  .539,  .462,  .392,  .377,  .414,
4  .469,  .522,  .532,  .503,  .466,  .249,  .119,  .093/
 DATA((CL506(I,J),J=1,26),I=5,7)/
5  .746,  .804,  .847,  .873,  .910,  .929,  .951,  .974,  .963,
5  .924,  .868,  .812,  .756,  .700,  .644,  .596,  .579,  .610,
5  .665,  .718,  .738,  .704,  .655,  .392,  .246,  .206,
6  .906,  .964, 1.010, 1.039, 1.070, 1.091, 1.105, 1.091, 1.054,
6 1.006,  .959,  .911,  .863,  .815,  .768,  .723,  .709,  .746,
6  .798,  .847,  .867,  .836,  .793,  .535,  .375,  .313,
7 1.052, 1.115, 1.164, 1.203, 1.229, 1.221, 1.207, 1.180, 1.148,
7 1.106, 1.065, 1.023,  .981,  .940,  .900,  .862,  .858,  .904,
7  .959, 1.013, 1.020,  .985,  .937,  .682,  .517,  .428/
 DATA((CL509(I,J),J=1,26),I=1,4)/
1  .018,  .016,  .015,  .015,  .015,  .017,  .024,  .011, -.029,
1 -.078, -.135, -.203, -.271, -.346, -.428, -.458, -.392, -.298,
1 -.228, -.224, -.229, -.235, -.240, -.274, -.295, -.296,
2  .233,  .254,  .268,  .277,  .285,  .297,  .310,  .320,  .308,
2  .276,  .196,  .110, -.000, -.137, -.237, -.236, -.168, -.084,
2 -.041, -.044, -.057, -.069, -.079, -.120, -.142, -.158,
3  .435,  .457,  .468,  .483,  .499,  .506,  .514,  .520,  .519,
3  .490,  .404,  .287,  .170,  .053, -.027, -.019,  .032,  .102,
3  .155,  .159,  .145,  .133,  .121,  .054,  .003, -.035,
4  .605,  .642,  .672,  .688,  .712,  .723,  .735,  .736,  .707,
4  .616,  .522,  .429,  .335,  .241,  .194,  .204,  .264,  .338,
4  .378,  .372,  .357,  .341,  .325,  .226,  .149,  .090/
 DATA((CL509(I,J),J=1,26),I=5,7)/
5  .749,  .806,  .849,  .870,  .895,  .908,  .893,  .863,  .789,
5  .714,  .640,  .565,  .490,  .416,  .366,  .375,  .434,  .508,
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5  .552,  .548,  .529,  .510,  .490,  .371,  .278,  .190,
6  .870,  .932,  .988, 1.018, 1.054, 1.046, 1.027,  .962,  .896,
6  .830,  .764,  .699,  .633,  .567,  .534,  .539,  .604,  .686,
6  .713,  .697,  .677,  .655,  .634,  .503,  .400,  .301,
7 1.001, 1.052, 1.110, 1.158, 1.159, 1.137, 1.102, 1.043,  .984,
7  .925,  .866,  .807,  .748,  .689,  .644,  .663,  .732,  .813,
7  .836,  .824,  .801,  .778,  .754,  .618,  .505,  .409/
 DATA((CL512(I,J),J=1,26),I=1,4)/
1  .014,  .012,  .013,  .016,  .020,  .021,  .014, -.013, -.068,
1 -.166, -.273, -.387, -.510, -.547, -.520, -.404, -.259, -.[illegible],
1 -.210, -.211, -.212, -.213, -.215, -.225, -.238, -.252,
2  .195,  .210,  .224,  .234,  .245,  .247,  .235,  .211,  .154,
2  .074, -.025, -.162, -.327, -.403, -.364, -.236, -.122, -.088,
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3  .363,  .383,  .399,  .407,  .418,  .426,  .433,  .418,  .373,
3  .268,  .152, -.011, -.157, -.192, -.147, -.057,  .023,  .049,
3  .042,  .029,  .021,  .017,  .012, -.013, -.024, -.029,
4  .537,  .572,  .600,  .614,  .628,  .631,  .622,  .568,  .475,
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4  .245,  .235,  .226,  .216,  .206,  .156,  .113,  .086/
 DATA((CL512(I,J),J=1,26),I=5,7)/
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5  .415,  .403,  .390,  .377,  .364,  .294,  .239,  .193,
6  .804,  .862,  .915,  .950,  .958,  .921,  .859,  .780,  .701,
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7  .913,  .976, 1.041, 1.075, 1.052, 1.012,  .958,  .882,  .799,
7  .717,  .635,  .553,  .478,  .449,  .493,  .594,  .683,  .696,
7  .683,  .669,  .655,  .641,  .627,  .545,  .474,  .412/
 DATA((CL515(I,J),J=1,26),I=1,4)/
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1 -.302, -.301, -.301, -.301, -.300, -.298, -.297, -.295,
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2 -.177, -.343, -.430, -.446, -.416, -.342, -.257, -.211, -.202,
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3  .044, -.102, -.308, -.352, -.299, -.195, -.085, -.057, -.054,
3 -.051, -.049, -.046, -.044, -.041, -.041, -.039, -.037,
4  .492,  .510,  .524,  .533,  .543,  .525,  .496,  .413,  .328,
4  .193,  .041, -.124, -.145, -.085,  .034,  .137,  .157,  .154,
4  .150,  .145,  .140,  .136,  .131,  .106,  .085,  .073/
 DATA((CL515(I,J),J=1,26),I=5,7)/
5  .636,  .666,  .681,  .694,  .689,  .664,  .605,  .532,  .423,
5  .314,  .205,  .090,  .066,  .113,  .230,  .328,  .357,  .349,
5  .342,  .334,  .327,  .319,  .312,  .266,  .220,  .187,
6  .734,  .779,  .813,  .836,  .822,  .771,  .719,  .616,  .507,
6  .397,  .288,  .176,  .164,  .216,  .329,  .428,  .455,  .448,
6  .440,  .432,  .424,  .416,  .408,  .360,  .328,  .295,
7  .835,  .871,  .919,  .960,  .930,  .865,  .792,  .719,  .620,
7  .492,  .364,  .253,  .233,  .286,  .395,  .496,  .526,  .524,
7  .517,  .509,  .502,  .494,  .486,  .443,  .407,  .374/
 DATA((CL518(I,J),J=1,26),I=1,4)/
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1 -.628, -.704, -.754, -.760, -.724, -.620, -.483, -.424, -.422,
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2 -.303, -.302, -.302, -.302, -.301, -.299, -.296, -.294,
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3 -.147, -.148, -.148, -.149, -.150, -.152, -.149, -.146,
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7  .450,  .439,  .428,  .417,  .406,  .349,  .292,  .242/
 DATA((CL521(I,J),J=1,26),I=1,4)/
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1 -.384, -.392, -.400, -       -.409, -.429, -.438, -.436,
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2 -.605, -.644, -.582, -.442, -.302, -.229, -.221, -.229, -.237,
2 -.245, -.251, -.257, -.263, -.269, -.298, -.306, -.315,
3  .169,  .188,  .207,  .221,  .207,  .128, -.025, -.177, -.330,
3 -.447, -.493, -.454, -.297, -.155, -.111, -.115, -.121, -.127,
3 -.133, -.140, -.146, -.152, -.158, -.184, -.202, -.211,
4  .329,  .350,  .370,  .381,  .352,  .268,  .106, -.055, -.216,
4 -.349, -.394, -.362, -.203, -.052, -.008, -.013, -.018, -.024,
4 -.029, -.034, -.040, -.045, -.051, -.084, -.102, -.119/
 DATA((CL521(I,J),J=1,26),I=5,7)/
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5  .162,  .154,  .146,  .137,  .129,  .092,  .03,  .037,
6  .578,  .609,  .640,  .653,  .588,  .464,  .332,  .199,  .067,
6 -.044, -.090, -.058,  .111,  .248,  .298,  .292,  .284,  .276,
6  .268,  .260,  .253,  .245,  .237,  .194,  .172,  .149,
7  .686,  .737,  .781,  .778,  .669,  .531,  .392,  .254,  .115,
7  .015, -.027,  .014,  .175,  .313,  .352,  .348,  .338,  .328,
7  .319,  .311,  .304,  .297,  .290,  .252,  .230,  .207/
 DATA((ALP504(J,N),N=1,9),J=1,13)/
& -7.17, -5.38, -3.59, -1.80,  -.06,  1.81,  4.57,  7.12,  9.67,
& -6.85, -5.20, -3.54, -1.88,  -.25,  1.54,  3.91,  6.38,  9.01,
& -6.59, -5.06, -3.52, -1.99,  -.42,  1.32,  3.47,  5.81,  8.50,
& -6.40, -4.96, -3.52, -2.07,  -.50,  1.19,  3.20,  5.51,  8.11,
& -6.21, -4.86, -3.52, -2.17,  -.62,  1.06,  2.96,  5.19,  7.64,
& -6.11, -4.81, -3.51, -2.21,  -.67,   .99,  2.83,  4.99,  7.34,
& -6.02, -4.76, -3.51, -2.26,  -.73,   .91,  2.68,  4.78,  7.15,
& -5.93, -4.72, -3.51, -2.30,  -.79,   .83,  2.55,  4.56,  6.95,
& -5.84, -4.68, -3.52, -2.37,  -.89,   .74,  2.42,  4.33,  6.76,
& -5.77, -4.66, -3.54, -2.43,  -.99,   .65,  2.27,  4.06,  6.80,
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& -5.75, -4.67, -3.58, -2.50, -1.09,   .56,  2.19,  4.00,  7.24,
& -5.77, -4.70, -3.64, -2.57, -1.20,   .54,  2.32,  4.51,  7.82,
& -5.85, -4.76, -3.68, -2.60, -1.18,   .71,  2.75,  5.37,  8.47/
 DATA((ALP504(J,N),N=1,9),J=14,26)/
& -6.16, -4.91, -3.67, -2.43,  -.69,  1.34,  3.34,  6.08,  9.13,
& -6.42, -4.89, -3.36, -1.79,   .04,  1.98,  3.89,  6.72,  9.80,
& -5.90, -4.30, -2.69, -1.03,   .72,  2.55,  4.54,  7.38, 10.48,
& -4.88, -3.45, -2.03,  -.44,  1.27,  3.03,  5.13,  7.97, 10.98,
& -4.46, -3.20, -1.92,  -.25,  1.55,  3.27,  5.40,  8.25, 11.21,
& -4.70, -3.44, -2.18,  -.51,  1.28,  2.99,  4.98,  7.69, 10.51,
& -4.94, -3.70, -2.46,  -.91,   .85,  2.58,  4.34,  7.02,  9.67,
& -5.15, -3.92, -2.69, -1.24,   .48,  2.22,  3.84,  6.45,  9.15,
& -5.30, -4.03, -2.77, -1.32,   .40,  2.12,  3.77,  6.21,  9.03,
& -5.11, -3.86, -2.60, -1.10,   .65,  2.42,  4.15,  6.76,  9.55,
& -4.95, -3.31, -1.57,   .63,  3.06,  5.80,  8.60, 11.40, 14.20,
& -5.20, -2.76,  -.16,  2.97,  6.18,  9.43, 12.68, 15.93, 19.19,
& -5.32, -2.62,   .61,  4.33,  7.90, 11.34, 14.79, 18.24, 21.69/
 DATA((ALP506(J,N),N=1,9),J=1,13)/
& -7.87, -5.94, -4.02, -2.10,  -.13,  1.76,  4.68,  7.29, 10.03,
& -7.58, -5.76, -3.95, -2.13,  -.40,  1.39,  3.94,  6.48,  9.13,
& -7.20, -5.52, -3.85, -2.18,  -.58,  1.13,  3.37,  5.88,  8.47,
& -6.99, -5.39, -3.79, -2.19,  -.67,   .99,  3.09,  5.53,  7.96,
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& -6.38, -5.02, -3.66, -2.30,  -.89,   .66,  2.47,  4.64,  7.86,
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 DATA((ALP506(J,N),N=1,9),J=14,26)/
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& -3.54, -2.26,  -.95,   .44,  2.08,  4.06,  7.11,  9.99, 12.86,
& -3.43, -2.10,  -.81,   .60,  2.23,  4.32,  7.22,  9.91, 12.59,
& -3.73, -2.37, -1.06,   .27,  1.89,  3.90,  6.68,  9.22, 11.75,
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& -4.51, -3.13, -1.76,  -.49,  1.00,  2.80,  5.27,  7.84, 10.25,
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& -4.62, -3.17, -1.74,  -.43,  1.13,  2.97,  5.45,  8.20, 10.89,
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& -7.17, -5.64, -4.11, -2.59,  -.81,  1.14,  3.23,  5.76,  8.60,
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& -6.97, -5.57, -4.17, -2.77, -1.12,   .78,  2.82,  5.60, 10.61,
& -6.66, -5.37, -4.07, -2.78, -1.20,   .74,  3.01,  6.94, 1[illegible].88,
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& -5.51, -2.61,   .56,  4.18,  7.83, 11.54, 15.24, 18.94, 22.65/
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& -3.95, -1.60,   .60,  2.76,  5.06,  8.11, 11.71, 15.32, 18.92,
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& -7.15, -3.82,  -.48,  1.66,  3.96,  6.61, 10.65, 14.69, 18.73,
& -7.13, -3.80,  -.37,  1.75,  4.12,  6.89, 10.93, 14.97, 19.01,
& -7.14, -3.78,  -.31,  1.84,  4.28,  7.17, 11.21, 15.25, 19.29,
& -7.08, -3.75,  -.22,  1.94,  4.44,  7.45, 11.49, 15.54, 19.58,
& -6.92, -3.58,   .15,  2.64,  5.44,  9.06, 12.90, 16.75, 20.60,
& -6.66, -3.38,   .35,  3.38,  6.68, 10.25, 13.82, 17.39, 20.96,
& -6.39, -3.16,   .50,  4.13,  7.78, 11.51, 15.25, 18.99, 22.73/
 DATA((ALP515(J,N),N=1,9),J=1,13)/
&-10.74, -7.59, -4.44, -1.43,   .98,  3.50,  7.31, 11.27, 15.23,
&-10.39, -7.49, -4.59, -1.70,   .84,  3.15,  6.46, 10.80, 15.15,
&-10.22, -7.44, -4.67, -1.88,   .75,  2.97,  5.80,  9.53, 13.30,
&-10.01, -7.35, -4.68, -2.01,   .70,  2.83,  5.49,  8.65, 11.87,
& -9.92, -7.31, -4.69, -2.08,   .63,  2.78,  5.67,  9.30, 13.00,
&-10.07, -7.33, -4.59, -1.84,   .72,  3.08,  6.62, 10.87, 15.13,
& -9.21, -6.61, -4.01, -1.42,   .97,  3.91,  8.22, 13.70, 19.18,
& -7.99, -5.58, -3.17,  -.70,  1.84,  5.62,  9.57, 13.46, 17.34,
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& -6.59, -4.27, -1.95,   .21,  3.52,  7.65, 11.19, 14.73, 18.27,
& -5.40, -2.35,  -.40,  2.12,  6.06, 10.27, 14.48, 18.69, 22.91,
& -2.92,  -.81,  1.43,  3.94,  8.95, 14.21, 19.47, 24.74, 30.00,
& -1.51,  1.17,  3.16,  6.62, 11.82, 17.01, 22.21, 27.40, 32.60,
& -1.02,  1.47,  3.37,  7.04, 12.84, 18.64, 24.43, 30.23, 36.03/
 DATA((ALP515(J,N),N=1,9),J=14,26)/
& -1.73,   .93,  2.86,  5.69, 11.26, 16.97, 22.69, 28.40, 34.11,
& -2.94,  -.07,  1.70,  3.69,  8.15, 14.21, 20.27, 26.33, 32.39,
& -4.22, -1.34,   .77,  2.66,  5.44, 11.06, 16.94, 22.82, 28.71,
& -5.35, -1.86,   .53,  2.43,  4.88, 10.08, 15.72, 21.35, 26.99,
& -5.88, -1.97,   .52,  2.47,  5.03, 10.00, 15.26, 20.53, 25.79,
& -5.92, -2.00,   .51,  2.52,  5.18, 10.16, 15.35, 20.55, 25.74,
& -5.96, -2.00,   .51,  2.58,  5.35, 10.36, 15.56, 20.75, 25.95,
& -5.94, -2.02,   .49,  2.64,  5.51, 10.51, 15.64, 20.77, 25.90,
& -5.94, -2.02,   .49,  2.70,  5.67, 10.72, 15.85, 20.97, 26.10,
& -5.96, -2.04,   .48,  2.76,  5.83, 10.92, 16.05, 21.18, 26.31,
& -5.98, -2.10,   .56,  3.18,  6.96, 11.78, 16.60, 21.42, 26.24,
& -6.12, -2.00,   .63,  3.70,  7.82, 12.89, 17.95, 23.01, 28.08,
& -6.39, -1.92,   .67,  4.24,  8.66, 13.72, 18.78, 23.85, 28.91/
 DATA((ALP518(J,N),N=1,9),J=1,13)/
& -8.55, -5.92, -3.29,  -.65,  1.73,  4.64,  8.40, 12.21, 16.02,
& -8.46, -5.88, -3.30,  -.76,  1.59,  4.24,  7.59, 11.03, 14.48,
& -8.07, -5.68, -3.28,  -.87,  1.45,  3.92,  6.67,  9.57, 12.46,
& -7.49, -5.38, -3.26,  -.98,  1.37,  3.91,  6.53,  9.63, 12.73,
& -6.75, -4.76, -2.77,  -.30,  2.04,  4.98,  8.62, 12.40, 16.17,
& -5.90, -3.97, -2.04,   .56,  3.03,  6.56, 10.56, 14.56, 18.56,
& -4.91, -2.95,  -.74,  1.72,  3.92,  8.58, 12.88, 17.18, 21.48,
& -3.73, -1.59,   .58,  2.86,  6.38, 12.26, 18.15, 24.03, 29.91,
& -2.31,  -.19,  2.02,  4.10, 11.51, 20.40, 29.29, 38.18, 47.07,
&  -.66,  1.38,  3.94,  8.00, 18.26, 28.51, 38.77, 49.03, 59.28,
&   .70,  2.70,  5.10, 13.82, 25.94, 38.06, 50.18, 62.30, 74.42,
&  1.07,  3.20,  5.69, 14.05, 23.14, 32.23, 41.32, 50.41, 59.50,
&   .70,  2.89,  5.21, 12.90, 22.90, 32.90, 42.90, 52.90, 62.90/
 DATA((ALP518(J,N),N=1,9),J=14,26)/
&  -.66,  1.36,  3.40,  5.36, 12.70, 22.70, 32.70, 42.70, 52.70,
& -1.72,  -.01,  2.00,  4.07,  6.21, 14.54, 22.88, 31.21, 39.54,
& -2.97,  -.57,  1.54,  3.63,  5.6[illegible] 13.02, 21.53, 30.04, 38.55,
& -3.60,  -.68,  1.53,  3.68,  5.75, 13.18, 21.35, 29.51, 37.67,
& -3.63,  -.69,  1.54,  3.74,  5.85, 13.91, 22.43, 30.94, 39.45,
& -3.63,  -.68,  1.59,  3.81,  5.96, 14.52, 23.22, 31.91, 40.61,
& -3.63,  -.68,  1.63,  3.88,  6.27, 15.16, 24.04, 32.93, 41.82,
& -3.63,  -.68,  1.67,  3.93,  6.73, 15.82, 24.91, 34.00, 43.09,
& -3.63,  -.67,  1.72,  4.00,  7.21, 16.51, 25.81, 35.12, 44.42,
& -3.65,  -.66,  1.76,  4.06,  7.71, 17.24, 26.76, 36.29, 45.81,
& -3.66,  -.65,  1.91,  4.52, 10.55, 20.55, 30.55, 40.55, 50.55,
& -3.68,  -.69,  2.07,  5.10, 14.17, 25.60, 37.03, 48.46, 59.89,
& -3.70,  -.73,  2.31,  5.84, 17.58, 29.70, 41.82, 53.94, 66.06/
 DATA((ALP521(J,N),N=1,9),J=1,13)/
& -7.97, -5.31, -2.64,   .39,  2.90,  6.41, 10.11, 13.81, 17.52,
& -8.06, -5.48, -2.90,   .15,  2.67,  5.84,  8.98, 12.11, 15.23,
& -8.41, -5.75, -3.08,  -.11,  2.40,  5.34,  8.27, 11.11, 13.94,
& -8.62, -5.88, -3.14,  -.30,  2.25,  5.12,  8.35, 11.55, 14.75,
& -8.89, -5.93, -2.96,  -.10,  2.69,  6.30, 11.23, 16.17, 21.11,
& -7.22, -4.28, -1.48,  1.03,  3.96, 10.06, 16.03, 22.00, 27.97,
& -5.27, -2.02,   .38,  3.23,  8.27, 14.93, 21.60, 28.27, 34.93,
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& -2.86,  -.26,  2.65,  6.04, 13.31, 20.58, 27.85, 35.13, 42.40,
&  -.80,  2.17,  4.60, 11.54, 19.88, 28.21, 36.54, 44.88, 53.21,
&   .96,  3.43,  7.49, 14.27, 21.05, 27.83, 34.61, 41.39, 48.17,
&  1.88,  3.89,  8.86, 15.21, 21.56, 27.90, 34.25, 40.60, 46.95,
&  1.17,  3.48,  7.61, 13.17, 18.72, 24.28, 29.83, 35.39, 40.94,
& -1.42,  2.03,  4.05,  8.78, 15.03, 21.28, 27.53, 33.78, 40.03/
 DATA((ALP521(J,N),N=1,9),J=14,26)/
& -3.16,  -.61,  2.53,  5.07, 10.68, 16.83, 22.98, 29.14, 35.29,
& -4.09, -1.51,  2.08,  4.23,  9.78, 17.19, 24.59, 32.00, 39.41,
& -4.56, -1.60,  2.13,  4.26,  9.86, 17.00, 24.14, 31.29, 38.43,
& -4.44, -1.46,  2.18,  4.42, 10.30, 17.70, 25.11, 32.52, 39.93,
& -4.33, -1.33,  2.25,  4.57, 10.77, 18.46, 26.15, 33.85, 41.54,
& -4.23, -1.20,  2.30,  4.72, 11.18, 19.02, 26.86, 34.71, 42.55,
& -4.11, -1.08,  2.36,  4.87, 11.49, 19.33, 27.18, 35.02, 42.86,
& -4.00,  -.97,  2.43,  5.01, 11.76, 19.61, 27.45, 35.29, 43.14,
& -3.93,  -.86,  2.49,  5.17, 11.96, 19.65, 27.35, 35.04, 42.73,
& -3.87,  -.76,  2.57,  5.31, 12.15, 19.70, 27.25, 34.79, 42.34,
& -3.56,  -.28,  2.95,  6.21, 13.10, 20.00, 26.90, 33.79, 40.69,
& -3.42,   .04,  3.24,  6.97, 13.86, 20.76, 27.66, 34.55, 41.45,
& -3.40,   .24,  3.53,  7.76, 14.66, 21.55, 28.45, 35.34, 42.24/
 DATA((CD504(I,J),J=1,26),I=1,5)/
1 .0164, .0173, .0177, .0179, .0181, .0182, .0183, .0184, .0186,
1 .0187, .0190, .0205, .0231, .0282, .0345, .0401, .0445, .0477,
1 .0501,  .521, .0531, .0541, .0542, .0516, .0401, .0280,
2 .0093, .0090, .0088, .0088, .0087, .0087, .0087, .0087, .0086,
2 .0088, .0093, .0118, .0165, .0230, .0293, .0341, .0379, .0407,
2 .0435, .0451, .0466, .0474, .0482, .0472, .0418, .0346,
3 .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
3 .0051, .0060, .0081, .0125, .0182, .0251, .0313, .0365, .0406,
3 .0444, .0463, .0481, .0499, .0512, .0583, .0639, .0704,
4 .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050, .0050,
4 .0056, .0066, .0087, .0145, .0215, .0293  769, .0440, .0511,
4 .0571, .0631, .0679, .0720, .0761, .0971  108, .1240,
5 .0123, .0088, .0072, .0069, .0069, .0069, .0070, .0070, .0074,
5 .0089, .0122, .0190, .0267, .0378, .0492, .0607, .0724, .0838,
5 .0948, .1057, .1157, .1239, .1322, .1544, .1629, .1672/
 DATA((CD506(I,J),J=1,26),I=1,5)/
1 .0158, .0157, .0156, .0156, .0155, .0155, .0155, .0155, .0155,
1 .0158, .0168, .0201, .0252, .0315, .0381, .0445, .0509, .0568,
1 .0610, .0639, .0666, .0685, .0704, .0645, .0525, .0385,
2 .0083, .0083, .0083, .0083, .0083, .0083, .0083, .0083, .0084,
2 .0094, .0114, .0147, .0191, .0243, .0305, .0371, .0435, .0474,
2 .0514, .0547, .0574, .0601, .0629, .0668, .0590, .0453,
3 .0055, .0055, .0055, .0055, .0055, .0056, .0056, .0056, .0056,
3 .0067, .0097, .0126, .0188, .0251, .0320, .0391, .0456, .0512,
3 .0558, .0592, .0623, .0644, .0666, .0742, .0779, .0779,
4 .0055, .0055, .0055, .0055, .0055, .0056, .0056, .0056, .0059,
4 .0077, .0110, .0157, .0212, .0297, .0409, .0505, .0579, .0643,
4 .0707, .0765, .0818, .0871, .0924, .1106, .1213, .1308,
5 .0128, .0106, .0094, .0094, .0094, .0094, .0095, .0098, .0149,
5 .0236, .0323, .0411, .0498, .0585, .0751, .0937, .1085, .1202,
5 .1311, .1411, .1512, .1605, .1694, .2017, .2196, .2241/
 DATA((CD509(I,J),J=1,26),I=1,5)/
1 .0141, .0141, .0141, .0141, .0141, .0141, .0141, .0141, .0144,
1 .0169, .0216, .0262, .0309, .0381, .0454, .0536, .0629, .0715,
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1 .0788, .0853, .0896, .0921, .0940, .0940, .0767, .0541,
2 .0083, .0082, .0081, .0081, .0081, .0081, .0084, .0088, .0100,
2 .0127, .0164, .0210, .0263, .0332, .0404, .0478, .0557, .0634,
2 .0700, .0747, .0776, .0792, .0802, .0791, .0706, .0566,
3 .0058, .0059, .0059, .0059, .0059, .0059, .0061, .0066, .0084,
3 .0121, .0165, .0217, .0276, .0347, .0425, .0511, .0600, .0683,
3 .0749, .0806, .0847, .0873, .0887, .0897, .0890, .0883,
4 .0059, .0059, .0059, .0059, .0059, .0059, .0062, .0068, .0090,
4 .0127, .0169, .0227, .0297, .0388, .0498, .0618, .0759, .0884,
4 .0949, .1003, .1050, .1098, .1136, .1326, .1480, .1616,
5 .0135, .0108, .0090, .0086, .0085, .0085, .0090, .0114, .0162,
5 .0216, .0285, .0374, .0471, .0619, .0766, .0952, .1125, .1257,
5 .1363, .1448, .1513, .1579, .1649, .2024, .2218, .2313/
 DATA((CD512(I,J),J=1,26),I=1,5)/
1 .0137, .0146, .0151, .0153, .0155, .0163, .0191, .0223, .0286,
1 .0371, .0455, .0540, .0670, .0804, .0941, .1053, .1132, .1178,
1 .1216, .1244, .1273, .1301, .1297, .1150, .0970, .0805,
2 .0103, .0103, .0103, .0103, .0103, .0103, .0111, .0145, .0187,
2 .0266, .0354, .0444, .0531, .0619, .0711, .0804, .0896, .0985,
2 .1073, .1150, .1223, .1264, .1293, .1231, .1046, .0872,
3 .0074, .0074, .0075, .0075, .0075, .0078, .0090, .0127, .0172,
3 .0241, .0317, .0406, .0509, .0627, .0738, .0851, .0964, .1077,
3 .1156, .1233, .1309, .1363, .1395, .1378, .1264, .1131,
4 .0074, .0075, .0075, .0075, .0076, .0079, .0089, .0109, .0147,
4 .0218, .0297, .0404, .0522, .0670, .0823, .0984, .1115, .1231,
4 .1339, .1433, .1527, .1605, .1652, .1708, .1676, .1634,
5 .0128, .0126, .0124, .0124, .0126, .0142, .0173, .0238, .0315,
5 .0447, .0609, .0786, .0945, .1102, .1256, .1411, .1533, .1655,
5 .1778, .1895, .2005, .2115, .2225, .2689, .2951, .3213/
 DATA((CD515(I,J),J=1,26),I=1,5)/
1 .0138, .0206, .0240, .0257, .0274, .0283, .0297, .0348, .0444,
1 .0543, .0642, .0751, .0860, .0959, .1049, .1138, .1225, .1312,
1 .1382, .1437, .1491, .1523, .1550, .1502, .1332, .1164,
2 .0103, .0114, .0119, .0126, .0132, .0139, .0166, .0238, .0331,
2 .0435, .0580, .0725, .0841, .0953, .1065, .1173, .1262, .1350,
2 .1431, .1486, .1541, .1587, .1582, .1514, .1369, .1220,
3 .0093, .0094, .0095, .0096, .0098, .0106, .0134, .0209, .0287,
3 .0431, .0575, .0718, .0861, .1003, .1117, .1223, .1329, .1435,
3 .1520, .1574, .1627, .1669, .1691, .1703, .1603, .1515,
4 .0094, .0100, .0104, .0105, .0108, .0119, .0140, .0181, .0276,
4 .0417, .0570, .0739, .0884, .1025, .1166, .1301, .1427, .1552,
4 .1651, .1739, .1827, .1897, .1937, .2040, .2079, .2061,
5 .0138, .0142, .0144, .0149, .0163, .0174, .0243, .0399, .0587,
5 .0793, .1003, .1199, .1391, .1582, .1758, .1933, .2082, .2194,
5 .2306, .2418, .2510, .2583, .2657, .2763, .2728, .2676/
 DATA((CD518(I,J),J=1,26),I=1,5)/
1 .0180, .0223, .0243, .0252, .0261, .0272, .0292, .0389, .0549,
1 .0750, .0911, .1066, .1184, .1274, .1363, .1453, .1505, .1548,
1 .1591, .1633, .1676, .1685, .1683, .1669, .1574, .1470,
2 .0158, .0155, .0153, .0152, .0151, .0161, .0227, .0389, .0586,
2 .0782, .0975, .1141, .1291, .1384, .1477, .1544, .1607, .1670,
2 .1718, .1745, .1772, .1798, .1806, .1787, .1712, .1591,
3 .0137, .0138, .0139, .0140, .0146, .0177, .0237, .0406, .0624,
3 .0831, .1017, .1174, .1306, .1437, .1550, .1629, .1709, .1788,
3 .1840, .1885, .1930, .1975, .2020, .2019, .1922, .1826,
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 4 .0137, .0137, .0144, .0147, .0157, .0181, .0292, .0450, .0651,
 4 .0851, .1036, .1221, .1390, .1543, .1695, .1812, .1910, .2009,
 4 .2108, .2151, .2188, .2225, .2262, .2367, .2356, .2345,
 5 .0197, .0239, .0261, .0273, .0298, .0363, .0572, .0782, .0991,
 5 .1201, .1435, .1721, .1931, .2109, .2287, .2437, .2572, .2707,
 5 .2843, .2913, .2918, .2923, .2927, .2956, .2984, .3012/
  DATA((CD521(I,J),J=1,26),I=1,5)/
 1 .0195, .0227, .0243, .0251, .0264, .0303, .0420, .059., .0757,
 1 .0925, .1095, .1265, .1435, .1586, .1738, .1889, .2018, .2101,
 1 .2185, .2268, .2301, .2324, .2347, .2388, .2388, .2388,
 2 .0213, .0230, .0239, .0243, .0265, .0351, .0491, .0649, .0808,
 2 .0972, .1136, .1312, .1496, .1673, .1819, .1965, .2097, .2166,
 2 .2236, .2305, .2375, .2443, .2462, .2533, .2545, .2557,
 3 .0155, .0182, .0195, .0201, .0216, .0273, .0451, .0633, .0805,
 3 .0969, .1133, .1327, .1537, .1720, .1865, .2009, .2154, .2291,
 3 .2366, .2441, .2516, .2591, .2666, .2715, .2742, .2769,
 4 .0176, .0201, .0214, .0221, .0250, .0366, .0520, .0690, .0864,
 4 .1047, .1261, .1474, .1687, .1887, .2074, .2260, .2447, .2561,
 4 .2647, .2733, .2818, .2898, .2912, .2993, .2998, .2998,
 5 .0241, .0269, .0283, .0290, .0338, .0517, .0738, .0950, .1188,
 5 .1459, .1720, .1989, .2247, .2472, .2634, .2797, .2960, .3123,
 5 .3239, .3350, .3462, .3471, .3467, .3443, .3420, .3396/
  DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
 & .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
 &1.1,1.125,1.15,1.3,1.45,1.6/
  DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
  DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
  DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
  IORDER(1)=IORDER(2)=1
  IPT (1) = -1
  IF (IKEY .EQ. 2) GO TO 1000
  IF (TR .LT. .04) GO TO 9
  IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
  IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
  IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
  IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
  IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 5
  IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 6
  IF (TR .GE. .21) GO TO 7
9 CALL IBI (7,ALPI,26,XMI,7,CL504,IORDER,IPT,AA,XM,CLFT04,IERR)
  CL=CLFT04
  GO TO 400
1 CALL IBI (7,ALPI,26,XMI,7,CL504,IORDER,IPT,AA,XM,CLFT04,IERR)
  IPT (1)=-1
  CALL IBI (7,ALPI,26,XMI,7,CL506,IORDER,IPT,AA,XM,CLFT06,IERR)
  CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
  GO TO 400
2 CALL IBI (7,ALPI,26,XMI,7,CL506,IORDER,IPT,AA,XM,CLFT06,IERR)
  IPT (1)=-1
  CALL IBI (7,ALPI,26,XMI,7,CL509,IORDER,IPT,AA,XM,CLFT09,IERR)
  CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
  GO TO 400
3 CALL IBI (7,ALPI,26,XMI,7,CL509,IORDER,IPT,AA,XM,CLFT09,IERR)
  IPT (1)=-1
  CALL IBI (7,ALPI,26,XMI,7,CL512,IORDER,IPT,AA,XM,CLFT12,IERR)
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      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL512,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL515,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL515,IORDER,IPT,AA,XM,CLFT15,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL518,IORDER,IPT,AA,XM,CLFT18,IERR)
      CL=CLFT15+(CLFT18-CLFT15)*((TR-.15)/(.18-.15))
      GO TO 400
    6 CALL IBI (7,ALPI,26,XMI,7,CL518,IORDER,IPT,AA,XM,CLFT18,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL521,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT18+(CLFT21-CLFT18)*((TR-.18)/(.21-.18))
      GO TO 400
    7 CALL IBI (7,ALPI,26,XMI,7,CL521,IORDER,IPT,AA,XM,CLFT21,IERR)
      CL=CLFT21
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 50
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 60
      IF (TR .GE. .21) GO TO 70
   90 CALL IBI (26,XMI,9,CLI,26,ALP504,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP504,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP506,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP506,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP509,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP509,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP512,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP512,IORDER,IPT,XM,CL,AA12,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP515,IORDER,IPT,XM,CL,AA15,IERR)
      AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
      GO TO 400
   50 CALL IBI (26,XMI,9,CLI,26,ALP515,IORDER,IPT,XM,CL,AA15,IERR)
      IPT (1) = -1
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      CALL IBI (26,XMI,9,CLI,26,ALP518,IORDER,IPT,XM,CL,AA18,IERR)
      AA=AA15+(AA18-AA15)*((TR-.15)/(.18-.15))
      GO TO 400
   60 CALL IBI (26,XMI,9,CLI,26,ALP518,IORDER,IPT,XM,CL,AA18,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP521,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA18+(AA21-AA18)*((TR-.18)/(.21-.18))
      GO TO 400
   70 CALL IBI (26,XMI,9,CLI,26,ALP521,IORDER,IPT,XM,CL,AA21,IERR)
      AA=AA21
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 91
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
      IF (TR .GE. .15 .AND. TR .LT. .18) GO TO 51
      IF (TR .GE. .18 .AND. TR .LT. .21) GO TO 61
      IF (TR .GE. .21) GO TO 71
   91 CALL IBI (5,CLII,26,XMI,5,CD504,IORDER,IPT,CL,XM,CDRG04,IERR)
      CD=CDRG04
      WRITE (6,201) TR
  201 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
      GO TO 250
   11 CALL IBI (5,CLII,26,XMI,5,CD504,IORDER,IPT,CL,XM,CDRG04,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD506,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD506,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD509,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD509,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD512,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD512,IORDER,IPT,CL,XM,CDRG12,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD515,IORDER,IPT,CL,XM,CDRG15,IERR)
      CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
      GO TO 250
   51 CALL IBI (5,CLII,26,XMI,5,CD515,IORDER,IPT,CL,XM,CDRG15,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD518,IORDER,IPT,CL,XM,CDRG18,IERR)
      CD=CDRG15+(CDRG18-CDRG15)*((TR-.15)/(.18-.15))
      GO TO 250
   61 CALL IBI (5,CLII,26,XMI,5,CD518,IORDER,IPT,CL,XM,CDRG18,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD521,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG18+(CDRG21-CDRG18)*((TR-.18)/(.21-.18))
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      GO TO 250
   71 CALL IBI (5,CLII,26,XMI,5,CD521,IORDER,IPT,CL,XM,CDRG21,IERR)
      CD=CDRG21
      IF (TR .GT. .21) WRITE(6,204) TR
  204 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.21 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE AERO6(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-6XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C       : CD=CD(MACH,CL,T/C)
C       :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP604(26,9),ALP606(26,9),
     & ALP609(26,9),ALP612(26,9),ALP615(26,9),
     & CLI(9),XMI(26),ALPI(7),CL604(7,26),
     & CL606(7,26),CL609(7,26),CL612(7,26),CL615(7,26),
     & CD604(5,26),CD606(5,26),
     & CD609(5,26),CD612(5,26),CD615(5,26),CLII(5)
      DATA((CL604(I,J),J=1,26),I=1,4)/
     1  .021,  .021,  .021,  .025,  .030,  .033,  .035,  .040,  .060,
     1  .086,  .111,  .125,  .112,  .052, -.017, -.085, -.154, -.214,
     1 -.202, -.127, -.051, -.018, -.026, -.194, -.263, -.235,
     2  .246,  .259,  .279,  .289,  .305,  .312,  .320,  .328,  .336,
     2  .343,  .351,  .349,  .313,  .254,  .190,  .116,  .037,  .009,
     2  .030,  .098,  .158,  .190,  .174,  .002, -.126, -.149,
     3  .467,  .497,  .523,  .540,  .559,  .569,  .579,  .591,  .603,
     3  .616,  .629,  .616,  .559,  .485,  .404,  .324,  .249,  .214,
     3  .235,  .287,  .352,  .378,  .356,  .172,  .027, -.031,
     4  .673,  .699,  .727,  .742,  .762,  .771,  .781,  .791,  .804,
     4  .818,  .828,  .808,  .739,  .670,  .600,  .530,  .463,  .422,
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4  .455,  .518,  .573,  .595,  .578,  .356,  .163,  .080/
 DATA((CL604(I,J),J=1,26),I=5,7)/
5  .820,  .858,  .895,  .919,  .948,  .968,  .989, 1.010, 1.032,
5 1.042, 1.028,  .997,  .943,  .877,  .812,  .746,  .681,  .663,
5  .699,  .757,  .811,  .830,  .799,  .520,  .298,  .191,
6  .953, 1.016, 1.060, 1.086, 1.121, 1.139, 1.157, 1.175, 1.192,
6 1.190, 1.170, 1.134, 1.078, 1.021,  .965,  .908,  .849,  .824,
6  .859,  .918,  .975, 1.005,  .975,  .655,  .415,  .309,
7 1.114, 1.169, 1.215, 1.239, 1.271, 1.288, 1.304, 1.324, 1.337,
7 1.321, 1.293, 1.254, 1.212, 1.165, 1.109, 1.053,  .993,  .960,
7 1.007, 1.083, 1.148, 1.158, 1.137,  .802,  .547,  .420/
 DATA((CL606(I,J),J=1,26),I=1,4)/
1  .057,  .055,  .060,  .065,  .070,  .072,  .073,  .071,  .044,
1 -.032, -.114, -.197, -.279, -.362, -.444, -.512, -.516, -.485,
1 -.420, -.357, -.336, -.345, -.352, -.361, -.366, -.371,
2  .273,  .282,  .298,  .309,  .326,  .334,  .342,  .345,  .337,
2  .296,  .210,  .124,  .037, -.049, -.135, -.211, -.231, -.183,
2 -.120, -.058, -.034, -.051, -.068, -.132, -.154, -.148,
3  .479,  .504,  .543,  .563,  .582,  .592,  .603,  .616,  .633,
3  .624,  .576,  .474,  .369,  .264,  .160,  .079,  .067,  .105,
3  .187,  .267,  .272,  .231,  [illegible]  .007, -.038,
4  .685,  .727,  .757,  .777,  [illegible]  .815,  .824,  .831,
4  .801,  .734,  .664,  .577,  .486,  [illegible]  .311,  .307,  .368,
4  .435,  .497,  .508,  .481,  .450,  [illegible]  .142,  .087/
 DATA((CL606(I,J),J=1,26),I=5,7)/
5  .806,  .867,  .913,  .941,  .970,  [illegible]  .998,  [illegible]9,  .975,
5  .921,  .855,  .789,  .723,  .657,  [illegible]0,  .533,  .520,  .557,
5  .638,  .711,  .721,  .680,  .639,  .421,  .260,  .188,
6  .936,  .994, 1.036, 1.068, 1.103, 1.122, 1.138, 1.136, 1.100,
6 1.055,  .998,  .941,  .884,  .817,  .746,  .680,  .668,  .714,
6  .793,  .862,  .873,  .835,  .791,  .546,  .366.  .283,
7 1.099, 1.158, 1.208, 1.237, 1.271, 1.288, 1.305, 1.278, 1.238,
7 1.191, 1.135, 1.078, 1.022,  .965,  .907,  .847,  .830,  .880,
7  .952, 1.023, 1.034,  .995,  .949,  .680,  .493,  .403/
 DATA((CL609(I,J),J=1,26),I=1,4)/
1  .077,  .097,  .099,  .100,  .107,  .112,  .113,  .111,  .082,
1 -.022, -.126, -.246, -.369, -.475, -.528, -.522, -.457, -.377,
1 -.299, -.268, -.274, -.284, -.293, -.304, -.309, -.309,
2  .288,  .308,  .334,  .347,  .369,  .379,  .376,  .358,  .304,
2  .227,  .111, -.005, -.123, -.247, -.304, -.308, -.234, -.141,
2 -.081, -.076, -.087, -.097, -.104, -.146, -.167, -.173,
3  .480,  .513,  .542,  .557,  .573,  .581,  .590,  .581,  .546,
3  .482,  .373,  .234,  .081, -.067, -.111, -.095, -.023,  [illegible]
3  .119,  .111,  .101,  .089,  .078,  .017, -.013, -.044,
4  .675,  .718,  .755,  .776,  .798,  .809,  .788,  .738,  .672,
4  .607,  .542,  .415,  .288,  .163,  .097,  .114,  .200,  .290,
4  .337,  .333,  .319,  .302,  .284,  .191,  .121,  .080/
 DATA((CL609(I,J),J=1,26),I=5,7)/
5  .785,  .830,  .885,  .912,  .950,  .952,  .925,  .857,  .787,
5  .717,  .634,  .533,  .433,  .346,  .307,  .328,  .401,  .490,
5  .535,  .526,  .507,  .487,  .466,  .349,  .256,  .190,
6  .908,  .970, 1.032, 1.074, 1.100, 1.087, 1.026,  .963,  .899,
6  .836,  .755,  .669,  .583,  .505,  .464,  .488,  .576,  .678,
6  .713,  .693,  .671,  .648,  .624,  .483,  .365,  .285,
7 1.019, 1.085, 1.146, 1.183, 1.196, 1.167, 1.121, 1.075, 1.013,
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7  .937,  .861,  .785,  .709,  .641,  .607,  .625,  .705,  .793,
7  .845,  .840,  .819,  .793,  .767,  .619,  .495,  .394/
 DATA((CL612(I,J),J=1,26),I=1,4)/
1  .063,  .079,  .087,  .093,  .099,  .095,  .070, -.002, -.113,
1 -.238, -.363, -.487, -.598, -.607, -.568, -.459, -.325, -.276,
1 -.278, -.280, -.282, -.284, -.286, -.298, -.310, -.321,
2  .247,  .277,  .295,  .305,  .297,  .282,  .247,  .173,  .057,
2 -.071, -.199, -.361, -.450, -.470, -.423, -.307, -.178, -.121,
2 -.123, -.125, -.127, -.129, -.130, -.142, -.153, -.164,
3  .424,  .447,  .466,  .480,  .493,  .487,  .457,  .367,  .245,
3  .122, -.000, -.122, -.241, -.279, -.2 7, -.118, -.014,  .019,
3  .015,  .011,  .006,  .002, -.002, -.028, -.035, -.032,
4  .601,  .631,  .659,  .676,  .679,  .657,  .590,  .482,  .374,
4  .267,  .159,  .051, -.047, -.077, -.038,  .096,  .187,  .221,
4  .219,  .205,  .192,  .179,  .168,  .118,  .095,  .072/
 DATA((CL612(I,J),J=1,26),I=5,7)/
5  .752,  .790,  .820,  .839,  .840,  .788,  .700,  .604,  .507,
5  .411,  .315,  .218,  .133,  .109,  .145,  .275,  .383,  .407,
5  .395,  .378,  .363,  .348,  .337,  .269,  .225,  .187,
6  .844,  .907,  .969, 1.006, 1.014,  .965,  .869,  .773,  .677,
6  .581,  .485,  .389,  .312,  .291,  .332,  .461,  .554,  .585,
6  .573,  .554,  .534,  .515,  .495,  .410,  .346,  .295,
7  .956, 1.022  1.083, 1.120, 1.124, 1.072,  .988,  .904,  .820,
7  .717,  .61[illegible]  .505,  .428,  .404,  .443,  .561,  .665,  .699,
7  .681,  .66[illegible]  .646,  .628,  .611,  .527,  .463,  .416/
 DATA((CL615(I,J),J=1,26),I=1,4)/
1  .072,  .080,  .084,  .086,  .072,  . 45, -.003, -.076, -.233,
1 -.407, -.627, -.835, -.922, -.89[illegible], -.769, -.591, -.439, -.417,
1 -.413, -.410, -.406, -.403, -.400, -.387, -.372, -.357,
2  .213,  [illegible]24,  .226,  .216,  .205,  .200,  .134,  .055, -.086,
2 -.265, -.444, -.616, -.696, -.630, -.506, -.353, -.258, - 250,
2 -.245, -.244, -.243, -.242, -.240, -.227, -.209, -.190,
3  .367,  .378,  .384,  .394,  .377,  .341,  .284,  .207,  .105,
3 -.041, -.232, -.416, -.474, -.415, -.283, -.156, -.114, -.107,
3 -.105, -.103, -.100, -.098, -.096, -.083, -.065, -.046,
4  .564,  .567,  .579,  .586,  .560,  .528,  .449,  .369,  .246,
4  .110, -.057, -.201, -.252, -.207, -.071,  .057,  .094,  .093,
4  .091,  .090,  .088,  .086,  .084,  .07[illegible],  .062,  .062/
  DATA((CL615(I,J),J=1,26),I=5,7)/
5  .688,  .717,  .734,  .745,  .725,  .676,  .602,  .515,  .398,
5  .281,  .160,  .046,  .003,  .046,  .182,  .308,  .341,  .335,
5  .328,  .322,  .314,  .306,  .298,  .253,  .212,  .172,
6  .789,  .839,  .870,  .880,  .826,  .777,  .702,  .601,  .500,
6  .375,  .239,  .133,  .087,  .130,  .281,  .404,  .435,  .433,
6  .425,  .418,  .410,  .403,  .395,  .353,  .313,  .274,
7  .887,  .939,  .991, 1.015,  .953,  .889,  .824,  .728,  .607,
7  .487,  .349,  .218,  .172,  .212,  .361,  .490,  .521,  .514,
7  .506,  .499,  .492,  .485,  .478,  .435,  .394,  .355/
 DATA((ALP604(J,N),N=1,9),J=1,13)/
& -7.74, -5.96, -4.19, -2.41,  -.61,  1.29,  3.73,  6.[illegible]8,  9.07,
& -7.54, -5.86, -4.18, -2.50,  -.82,  1.02,  3.27,  5.80,  8.41,
& -7.26, -5.71, -4.16, -2.61, -1.01,   .75,  2.87,  5.27,  7.81,
& -7.22, -[illegible], -4.19, -2.67, -1.12,   .59,  2.66,  4.97,  7.49,
& -7.13, -5.67, -4.22, -2.76, -1.25,   .40,  2.41,  4.60,  7.05,
& -7.10, -5.67, -4.24, -2.80, -1.32,   .31,  2.29,  4.37,  6.82,
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& -7.05, -5.65, -4.25, -2.84, -1.38,   .21,  2.18,  4.13,  6.59,
& -7.06, -5.67, -4.28, -2.89, -1.45,   .09,  2.08,  3.91,  6.34,
& -7.33, -5.88, -4.43, -2.99, -1.52,  -.02,  1.96,  3.72,  6.11,
& -7.78, -6.23, -4.67, -3.11, -1.58,  -.12,  1.82,  3.63,  6.15,
& -8.26, -6.59, -4.93, -3.26, -1.65,  -.21,  1.72,  3.72,  6.49,
& -8.69, -6.90, -5.12, -3.33, -1.62,  -.12,  1.92,  4.04,  7.10,
& -9.09, -7.10, -5.11, -3.12, -1.29,   .46,  2.60,  4.84,  7.82/
 DATA((ALP604(J,N),N=1,9),J=14,26)/
& -8.48, -6.50, -4.51, -2.53,  -.74,  1.24,  3.26,  5.71,  8.49,
& -7.70, -5.77, -3.84, -1.91,  -.04,  2.00,  3.89,  6.49,  9.26,
& -7.13, -5.14, -3.15, -1.19,   .74,  2.65,  4.67,  7.27, 10.03,
& -6.5[illegible] -4.48, -2.39,  -.46,  1.41,  3.26,  5.42,  8.10, 10.88,
& -5.6[illegible], -3.87, -2.08,  -.14,  1.79,  3.48,  5.70,  8.59, 11.53,
& -5.71, -3.98, -2.26,  -.34,  1.50,  3.19,  5.26,  7.91, 10.61,
& -6.43, -4.65, -2.87,  -.92,   .98,  2.69,  4.53,  6.99,  9.42,
& -7.34, -5.43, -3.51, -1.57,   .43,  2.23,  3.91,  6.29,  8.60,
& -7.67, -5.75, -3.83, -1.89,   .20,  2.04,  3.74,  5.94,  8.55,
& -7.74, -5.74, -3.74, -1.71,   .40,  2.20,  4.01,  6.31,  8.78,
& -6.10, -4.06, -2.02,   .30,  2.54,  5.19,  7.97, 10.69, 13.41,
& -6.00, -3.08,  -.35,  2.55,  5.74,  8.80, 11.83, 14.86, 17.89,
& -7.84, -3.19,   .56,  4.15,  7.64, 11.24, 14.85, 18.45, 22.05/
 DATA((ALP606(J,N),N=1,9),J=1,13)/
& -8.23, -6.38, -4.53, -2.68,  -.77,  1.17,  3.90,  6.79,  9.24,
& -8.01, -6.25, -4.48, -2.72,  -.94,   .86,  3.04,  6.07,  8.51,
& -7.87, -6.18, -4.50, -2.82, -1.17,   .53,  2.55,  5.41,  7.91,
& -7.81, -6.17, -4.53, -2.89, -1.28,   .35,  2.28,  4.93,  7.56,
& -7.67, -6.11, -4.55, -2.98, -1.42,   .17,  2.05,  4.45,  7.15,
& -7.60, -6.08, -4.55, -3.02, -1.49,   .07,  1.94,  4.23,  6.94,
& -7.52, -6.03, -4.54, -3.06, -1.56,  -.02,  1.86,  4.03,  6.74,
& -7.44, -5.98, -4.52, -3.06, -1.59,  -.12,  1.77,  4.01,  6.90,
& -7.03, -5.67, -4.30, -2.94, -1.57,  -.22,  1.69,  4.40,  7.45,
& -6.24, -5.02, -3.80, -2.59, -1.37,  -.15,  1.99,  5.18,  8.13,
& -5.77, -4.53, -3.30, -2.06,  -.96,   .30,  3.09,  6.03,  8.95,
& -5.26, -4.02, -2.77, -1.57,  -.42,  1.33,  4.14,  6.86,  9.78,
& -4.77, -3.50, -2.23, -1.02,   .30,  2.32,  4.96,  7.68, 10.58/
 DATA((ALP606(J,N),N=1,9),J=14,26)/
& -4.24, -2.96, -1.69,  -.41,  1.21,  3.33,  5.79,  8.47, 11.18,
& -3.72, -2.42, -1.08,   .33,  2.00,  4.13,  6.67,  9.16, 11.64,
& -3.26, -1.92,  -.54,  1.04,  2.80,  4.91,  7.44,  9.83, 12.23,
& -3.19, -1.79,  -.45,  1.11,  2.87,  5.08,  7.63, 10.10, 12.57,
& -[illegible]4, -2.11,  -.73,   .72,  2.34,  4.55,  7.04,  9.45, 11.86,
& -3.87, -2.53, -1.22,   .10,  1.72,  3.63,  6.09,  8.6[illegible], 11.12,
& -4.29, -2.95, -1.64,  -.41,  1.16,  2.96,  5.18,  7.71, 10.20,
& -4.42, -3.10, -1.78,  -.47,  1.08,  2.86,  5.34,  7.58, 10.06,
& -4.37, -3.01, -1.66,  -.34,  1.30,  3.20,  5.55,  8.06, 10.56,
& -4.34, -2.93, -1.54,  -.20,  1.55,  3.59,  6.11,  8.65, 11.18,
& -4.34, -2.59,  -.90,  1.09,  3.71,  6.81,  9.79, 12.78, 15.76,
& -4.32, -2.43,  -.09,  2.98,  6.54,  9.69, 12.83, 15.96, 19.13,
& -4.26, -2.47,   .61,  4.25,  7.95, 11.28, 14.62, 17.95, 21.28/
 DATA((ALP609(J,N),N=1,9),J=1,13)/
& -8.52, -6.63, -4.73, -2.83,  -.83,  1.23,  4.24,  7.66, 11.26,
& -8.71, -6.82, -4.92, -3.02, -1.10,   .85,  3.46,  6.52, 10.00,
& -8.25, -6.54, -4.84, -3.14, -1.37,   .54,  2.69,  5.56,  8.95,
& -8.05, -6.43, -4.81, -3.19, -1.50,   .39,  2.35,  5.09,  8.31,
& -7.87, -6.34, -4.82, -3.29, -1.70,   .24,  2.03,  4.67,  8.08,
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& -7.84, -6.34, -4.84, -3.34, -1.79,   .17,  1.92,  4.71,  8.83,
& -7.90, -6.38, -4.86, -3.34, -1.78,   .10,  2.18,  5.49,  9.66,
& -8.14, -6.52, -4.90, -3.28, -1.62,   .24,  3.04,  6.66, 10.23,
& -8.34, -6.54, -4.74, -2.94, -1.21,   .86,  4.23,  7.77, 11.28,
& -7.04, -5.43, -3.82, -2.22,  -.64,  1.89,  5.39,  9.25, 13.21,
& -6.31, -4.62, -2.94, -1.32,   .32,  3.26,  6.85, 10.62, 14.40,
& -5.28, -3.62, -1.96,  -.28,  1.83,  4.99,  8.26, 11.71, 15.16,
& -4.25, -2.63,  -.79,  1.15,  3.54,  6.27,  9.44, 12.62, 15.79/
 DATA((ALP609(J,N),N=1,9),J=14,26)/
& -3.34, -1.48,   .58,  2.40,  4.68,  7.40, 10.34, 13.28, 16.22,
& -2.86,  -.92,  1.07,  2.98,  5.18,  7.90, 10.70, 13.50, 16.29,
& -2.86,  -.94    .91,  2.80,  4.90,  7.64, 10.55, 13.47, 16.39,
& -3.49, -1.6-,   .21,  2.00,  3.99,  6.37,  9.47, 12.57, 15.67,
& -4.19, -2.50,  -.64,  1.20,  3.10,  5.17,  8.12, 11.60, 15.08,
& -4.93, -3.09, -1.19,   .74,  2.64,  4.73,  7.32, 10.35, 13.38,
& -5.38, -3.29, -1.19,   .80,  2.69,  4.89,  7.46, 10.18, 12.90,
& -5.35, -3.21, -1.07,   .91,  2.86,  5.13,  7.74, 10.45, 13.15,
& -5.24, -3.10,  -.96,  1.04,  3.06,  5.40,  8.10, 10.86, 13.61,
& -5.13, -3.02,  -.86,  1.18,  3.27,  5.70,  8.46, 11.26, 14.06,
& -5.22, -2.68,  -.21,  2.11,  4.76,  7.72, 10.66, 13.60, 16.54,
& -5.28, -2.46,   .19,  3.17,  6.54,  9.62, 12.69, 15.77, 18.85,
& -5.34, -2.40,   .71,  4.21,  8.11, 11.78, 15.45, 19.12, 22.79/
 DATA((ALP612(J,N),N=1,9),J=1,13)/
& -9.03, -6.86, -4.68, -2.51,  -.27,  1.99,  5.04,  8.74, 12.25,
& -8.84, -6.82, -4.80, -2.78,  -.55,  1.66,  4.17,  7.62, 11.10,
& -8.68, -6.76, -4.84, -2.91,  -.77,  1.39,  3.75,  6.54, 10.05,
& -8.65, -6.76, -4.88, -2.99,  -.91,  1.22,  3.52,  5.93,  9.40,
& -9.04, -7.02, -5.00, -2.98,  -.95,  1.15,  3.50,  5.84,  9.38,
& -9.29, -7.16, -5.02, -2.88,  -.85,  1.33,  4.14,  6.65, 10.39,
& -9.31, -7.05, -4.79, -2.53,  -.54,  2.18,  5.18,  8.20, 11.56,
& -8.55, -6.26, -3.98, -1.72,   .57,  3.93,  6.41,  9.47, 12.52,
& -7.38, -5.02, -2.67,  -.48,  2.39,  5.09,  7.72, 10.52, 13.31,
& -5.94, -3.54, -1.26,  1.08,  3.85,  6.28,  9.22  12.16, 15.10,
& -4.45, -2.01,  0.00,  2.53,  5.00,  7.83, 11.00, 14.17, 17.35,
& -2.62,  -.65,  1.41,  3.78,  6.19,  9.64, 13.09, 16.53, 19.98,
& -1.52,   .42,  2.52,  4.75,  7.52, 10.97, 14.41, 17.86, 21.31/
 DATA((ALP612(J,N),N=1,9),J=14,26)/
& -1.27,   .78,  2.83,  5.00,  7.93, 11.47, 15.0-, 18.55, 22.09,
& -1.74,   .45,  2.42,  4.59,  7.23, 10.83, 14.43, 18.04, 21.64,
& -3.22,  -.87,  1.10,  3.16,  5.34,  8.78, 12.78, 16.78, 20.78,
& -5.02, -2.30,   .14,  2.13,  4.20,  6.83, 10.43, 14.04, 17.64,
& -5.60, -3.02,  -.27,  1.79,  3.92,  6.26,  9.77, 13.28, 16.79,
& -5.57, -2.99,  -.22,  1.81,  4.08,  6.50, 10.20, 13.91, 17.61,
& -5.55, -2.97,  -.16,  1.95,  4.25,  6.84, 10.51, 14.18, 17.85,
& -5.52, -2.94,  -.09,  2.09,  4.43,  7.18, 10.75, 14.32, 17.89,
& -5.50, -2.92,  -.03,  2.25,  4.62,  7.50, 11.04, 14.58, 18.12,
& -5.46, -2.90,   .02,  2.38,  4.80,  7.81, 11.26, 14.71, 18.16,
& -5.31, -2.74,   .38,  3.09,  5.86,  9.25, 12.67, 16.09, 19.50,
& -5.15, -2.60,   .54,  3.62,  6.92, 10.34, 13.76, 17.18, 20.60,
& -5.01, -2.46,   .62,  4.24,  7.74, 11.04, 14.35, 17.65, 20.96/
 DATA((ALP615(J,N),N=1,9),J=1,13)/
&-10.70, -[illegible] -5.02, -2.18,   .37,  2.78,  6.22, 10.31, 14.39,
&-10.67, -[illegible], -5.11, -2.33,   .23,  2.44,  5.36,  9.22, 13.22,
&-10.82, -8.00, -5.18, -2.37,   .16,  2.27,  4.97,  8.15, 11.45,
&-11.48, -8.40, -5.32, -2.25,   .06,  2.18,  4.81,  7.78, 10.74,
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&-11.10, -8.09, -5.08, -2.08,   .25,  2.48,  5.49,  8.74, 11.89,
& -9.74, -7.16, -4.58, -2.00,   .63,  2.97,  6.41,  9.98, 13.55,
& -9.80, -6.88, -3.96, -1.12,  1.41,  3.97,  7.61, 10.89, 14.16,
& -8.95, -5.89, -2.84,  -.09,  2.42,  5.98,  9.13, 12.28, 15.43,
& -6.27, -3.55, -1.10,  1.35,  4.04,  7.87, 11.61, 15.35, 19.08,
& -3.90, -1.42,   .54,  3.05,  6.45, 10.02, 13.59, 17.16, 20.73,
& -1.58,   .37,  2.53,  5.01,  8.93, 12.56, 16.20, 19.84, 23.47,
&   .15,  2.01,  3.63,  7.58, 12.28, 16.99, 21.69, 26.40, 31.11,
&   .67,  2.41,  3.98,  8.66, 13.36, 18.07, 22.78, 27.48, 32.19/
 DATA((ALP615(J,N),N=1,9),J=14,26)/
&   .14,  2.06,  3.64,  7.71, 12.59, 17.46, 22.34, 27.22, 32.10,
& -1.05,   .78,  2.56,  4.36,  8.98, 13.98, 18.98, 23.98, 28.98,
& -2.39,  -.45,  1.46,  3.14,  5.92, 10.56, 15.21, 19.86, 24.51,
& -3.57, -1.19,  1.10,  2.86,  5.26,  9.84, 14.49, 19.14, 23.79,
& -3.80, -1.30,  1.07,  2.88,  5.33, 10.12, 15.06, 20.00, 24.94,
& -3.85, -1.36,  1.07,  2.92,  5.48, 10.32, 15.26, 20.20, 25.14,
& -3.88, -1.38,  1.07,  2.95,  5.63, 10.49, 15.43, 20.37, 25.31,
& -3.93, -1.40,  1.06,  2.99,  5.79, 10.63, 15.51, 20.39, 25.27,
& -3.96, -1.42,  1.07,  3.04,  5.94, 10.80, 15.68, 20.56, 25.44,
& -4.00, -1.44,  1.07,  3.08,  6.12, 10.94, 15.76, 20.58, 25.40,
& -4.16, -1.63,  1.08,  3.42,  7.15, 12.02, 16.90, 21.78, 26.66,
& -4.34, -1.88,  1.02,  3.84,  8.15, 13.09, 18.02, 22.96, 27.90,
& -4.51, -2.12,   .85,  4.55,  9.11, 14.05, 18.99, 23.93, 28.86/
 DATA((CD604(I,J),J=1,26),I=1,5)/
1 .0224, .0253, .0268, .0275, .0282, .0286, .0289, .0293, .0297,
1 .0301, .0318, .0354, .0408, .0462, .0515, .0569, .0616, .0655,
1 .0675, .0687,  0694, .0700, .0705, .0628, .0458, .0344,
2 .0120, .0134, .0141, .0144, .0148, .0150, .0151, .0153, .0157,
2 .0162, .0185, .0220, .0274, .0328, .0382, .0435, .0487, .0518,
2 .0546, .0561, .0566, .0572, .0578, .0560, .0491, .0397,
3 .0063, .0062, .0062, .0062, .0062, .0062, .0062, .0063, .0065,
3 .0073, .0117, .0162, .0206, .0250, .0299, .0359, .0419, .0480,
3 .0523, .0543, .0564, .0584, .0595, .0646, .0691, .0731,
4 .0055, .0054, .0053, .0053, .0053, .0053, .0053, .0053, .0056,
4 .0064, .0098, .0134, .0169, .0227, .0310, .0393, .0478, .0550,
4 .0600, .0650, .0698, .0737, .0776, .0987, .1129, .1284,
5 .0070, .0067, .0065, .0066, .0066, .0066, .0066, .0068, .0070,
5 .0083, .0153, .0223, .0293, .0370, .0498, .0621, .0724, .0826,
5 .0921, .1016, .1094, .1163, .1232, .1587, .1786, .1906/
 DATA((CD606(I,J),J=1,26),I=1,5)/
1 .0198, .0213, .0221, .0225, .0228, .0230, .0232, .0236, .0248,
1 .0264, .0296, .0334, .0382, .0441, .0500, .0559, .0617, .0667,
1 .0694, .0717, .0723, .0729, .0735, .0662, .0532, .0411,
2 .0116, .0116, .0115, .0115, .0115, .0117, .0121, .0129, .0140,
2 .0160, .0186, .0227, .0274, .0322, .0372, .0429, .0485, .0534,
2 .0569, .0605, .0640, .0676, .0688, .0672, .0579, .0484,
3 .0058, .0058, .0058, .0058, .0058, .0061, .0065, .0074, .0088,
3 .0121, .0153, .0186, .0219, .0271, .0353, .0435, .0517, .0574,
3 .0631, .0682, .0711, .0740, .0770, .0803, .0810, .0810,
4 .0058, .0059, .0059, .0059, .0059, .0059, .0059, .0064, .0075,
4 .0089, .0124, .0169, .0213, .0265, .0374, .0481, .0586, .0673,
4 .0737, .0796, .0843, .0889, .0936, .1144, .1293, .1430,
5 .0082, .0075, .0072, .0072, .0073, .0076, .0080, .0088, .0102,
5 .0144, .0245, .0346, .0448, .0549, .0651, .0858, .1041, .1178,
5 .1304, .1417, .1530, .1630, .1721, .2178, .2484, .2682/
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 DATA((CD609(I,J),J=1,26),I=1,5)/
1 .0179, .0177, .0176, .0176, .0175, .0175, .0175, .0182, .0201,
1 .0235, .0291, .0347, .0439, .0536, .0629, .0710, .0786, .0846,
1 .0905, .0965, .1016, .1035, .1053, .1071, .0972, .0780,
2 .0113, .0112, .0111, .0111, .0115, .0120, .0127, .0139, .0162,
2 .0206, .0249, .0293, .0343, .0418, .0493, .0568, .0640, .0707,
2 .0771, .0811, .0844, .0863, .0882, .0854, .0757, .0655,
3 .0066, .0064, .0062, .0062, .0064, .0068, .0076, .0096, .0121,
3 .0147, .0189, .0254, .0320, .0409, .0525, .0640, .0716, .0787,
3 .0858, .0910, .0942, .0974, .1002, .1024, .1015, .0989,
4 .0079, .0078, .0078, .0078, .0077, .0078, .0081, .0087, .0099,
4 .0147, .0200, .0264, .0351, .0454, .0575, .0699, .0816, .0907,
4 .0992, .1058, .1123, .1179, .1207, .1356, .1464, .1536,
5 .0100, .0081, .0073, .0073, .0080, .0087, .0103, .0126, .0165,
5 .0204, .0279, .0371, .0463, .0619, .0779, .0975, .1169, .1352,
5 .1478, .1572, .1642, .1672, .1691, .1762, .1809, .1855/
 DATA((CD612(I,J),J=1,26),I=1,5)/
1 .0197, .0206, .0211, .0217, .0223, .0227, .0232, .0259, .0312,
1 .0381, .0462, .0550, .0638, .0725, .0818, .0930, .1020, .1104,
1 .1189, .1256, .1302, .1348, .1366, .1294, .1084, .0833,
2 .0127, .0127, .0128, .0128, .0133, .0138, .0163, .0209, .0270,
2 .0349, .0430, .0519, .0617, .0712, .0806, .0894, .0976, .1058,
2 .1140, .1199, .1257, .1316, .1363, .1379, .1187, .0947,
3 .0097, .0097, .0096, .0096, .0103, .0115, .0139, .0178, .0235,
3 .0313, .0407, .0512, .0621, .0725, .0830, .0942, .1054, .1136,
3 .1218, .1300, .1365, .1426, .1486, .1538, .1444, .1284,
4 .0078, .0078, .0078, .0078, .0078, .0091, .0111, .0141, .0208,
4 .0275, .0343, .0454, .0578, .0707, .0839, .0971, .1100, .1230,
4 .1343, .1432, .1521, .1610, .1678, .1968, .1952, .1853,
5 .0107, .0107, .0107, .0107, .0108, .0123, .0166, .0219, .0313,
5 .0471, .0636, .0798, .0959, .1103, .1236, .1374, .1517, .1661,
5 .1785, .1897, .2008, .2120, .2229, .2798, .3189, .3488/
 DATA((CD615(I,J),J=1,26),I=1,5)/
1 .0160, .0272, .0328, .0355, .0386, .0413, .0450, .0534, .0628,
1 .0731, .0834, .0924, .1011, .1097, .1182, .1256, .1324, .1392,
1 .1453, .1504, .1553, .1572, .1591, .1547, .1349, .1190,
2 .0131, .0130, .0130, .0137, .0155, .0186, .0248, .0326, .0454,
2 .0598, .0752, .0895, .1014, .1132, .1237, .1317, .1396, .1454,
2 .1510, .1559, .1586, .1612, .1631, .1594, .1409, .1243,
3 .0106, .0105, .0105, .0106, .0120, .0146, .0225, .0319, .0413,
3 .0579, .0740, .0899, .1063, .1201, .1294, .1387, .1469, .1546,
3 .1623, .1689, .1722, .1755, .1788, .1755, .1678, .1583,
4 .0099, .0098, .0098, .0098, .0108, .0132, .0200, .0302, .0404,
4 .0506, .0663, .0833, .1017, .1200, .1346, .1490, .1625, .1722,
4 .1818, .1908, .1951, .1993, .2036, .2162, .2173, .2155,
5 .0119, .0119, .0119, .0125, .0147, .0215, .0314, .0413, .0610,
5 .0817, .1049, .1285, .1509, .1732, .1923, .2092, .2262, .2423,
5 .2559, .2695, .2796, .2788, .2780, .2734, .2688, .2642/
 DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
& .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
&1.1,1.125,1.15,1.3,1.45,1.6/
 DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
 DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
 DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
 IORDER(1)=IORDER(2)=1
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      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .04) GO TO 9
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 4
      IF (TR .GE. .15) GO TO 5
    9 CALL IBI (7,ALPI,26,XMI,7,CL604,IORDER,IPT,AA,XM,CLFT04,IERR)
      CL=CLFT04
      GO TO 400
    1 CALL IBI (7,ALPI,26,XMI,7,CL604,IORDER,IPT,AA,XM,CLFT04,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL606,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT04 + (CLFT06-CLFT04)*((TR-.04)/(.06-.04))
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL606,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL609,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL609,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL612,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL612,IORDER,IPT,AA,XM,CLFT12,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL615,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT12 + (CLFT15-CLFT12)*((TR-.12)/(.15-.12))
      GO TO 400
    5 CALL IBI (7,ALPI,26,XMI,7,CL615,IORDER,IPT,AA,XM,CLFT15,IERR)
      CL=CLFT15
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .04) GO TO 90
      IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 40
      IF (TR .GE. .15) GO TO 50
   90 CALL IBI (26,XMI,9,CLI,26,ALP604,IORDER,IPT,XM,CL,AA04,IERR)
      AA=AA04
      GO TO 400
   10 CALL IBI (26,XMI,9,CLI,26,ALP604,IORDER,IPT,XM,CL,AA04,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP606,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA04 + (AA06-AA04)*((TR-.04)/(.06-.04))
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP606,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP609,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
      GO TO 400
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 30  CALL IBI (26,XMI,9,CLI,26,ALP609,IORDER,IPT,XM,CL,AA09,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP612,IORDER,IPT,XM,CL,AA12,IERR)
     AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
     GO TO 400
 40  CALL IBI (26,XMI,9,CLI,26,ALP612,IORDER,IPT,XM,CL,AA12,IERR)
     IPT (1) = -1
     CALL IBI (26,XMI,9,CLI,26,ALP615,IORDER,IPT,XM,CL,AA15,IERR)
     AA=AA12+(AA15-AA12)*((TR-.12)/(.15-.12))
     GO TO 400
 50  CALL IBI (26,XMI,9,CLI,26,ALP615,IORDER,IPT,XM,CL,AA15,IERR)
     AA=AA15
 400 CONTINUE
     IPT (1)=-1
     IF (TR .LT. .04) GO TO 91
     IF (TR .GE. .04 .AND. TR .LT. .06) GO TO 11
     IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
     IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
     IF (TR .GE. .12 .AND. TR .LT. .15) GO TO 41
     IF (TR .GE. .15) GO TO 51
  91 CALL IBI (5,CLII,26,XMI,5,CD604,IORDER,IPT,CL,XM,CDRG04,IERR)
     CD=CDRG04
     WRITE (6,201) TR
201  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
    &*/* THE VALUES FOR T/C=.04 HAVE BEEN RETURNED*)
     GO TO 250
  11 CALL IBI (5,CLII,26,XMI,5,CD604,IORDER,IPT,CL,XM,CDRG04,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD606,IORDER,IPT,CL,XM,CDRG06,IERR)
     CD=CDRG04 + (CDRG06-CDRG04)*((TR-.04)/(.06-.04))
     GO TO 250
  21 CALL IBI (5,CLII,26,XMI,5,CD606,IORDER,IPT,CL,XM,CDRG06,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD609,IORDER,IPT,CL,XM,CDRG09,IERR)
     CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
     GO TO 250
  31 CALL IBI (5,CLII,26,XMI,5,CD609,IORDER,IPT,CL,XM,CDRG09,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD612,IORDER,IPT,CL,XM,CDRG12,IERR)
     CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
     GO TO 250
  41 CALL IBI (5,CLII,26,XMI,5,CD612,IORDER,IPT,CL,XM,CDRG12,IERR)
     IPT (1)=-1
     CALL IBI (5,CLII,26,XMI,5,CD615,IORDER,IPT,CL,XM,CDRG15,IERR)
     CD=CDRG12 + (CDRG15-CDRG12)*((TR-.12)/(.15-.12))
     GO TO 250
  51 CALL IBI (5,CLII,26,XMI,5,CD615,IORDER,IPT,CL,XM,CDRG15,IERR)
     CD=CDRG15
     IF (TR .GT. .15) WRITE (6,205) TR
205  FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
    &*/* THE VALUES  FOR T/C=.15 HAVE BEEN RETURNED.*)
 250 IF(CL .GT. .8) GO TO 251
     RETURN
     CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
     CD=CDT
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      RETURN
      END


      SUBROUTINE AERO7(XLD,CL,CD,XM,AA,IKEY,TR,CLDES,ALT,COR,D)
C
C
C THIS SUBROUTINE IS DESIGNED TO COMPUTE THE AIRFOIL
C CHARACTERISTICS FOR A 16 SERIES AIRFOIL WITH A GIVEN CAMBER.
C
C THIS SUBROUTINE RELATES CL,CD,CL/CD,MACH,T/C,AND ALPHA.
C IT REPRESENTS THE DATA OF A 16-7XX AIRFOIL.
C
C XM=RELATIVE MACH NO. AT BLADE ELEMENT
C AA=ANGLE OF ATTACK IN DEGREES
C IKEY1: CL=CL(MACH,ALPHA,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C IKEY2: ALPHA=ALPHA(MACH,CL,T/C)
C      : CD=CD(MACH,CL,T/C)
C      :XLD=CL/CD
C TR=T/C
C
C
C
C
      DIMENSION IORDER(2),IPT(2),ALP706(26,9),
     & ALP709(26,9),ALP712(26,9),
     & CLI(9),XMI(26),ALPI(7),
     & CL706(7,26),CL709(7,26),CL712(7,26),
     & CD709(5,26),CD712(5,26),CD706(5,26),CLII(5)
      DATA((CL706(I,J),J=1,26),I=1,4)/
     1  .112,  .118,  .128,  .133,  .140,  .146,  .153,  .157,  .148,
     1  .117,  .075,  .010, -.071, -.158, -.245, -.325, -.349, -.309,
     1 -.188, -.101, -.081, -.098, -.114, -.202, -.259, -.280,
     2  .340,  .359,  .381,  .398,  .416,  .424,  .441,  .443,  .417,
     2  .379,  .333,  .267,  .190,  .094, -.013, -.129, -.151, -.115,
     2 -.021,  .066,  .083,  .068,  .050, -.050, -.136, -.159,
     3  .519,  .569,  .599,  .618,  .649,  .672,  .695,  .705,  .675,
     3  .618,  .537,  .435,  .330,  .224,  .118,  .027,  .015,  .076,
     3  .153,  .225,  .248,  .225,  .202,  .074, -.021, -.038,
     4  .715,  .768,  .802,  .823,  .843,  .856,  .874,  .866,  .825,
     4  .761,  .[illegible]79,  .592,  .505,  .418,  .331,  .246,  .246,  .299,
     4  .381,   55,  .457,  .431,  .402,  .231,  .106,  .076/
      DATA((CL706(I,J),J=1,26),I=5,7)/
     5  .852,  .911,  .947,  .973, 1.002, 1.017, 1.027, 1.013,  .963,
     5  .891,  .813,  .734,  .655,  .577,  .498,  .445,  .439,  .498,
     5  .583,  .655,  .661,  .628,  .594,  .400,  .255,  .186,
     6  .983, 1.043, 1.092, 1.126, 1.163, 1.182, 1.183, 1.168, 1.126,
     6 1.057,  .980,  .904,  .827,  .751,  .674,  .615,  .621,  .689,
     6  .768,  .837,  .839,  .807,  .767,  .539,  .372,  .297,
     7 1.135, 1.201, 1.252, 1.282, 1.329, 1.345, 1.339, 1.315, 1.268,
     7 1.205, 1.138, 1.071, 1.005,  .938,  .872,  .818,  .818,  .884,
     7  .975, 1.040, 1.036,  .991,  .943,  .676,  .491,  .403/
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 DATA((CL709(I,J),J=1,26),I=1,4)/
1  .158,  .164,  .168,  .170,  .174,  .163,  .140,  .080,  .011
1 -.085, -.264, -.442, -.620, -.779, -.849, -.801, -.717, -.609,
1 -.500, -.392, -.321, -.312, -.319, -.352, -.369, -.387,
2  .359,  .388,  .407,  .420,  .433,  .420,  .402,  .348,  .285,
2  .180,  .041, -.125, -.291, -.448, -.527, -.475, -.375, -.266,
2 -.158, -.115, -.120, -.125, -.132, -.181, -.210, -.210,
3  .550,  .594,  .624,  .644,  .664,  .673,  .640,  .605,  .519,
3  .429,  .295,  .153,  .011, -.122, -.191, -.175, -.077,  .043,
3  .102,  .097,  .086,  .076,  .066,  .017, -.012, -.029,
4  .734,  .783,  .814,  .837,  .856,  .844,  .821,  .771,  .710,
4  .648,  .527,  .388,  .248,  .130,  .088,  .095,  .178,  .263,
4  .322,  .313,  .294,  .277,  .263,  .179,  .119,  .076/
 DATA((CL709(I,J),J=1,26),I=5,7)/
5  .852,  .906,  .958,  .984, 1.016,  .997,  .970,  .902,  .828,
5  .754,  .680,  .597,  .467,  .337,  .243,  .256,  .334,  .467,
5  .512,  .506,  .489,  .471,  .452,  .336,  .253,  .194,
6  .961, 1.023, 1.097, 1.137, 1.127, 1.107, 1.057, 1.007,  .957,
6  .879,  .798,  .717,  .620,  .500,  .435,  .444,  .529,  .642,
6  .711,  .702,  .678,  .654,  .630,  .502,  .391,  .297,
7 1.096, 1.173, 1.231, 1.264, 1.239, 1.193, 1.147, 1.101, 1.055,
7  .979,  .897,  .816,  .734,  .644,  .586,  .598,  .689,  .843,
7  .872,  .849,  .827,  .803,  .779,  .634,  .514,  .414/
 DATA((CL712(I,J),J=1,26),I=1,4)/
1  .122,  .144,  .154,  .164,  .141,  .103,  .051, -.044, -.167,
1 -.290, -.418, -.558, -.612, -.625, -.593, -.522, -.413, -.338,
1 -.322, -.324, -.326, -.328, -.331, -.343, -.351, -.357,
2  .320,  .352,  .368,  .380,  .364,  .332,  .264,  .146,  .016,
2 -.115, -.245, -.381, -.459, -.478, -.440, -.339, -.224, -.162,
2 -.159, -.162, -.166, -.170, -.175, -.195, -.193, -.195,
3  .495,  .538,  .559,  .575,  .568,  .529,  .442,  .324,  .191,
3  .054, -.083, -.219, -.318, -.351, -.309, -.167, -.031,  .001,
3  .003, -.003, -.009, -.015, -.021, -.041, -.044, -.050,
4  .684,  .720,  .748,  .758,  .731,  .671,  .573,  .451,  .329,
4  .207,  .084, -.038, -.119, -.145, -.101,  .043,  .164,  .195,
4  .187,  .179,  .171,  .162,  .154,  .110,  .080,  .059/
 DATA((CL712(I,J),J=1,26),I=5,7)/
5  .819,  .875,  .903,  .920,  .873,  .773,  .673,  .572,  .472,
5  .372,  .272,  .172,  .091,  .064,  .115,  .255,  .373,  .400,
5  .394,  .383,  .370,  .357,  .344,  .271,  .216,  .171,
6  .936, 1.006, 1.058, 1.079, 1.019,  .950,  .850,  .751,  .652,
6  .552,  .453,  .354,  .281,  .253,  .310,  .457,  .583,  .594,
6  .577,  .560,  .544,  .527,  .511,  .417,  .348,  .283,
7 1.032, 1.099, 1.153, 1.182, 1.125, 1.061,  .984,  .886,  .788,
7  .691,  .593,  .495,  .402,  .377,  .419,  .603,  .727,  .737,
7  .724,  .707,  .689,  .672,  .654,  .548,  .468,  .395/
 DATA((ALP706(J,N),N=1,9),J=1,13)/
& -8.49, -6.74, -4.98, -3.23, -1.33,   .83,  3.24,  6.22,  8.86,
& -8.30, -6.64, -4.98, -3.32, -1.61,   .31,  2.45,  5.35,  7.99,
& -8.17, -6.59, -5.01, -3.43, -1.83,   .01,  1.98,  4.73,  7.35,
& -8.02, -6.51, -5.00, -3.49, -1.98,  -.16,  1.78,  4.35,  6.95,
& -7.91, -6.46, -5.01, -3.57, -2.12,  -.42,  1.56,  3.97,  6.45,
& -7.93, -6.49, -5.05, -3.61, -2.17,  -.58,  1.39,  3.79,  6.22,
& -7.84, -6.45, -5.06, -3.67, -2.28,  -.75,  1.17,  3.65,  6.22,
& -7.90, -6.50, -5.10, -3.70, -2.30,  -.80,  1.18,  3.82,  6.44,
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& -8.07, -6.59, -5.10, -3.61, -2.13,  -.58,  1.67,  4.45,  7.04,
& -7.95, -6.42, -4.89, -3.37, -1.82,  -.15,  2.60,  5.31,  7.93,
& -7.68, -6.13, -4.58, -3.03, -1.34,   .89,  3.81,  6.25,  8.78,
& -7.19, -5.63, -4.08, -2.52,  -.42,  2.11,  4.78,  7.15,  9.54,
& -6.52, -4.99, -3.46, -1.86,   .80,  3.27,  5.69,  7.94, 10.19/
 DATA((ALP706(J,N),N=1,9),J=14,26)/
& -5.92, -4.33, -2.75,  -.37,  1.81,  4.26,  6.52,  8.66, 10.80,
& -5.34, -3.61, -1.80,   .77,  2.83,  5.16,  7.27,  9.29, 11.31,
& -4.77, -2.72,  -.35,  1.58,  3.55,  5.82,  7.82,  9.79, 11.76,
& -4.52, -2.49,  -.18,  1.60,  3.60,  5.77,  7.82,  9.85, 11.88,
& -4.94, -2.88,  -.80,  1.11,  3.02,  5.07,  7.14,  9.19, 11.24,
& -6.54, -4.14, -1.76,   .41,  2.19,  4.18,  6.31,  8.24, 10.17,
& -7.58, -5.19, -2.79,  -.31,  1.52,  3.45,  5.59,  7.61,  9.58,
& -7.89, -5.45, -3.01,  -.58,  1.45,  3.40,  5.56,  7.63,  9.66,
& -7.64, -5.23, -2.82,  -.32,  1.70,  3.72,  5.92,  8.10, 10.27,
& -7.49, -5.05, -2.61,  -.03,  1.98,  4.07,  6.38,  8.65, 10.92,
& -6.61, -3.97, -1.19,  1.61,  4.00,  6.89,  9.81, 12.73, 15.65,
& -6.29, -3.04,   .33,  3.26,  6.47,  9.83, 13.19, 16.55, 19.92,
& -5.98, -2.68,   .67,  4.25,  7.94, 11.72, 15.49, 19.26, 23.04/
 DATA((ALP709(J,N),N=1,9),J=1,13)/
& -9.55, -7.56, -5.57, -3.58, -1.57,   .54,  3.12,  6.58,  9.54,
& -9.04, -7.25, -5.46, -3.68, -1.88,   .06,  2.28,  5.61,  8.36,
& -8.75, -7.08, -5.41, -3.73, -2.06,  -.22,  1.85,  4.60,  7.54,
& -8.56, -6.96, -5.36, -3.76, -2.16,  -.39,  1.62,  4.21,  6.99,
& -8.43, -6.89, -5.34, -3.80, -2.25,  -.55,  1.42,  3.80,  7.30,
& -8.38, -6.82, -5.27, -3.71, -2.16,  -.58,  1.49,  4.05,  8.16,
& -8.12, -6.60, -5.07, -3.54, -2.02,  -.34,  1.77,  4.69,  9.18,
& -7.58, -6.09, -4.60, -3.10, -1.60,  -.04,  2.44,  5.87, 10.11,
& -7.00, -5.54, -4.08, -2.62, -1.02,   .85,  3.53,  6.88, 10.96,
& -6.38, -4.87, -3.36, -1.84,  -.23,  1.56,  4.74,  8.42, 12.42,
& -4.89, -3.58, -2.27,  -.75,   .91,  2.95,  6.04, 10.08, 14.12,
& -3.74, -2.47, -1.10,   .40,  2.11,  4.05,  7.68, 11.72, 15.76,
& -2.66, -1.40,  -.07,  1.59,  3.39,  5.74,  9.16, 12.67, 16.18/
 DATA((ALP709(J,N),N=1,9),J=14,26)/
& -1.71,  -.48,   .97,  2.68,  4.77,  7.39, 10.17, 12.94, 15.72,
& -1.24,  -.05,  1.37,  3.45,  5.64,  8.19, 10.83, 13.48, 16.13,
& -1.50,  -.17,  1.30,  3.30,  5.53,  8.03, 10.62, 13.22, 15.82,
& -2.15,  -.83,   .60,  2.28,  4.68,  6.89,  9.39, 11.89, 14.39,
& -2.78, -1.57,  -.28,  1.43,  3.34,  5.52,  7.57,  9.56, 11.55,
& -3.42, -2.25,  -.78,   .89,  2.82,  4.88,  7.11,  9.59, 12.07,
& -4.06, -2.61,  -.92,   .95,  2.90,  4.96,  7.33, 10.05, 12.78,
& -4.79, -2.80,  -.83,  1.10,  3.09,  5.17,  7.64, 10.32, 13.01,
& -4.94, -2.80,  -.76,  1.23,  3.27,  5.41,  7.96, 10.64, 13.33,
& -4.87, -2.73,  -.67,  1.36,  3.45,  5.66,  8.28, 10.97, 13.65,
& -4.56, -2.22,  -.17,  2.27,  4.77,  7.48, 10.52, 13.55, 16.58,
& -4.39, -1.90,   .18,  3.21,  6.15,  9.40, 12.65, 15.90, 19.15,
& -4.15, -1.89,   .55,  4.12,  7.76, 11.1[illegible], 14.60, 18.02, 21.44/
 DATA((ALP712(J,N),N=1,9),J=1,13)/
& -9.27, -7.25, -5.23, -3.21, -1.09,  1.11,  3.72,  7.33, 11.50,
& -9.23, -7.31, -5.38, -3.46, -1.48,   .68,  3.03,  5.91, 10.17,
& -9.18, -7.31, -5.44, -3.57, -1.66,   .43,  2.67,  5.25,  8.99,
& -9.22, -7.37, -5.52, -3.67, -1.79,   .27,  2.52,  5.01,  8.35,
& -8.85, -7.06, -5.26, -3.47, -1.65,   .39,  2.97,  5.74,  9.42,
& -8.39, -6.65, -4.90, -3.15, -1.31,  1.00,  4.31,  6.90, 10.50,
& -8.23, -6.36, -4.48, -2.60,  -.47,  2.54,  5.44,  8.24, 11.22,
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& -7.75, -5.64, -3.54, -1.39,  1.20,  4.31,  6.73,  9.69, 12.65,
& -6.55, -4.36, -2.17,   .13,  2.99,  5.42,  8.18, 11.12, 14.06,
& -5.26, -2.97,  -.64,  1.91,  4.31,  6.69,  9.57, 12.45, 15.32,
& -3.79, -1.44,   .99,  3.23,  5.41,  8.10, 10.96, 13.81, 16.67,
& -2.21,   .21,  2.36,  4.31,  6.65,  9.49, 12.33, 15.16, 18.00,
& -1.16,  1.19,  3.13,  5.15,  7.97, 11.27, 14.58, 17.88, 21.19/
 DATA((ALP712(J,N),N=1,9),J=14,26)/
&  -.77,  1.47,  3.39,  5.44,  8.37, 11.60, 14.82, 18.05, 21.27,
& -1.39,  1.05,  2.94,  4.87,  7.65, 11.32, 14.99, 18.66, 22.33,
& -2.67,  -.38,  1.59,  3.48,  5.44,  7.96, 10.70, 13.44, 16.18,
& -3.86, -1.75,   .32,  2.34,  4.26,  6.24,  9.01, 11.79, 14.57,
& -4.70, -2.43,  -.01,  2.05,  4.00,  6.08,  8.88, 11.68, 14.48,
& -4.96, -2.50,  -.04,  2.13,  4.07,  6.31,  9.03, 11.76, 14.48,
& -4.94, -2.47,   .03,  2.21,  4.19,  6.54,  9.27, 11.99, 14.71,
& -4.93, -2.43,   .10,  2.29,  4.34,  6.77,  9.53, 12.29, 15.05,
& -4.91, -2.38,   .17,  2.39,  4.51,  7.01,  9.77, 12.52, 15.28,
& -4.88, -2.32,   .24,  2.48,  4.67,  7.24, 10.04, 12.84, 15.64,
& -4.77, -2.07,   .54,  3.12,  5.77,  8.79, 11.85, 14.90, 17.95,
& -4.62, -2.09,   .71,  3.76,  6.87, 10.20, 13.53, 16.87, 20.20,
& -4.53, -2.06,   .92,  4.52,  8.09, 11.66, 15.23, 18.80, 22.38/
 DATA((CD706(I,J),J=1,26),I=1,5)/
1 .0265, .0282, .0288, .0291, .0294, .0296, .0297, .0300, .0317,
1 .0350, .0393, .0435, .0483, .0535, .0586, .0637, .0689, .0740,
1 .0766, .0782, .0798, .0805, .0812, .0749, .0600, .0497,
2 .0177, .0183, .0185, .0186, .0187, .0185, .0189, .0199, .0221,
2 .0259, .0308, .0356, .0402, .0447, .0493, .0540, .0588, .0633,
2 .0671, .0709, .0747, .0774, .0797, .0778, .0684, .0582,
3 .0080, .0082, .0085, .0086, .0090, .0094, .0100, .0108, .0124,
3 .0157, .0201, .0244, .0300, .0374, .0448, .0529, .0615, .0687,
3 .0739, .0784, .0817, .0851, .0875, .0920, .0911, .0901,
4 .0067, .0068, .0069, .0069, .0069, .0070, .0073, .0081, .0092,
4 .0112, .0136, .0195, .0267, .0349, .0466, .0588, .0691, .0769,
4 .0847, .0901, .0953, .1006, .1047, .1223, .1371, .1512,
5 .0067, .0068, .0068, .0069, .0069, .0069, .0074, .0084, .0109,
5 .0139, .0187, .0263, .0389, .0547, .0719, .0889, .1051, .1208,
5 .1349, .1470, .1560, .1621, .1681, .1998, .2300, .2478/
 DATA((CD709(I,J),J=1,26),I=1,5)/
1 .0245, .0304, .0333, .0348, .0363, .0374, .0386, .0410, .0439,
1 .0488, .0537, .0586, .0635, .0684, .0733, .0790, .0854, .0919,
1 .0983, .1023, .1042, .1060, .1063, .1021, .0878, .0696,
2 .0140, .0170, .0189, .0200, .0211, .0217, .0225, .0261, .0308,
2 .0355, .0402, .0450, .0502, .0553, .0604, .0655, .0705, .0755,
2 .0805, .0855, .0898, .0908, .0918, .0907, .0853, .0730,
3 .0093, .0096, .0100, .0102, .0104, .0106, .0128, .0179, .0231,
3 .0283, .0334, .0397, .0470, .0542, .0617, .0698, .0779, .0859,
3 .0925, .0980, .1034, .1068, .1083, .1084, .1053, .1024,
4 .0076, .0078, .0078, .0078, .0081, .0083, .0105, .0132, .0180,
4 .0241, .0301, .0363, .0423, .0528, .0665, .0802, .0936, .1042,
4 .1148, .1233, .1285, .1336, .1388, .1492, .1529, .1551,
5 .0077, .0077, .0078, .0079, .0080, .0082, .0110, .0158, .0205,
5 .0253, .0360, .0481, .0602, .0723, .0899, .1097, .1295, .1475,
5 .1644, .1813, .1957, .2029, .2101, .2435, .2569, .265
 DATA((CD712(I,J),J=1,26),I=1,5)/
1 .0221, .0315, .0362, .0386, .0426, .0454, .0492, .0530, .0568,
1 .0606, .0666, .0734, .0802, .0872, .0952, .1032, .1112, .1196,
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     1 .1283, .1371, .1441, .1457, .1473, .1408, .1201, .0934,
     2 .0130, .0146, .0154, .0161, .0176, .0195, .0242, .0325, .0403,
     2 .0470, .0544, .0620, .0709, .0807, .0905, .0998, .1091, .1184,
     2 .1272, .1348, .1423, .1480, .1504, .1474, .1252, .0990,
     3 .0110, .0113, .0118, .0120, .0128, .0150, .0201, .0265, .0330,
     3 .0418, .0505, .0594, .0709, .0825, .0940, .1044, .1148, .1253,
     3 .1350, .1447, .1541, .1589, .1637, .1600, .1469, .1324,
     4 .0099, .0099, .0099, .0099, .0099, .0110, .0162, .0222, .0284,
     4 .0378, .0476, .0574, .0701, .0849, .0997, .1147, .1297, .1434,
     4 .1568, .1696, .1778, .1861, .1909, .1992, .1923, .1824,
     5 .0099, .0099, .0099, .0099, .0103, .0126, .0182, .0239, .0367,
     5 .0499, .0661, .0836, .1023, .1198, .1367, .1508, .1637, .1766,
     5 .1891, .2012, .2134, .2245, .2346, .2764, .2948, .3025/
      DATA(XMI(J),J=1,26)/.3,.5,.6,.65,.7,.725,.75,.775,
     & .8,.825,.85,.875,.9,.925,.95,.975,1.0,1.025,1.05,1.075,
     &1.1,1.125,1.15,1.3,1.45,1.6/
      DATA(CLI(J),J=1,9)/-.4,-.2,0.0,.2,.4,.6,.8,1.0,1.2/
      DATA(ALPI(J),J=1,7)/-4.0,-2.0,0.0,2.0,4.0,6.0,8.0/
      DATA(CLII(J),J=1,5)/0.0,.2,.4,.6,.8/
      IORDER(1)=IORDER(2)=1
      IPT (1) = -1
      IF (IKEY .EQ. 2) GO TO 1000
      IF (TR .LT. .06) GO TO 1
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 2
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 3
      IF (TR .GE. .12) GO TO 4
    1 CALL IBI (7,ALPI,26,XMI,7,CL706,IORDER,IPT,AA,XM,CLFT06,IERR)
      CL=CLFT06
      GO TO 400
    2 CALL IBI (7,ALPI,26,XMI,7,CL706,IORDER,IPT,AA,XM,CLFT06,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL709,IORDER,IPT,AA,XM,CLFT09,IERR)
      CL=CLFT06 + (CLFT09 - CLFT06)*((TR-.06)/(.09-.06))
      GO TO 400
    3 CALL IBI (7,ALPI,26,XMI,7,CL709,IORDER,IPT,AA,XM,CLFT09,IERR)
      IPT (1)=-1
      CALL IBI (7,ALPI,26,XMI,7,CL712,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT09+(CLFT12-CLFT09)*((TR-.09)/(.12-.09))
      GO TO 400
    4 CALL IBI (7,ALPI,26,XMI,7,CL712,IORDER,IPT,AA,XM,CLFT12,IERR)
      CL=CLFT12
      GO TO 400
 1000 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .06) GO TO 10
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 20
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 30
      IF (TR .GE. .12) GO TO 40
   10 CALL IBI (26,XMI,9,CLI,26,ALP706,IORDER,IPT,XM,CL,AA06,IERR)
      AA=AA06
      GO TO 400
   20 CALL IBI (26,XMI,9,CLI,26,ALP706,IORDER,IPT,XM,CL,AA06,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP709,IORDER,IPT,XM,CL,AA09,IERR)
      AA=AA06 + (AA09 - AA06)*((TR -.06)/(.09-.06))
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      GO TO 400
   30 CALL IBI (26,XMI,9,CLI,26,ALP709,IORDER,IPT,XM,CL,AA09,IERR)
      IPT (1) = -1
      CALL IBI (26,XMI,9,CLI,26,ALP712,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA09+(AA12-AA09)*((TR-.09)/(.12-.09))
      GO TO 400
   40 CALL IBI (26,XMI,9,CLI,26,ALP712,IORDER,IPT,XM,CL,AA12,IERR)
      AA=AA12
  400 CONTINUE
      IPT (1)=-1
      IF (TR .LT. .06) GO TO 11
      IF (TR .GE. .06 .AND. TR .LT. .09) GO TO 21
      IF (TR .GE. .09 .AND. TR .LT. .12) GO TO 31
      IF (TR .GE. .12) GO TO 41
   11 CALL IBI (5,CLII,26,XMI,5,CD706,IORDER,IPT,CL,XM,CDRG06,IERR)
      CD=CDRG06
      WRITE (6,206) TR
  206 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.06 HAVE BEEN RETURNED.*)
      GO TO 250
   21 CALL IBI (5,CLII,26,XMI,5,CD706,IORDER,IPT,CL,XM,CDRG06,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD709,IORDER,IPT,CL,XM,CDRG09,IERR)
      CD=CDRG06 + (CDRG09 - CDRG06)*((TR-.06)/(.09-.06))
      GO TO 250
   31 CALL IBI (5,CLII,26,XMI,5,CD709,IORDER,IPT,CL,XM,CDRG09,IERR)
      IPT (1)=-1
      CALL IBI (5,CLII,26,XMI,5,CD712,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG09+(CDRG12-CDRG09)*((TR-.09)/(.12-.09))
      GO TO 250
   41 CALL IBI (5,CLII,26,XMI,5,CD712,IORDER,IPT,CL,XM,CDRG12,IERR)
      CD=CDRG12
      IF (TR .GT. .12) WRITE (6,207) TR
  207 FORMAT(*0THICKNESS RATIO=*,F5.3,* IS OUT OF RANGE.
     &*/* THE VALUES FOR T/C=.12 HAVE BEEN RETURNED.*)
  250 IF(CL .GT. .8) GO TO 251
      RETURN
  251 CALL COMPUT(D,XM,ALT,COR,TR,AA,CDT,CL,CD,CLDES)
      CD=CDT
      RETURN
      END


      SUBROUTINE IBI(NX,X,NY,Y,MAXF,F,IORDER,IPT,X0,Y0,Z,IERR)
C
C                                                                      *
C*********************************************************************
C*                                                                     *
C* PURPOSE                                                             *
C*                                                                     *
C*    FIRST OR SECOND ORDER LAGRANGIAN INTEPOLATION FOR A BIVARIATE    *
C*    FUNCTION Z = F(X0,Y0).  THE ORDER OF INTERPOLATION IN THE X      *
C*    DIRECTION MAY DIFFER FROM THE ORDER IN THE Y DIRECTION.  VALUES  *
C*    IN THE X AND Y ARRAYS NEED NOT BE EQUALLY SPACED, NOR DO THE X   *
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C*    AND Y ARRAYS REQUIRE THE SAME NUMBER OF ELEMENTS.  THE X AND Y    *
C*    ARRAYS EACH REQUIRE AT LEAST TWO ELEMENTS FOR FIRST ORDER INTERP-*
C*    OLATION AND AT LEAST THREE POINTS FOR SECOND ORDER INTERPOLATION.*
C*    F MUST BE KNOWN AT THE NODE POINTS (X(I),Y(J)).                  *
C*                                                                     *
C*    THE PROGRAM USES INTERNAL POINTERS IN THE X AND Y DIRECTIONS     *
C*    TO BEGIN SEARCHES.  THESE POINTERS CONTAIN THE INDICES OF THE X  *
C*    AND Y MESH LINES NEAREST THE PREVIOUS (X0,Y0).  THESE POINTERS   *
C*    ARE USED TO MINIMIZE THE SEARCH TIMES BASED ON THE PREMISE THAT  *
C*    IN SCIENTIFIC INTERPOLATION SUCCESSIVE POINTS TO BE INTERPOLATED *
C*    WILL BE FOUND IN THE SAME OR NEARBY GRID RECTANGLES.             *
C*                                                                     *
C* USE                                                                 *
C*                                                                     *
C*    CALL IBI(NX,X,NY,Y,MAXF,F,IORDER,IPT,X0,Y0,Z,IERR)               *
C*                                                                     *
C* PARAMETERS                                                          *
C*                                                                     *
C*    NX-----AN INPUT INTEGER SPECIFYING THE NUMBER OF DATA POINTS FOR *
C*           THE FIRST INDEPENDENT VARIABLE.                           *
C*                                                                     *
C*    X------ONE INPUT INDEPENDENT VARIABLE ARRAY DIMENSIONED AT LEAST *
C*           NX IN THE CALLING PROGRAM.  UPON ENTRY TO IBI, X(I) MUST  *
C*           CONTAIN THE I-TH VALUE OF THE FIRST INDEPENDENT VARIABLE  *
C*           AT WHICH THE FUNCTION IS KNOWN.                           *
C*           X MUST BE STRICTLY INCREASING, X(I+1)>X(I).               *
C*                                                                     *
C*    NY-----AN INPUT INTEGER SPECIFYING THE NUMBER OF DATA POINTS FOR *
C*           THE SECOND INDEPENDENT VARIABLE.                          *
C*                                                                     *
C*    Y------THE OTHER INPUT INDEPENDENT VARIABLE ARRAY DIMENSIONED AT *
C*        C  LEAST NY IN THE CALLING PROGRAM.  UPON ENTRY TO IBI, Y(J) *
C*           MUST CONTAIN THE J-TH VALUE OF THE SECOND INDEPENDENT     *
C*           VARIABLE AT WHICH THE FUNCTION IS KNOWN.                  *
C*           Y MUST BE STRICTLY INCREASING, Y(J+1)>Y(J).               *
C*                                                                     *
C*    MAXF---AN INPUT INTEGER GIVING THE MAXIMUM ROW DIMENSION OF F IN *
C*           THE CALLING PROGRAM.                                      *
C*                                                                     *
C*    F------THE INPUT TABLE OF DEPENDENT VARIABLE (FUNCTIONAL) VALUES *
C*           DIMENSIONED F(MAXF,NY) IN THE CALLING PROGRAM.  ACTUALLY  *
C*           F MAY HAVE MORE THAN NY COLUMNS BUT NOT MORE THAN MAXF ROW *
C*           UPON ENTRY TO IBI, F(I,J) MUST CONTAIN THE FUNCTIONAL     *
C*           VALUE AT (X(I),Y(J)).                                     *
C*                                                                     *
C*    IORDER-AN INTEGER INPUT ARRAY OF INTERPOLATION ORDERS. DIMENSION *
C*           IORDER(2).                                                *
C*                                                                     *
C*           IORDER(1)--ORDER OF INTERPOLATION FOR X.                  *
C*                                                                     *
C*           IORDER(2)--ORDER OF INTERPOLATION FOR Y.                  *
C*                                                                     *
C*           =1 FIRST ORDER INTERPOLATION.                             *
C*                                                                     *
C*           =2 SECOND ORDER INTERPOLATION.                            *
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C*
C*     IPT----AN INPUT/OUTPUT INTEGER ARRAY WITH THE FOLLOWING FUNCTIONS
C*            DIMENSION IPT(2).
C*
C*            INPUT--INITIALIZATION OF IBI AND CHECK ARRAYS X AND Y.
C*
C*                   = -1 WHENEVER A NEW X OR Y ARRAY IS INPUT, THIS
C*                        VALUE OF IPT(1) SHOULD BE SPECIFIED BY THE
C*                        USER TO INITIALIZE IBI AND CHECK THAT ARRAY
C*                        X IS STRICTLY INCREASING WITH AT LEAST NX
C*                        POINTS AND ARRAY Y IS STRICTLY INCREASING WITH
C*                        AT LEAST NY POINTS.
C*
C*            OUTPUT-INDEX POINTER.
C*
C*                   IPT(1)-THE X INDEX POINTER.
C*
C*                          = K INDICATES THAT ABS(X0-X(K))<ABS(X0-X(I))
C*                              I=1,...,NX I"K, THAT IS, X(K) IS THE
C*                              NEAREST MESH LINE TO X0.  IF
C*                              EXTRAPOLATION WAS USED (IERR=-3) IPT(1)
C*                              =0 ON RETURN IF X0<X(1) AND IPT(1)=NX IF
C*                              X0>X(NX).  ON THE NEXT CALL K IS USED AS
C*                              THE INDEX OF X WHERE THE SEARCH FOR X0
C*                              BEGINS.
C*
C*                   IPT(2)-THE Y INDEX POINTER.
C*
C*                          = J INDICATES THAT ABS(Y0-Y(J))<ABS(Y0-Y(I))
C*                              I=1,...,NY I"J, THAT IS, Y(J) IS THE
C*                              NEAREST MESH LINE TO Y0.  IF
C*                              EXTRAPOLATION WAS USED (IERR=-3) IPT(2)
C*                              =0 ON RETURN IF Y0<Y(1) AND IPT(2)=NY IF
C*                              Y0>Y(NY).  ON THE NEXT CALL, J IS USED
C*                              AS THE INDEX OF Y WHERE THE SEARCH FOR
C*                              Y0 BEGINS.
C*
C*     X0-----THE INPUT X POINT WHERE INTERPOLATION IS DESIRED.
C*
C*     Y0-----THE INPUT Y POINT WHERE INTERPOLATION IS DESIRED.
C*
C*     Z------THE OUTPUT INTERPOLATED VALUE OF THE FUNCTION AT (X0,Y0),
C*            Z=F(X0,Y0).
C*
C*     IERR---INTEGER OUTPUT ERROR CODE GENERATED AND RETURNED BY IBI.
C*
C*            = 0 NORMAL RETURN.  NO PROBLEMS ENCOUNTERED.
C*
C*            =-1 THE X OR Y ARRAY WAS NOT STRICTLY INCREASING.
C*                NO INTERPOLATION PERFORMED.
C*
C*            =-2 INSUFFICIENT VALUES IN X OR Y TO PERFORM THE ORDER OF
C*                INTERPOLATION REQUESTED, POSSIBLY USER INPUT NX OR NY
C*                INCORRECTLY.  NO INTERPOLATION PERFORMED.
C*
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C*            =-3 EXTRAPOLATION USED.  THE VALUE Z RETURNED MAY BE QUITE*
C*                INACCURATE.                                           *
C*                                                                      *
C*            =-4 IORDER(1) OR IORDER(2) NOT CORRECTLY INPUT BY USER    *
C*                AS 1 OR 2.  NO INTERPOLATION PERFORMED.               *
C*                                                                      *
C*            THE USER SHOULD TEST IERR ON EACH RETURN FROM IBI.        *
C*                                                                      *
C* REQUIRED ROUTINES                                                    *
C*                                                                      *
C*    MONO, FINDER, LAGRAG,INDIXR.                                      *
C*                                                                      *
C*                                                                      *
C* AUTHOR/IMPLEMENTER                                                   *
C*                                                                      *
C*    S. BAUDENDISTEL/G.W. HAIGLER.                                     *
C*                                                                      *
C* LANGUAGE                                                             *
C*                                                                      *
C*    FORTRAN.                                                          *
C*                                                                      *
C* DATE RELEASED                                                        *
C*                                                                      *
C*    AUGUST 15, 1973                                                   *
C*                                                                      *
C* LATEST REVISION                                                      *
C*                                                                      *
C*    AUGUST 15, 1973                                                   *
C*                                                                      *
C************************************************************************
C                                                                 IBI  15
      DIMENSION X(1),Y(1),F(MAXF,1),P(3),S(3),IPT(2),IORDER(2)
C
      IF(IPT(1).NE.-1)GOTO 10
C
C     INITIALIZE AND CHECK X,Y ARRAYS ARE STRICTLY INCREASING.
C
      IERR=-1
      IF(MONO(NX,X,IPT(1)).LT.0)RETURN
      IF(MONO(NY,Y,IPT(2)).LT.0)RETURN
      IPT(1)=IPT(2)=1
C
C     CHECK THAT IORDER(1) AND IORDER(2) ARE 1 OR 2 ONLY.
C
   10 IERR=-4
      IF(IORDER(1).NE.1.AND.IORDER(1).NE.2)RETURN
      IF(IORDER(2).NE.1.AND.IORDER(2).NE.2)RETURN
C
C     CHECK THAT THERE ARE SUFFICIENT POINTS IN X ARRAY TO DO IORDER(1)
C     INTERPOLATION AND SUFFICIENT POINTS IN Y ARRAY TO DO IORDER(2)
C     INTERPOLATION.
C
      IERR=-2
      IF(NX-1.LT.IORDER(1))RETURN
      IF(NY-1.LT.IORDER(2))RETURN
```

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```
      IERR=0
C
C     SEARCH FOR THE X AND Y MESH LINES NEAREST TO  X0,Y0 AND RECORD
C     THESE INDICES IN IPT(1) AND IPT(2).
C
      CALL FINDER(X0,X,IPT(1),NX,M,IERR)
      CALL FINDER(Y0,Y,IPT(2),NY,N,IERR)
C
C     OBTAIN INDICES FOR Y DIRECTION INTERPOLATION TABLE LOOK UP.
C
      CALL INDIXR(IPT(2),IORDER(2),Y0,KL,KR,Y,NY)
      KM=KL+1
C
C     DETERMINE THE LAGRANGIAN INTERPOLATING COEFFICIENTS FOR Y
C     DIRECTION INTERPOLATION.
C
      CALL LAGRAG(Y0,Y(KR),Y(KM),Y(KL),P,IORDER(2))
C
C     OBTAIN INDICES FOR X DIRECTION INTERPOLATION TABLE LOOK UP.
C
      CALL INDIXR(IPT(1),IORDER(1),X0,LL,LR,X,NX)
      LM=LL+1
C
C     DETERMINE THE LAGRANGIAN INTERPOLATING COEFFICIENTS FOR X
C     DIRECTION INTERPOLATION.
C
      CALL LAGRAG(X0,X(LR),X(LM),X(LL),S,IORDER(1))
C
C     COMPLETE LAGRANGIAN INTERPOLATION BY COMPUTING THE DOUBLE SUM
C     OF PRODUCTS.
C
      Z=0.
      LP1=0
      DO 30 I=LL,LR
      LP1=LP1+1
      SUM=0.
      KP1=0
      DO 20 J=KL,KR
      KP1=KP1+1
   20 SUM=P(KP1)*F(I,J)+SUM
   30 Z=SUM*S(LP1)+Z
      IF(IERR.GE.0)RETURN
      IPT(1)=M $ IPT(2)=N
      RETURN
      END


      SUBROUTINE COMPUT (D,XM,ALT,COR,TR,ALPHA,CD,CL,CDINPUT,CLDES)
      DIMENSION CDARAY(11,1),CLARAY(6,9),CLMXAR(10,12)
      DIMENSION ALPHA0(11),RN1(3),CLDSIN(4),DELALR(10,3),ALCLMX(10,4)
      DIMENSION IPT(2),IORDER(2)
      DIMENSION TR0(10),RN0(12),CLMAX0(6),DELAL0(9)
      DATA ((CDARAY(I,J),I= 1,11),J=1,1)/  0.00,  0.00,   .07,   .29,
     1 .42,  .53,   .67,   .81,   .96,   1.15,  1.28/
```

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```
      DATA ((CLARAY(K,L),K=1,6),L=1,9)  /
     1  0.800,  0.980,  1.200,  1.400,  1.600,  1.800,
     2  1.080,  1.290,  1.380,  1.540,  1.770,  1.985,
     3  1.200,  1.345,  1.415,  1.565,  1.790,  2.010,
     4  1.200,  1.330,  1.405,  1.550,  1.770,  1.990,
     5  1.180,  1.305,  1.380,  1.520,  1.745,  1.960,
     6  1.175,  1.290,  1.365,  1.505,  1.725,  1.940,
     7  1.170,  1.280,  1.355,  1.495,  1.710,  1.925,
     8  1.170,  1.270,  1.345,  1.490,  1.700,  1.915,
     9  1.170,  1.260,  1.335,  1.480,  1.690,  1.905/
      DATA  ((CLMXAR(M,N),M=1,10),N=1,12)  /
     1 .750, .750, .750, .752,  .760,  .790,  .820,  .832,  .840,  .840,
     2 .750, .750, .750, .760,  .780,  .835,  .860,  .870,  .872,  .870,
     3 .750, .750, .760, .780,  .840,  .895,  .920,  .930,  .930,  .920,
     4 .750, .750, .760, .790,  .900,  .965,  .990, 1.000, 1.000,  .990,
     5 .750, .750, .760, .800,  .960, 1.045, 1.075, 1.078, 1.063, 1.040,
     6 .750, .750, .768, .825, 1.010, 1.110, 1.140, 1.140, 1.120, 1.080,
     7 .750, .750, .770, .850, 1.080, 1.205, 1.240, 1.235, 1.200, 1.135,
     8 .760, .760, .820, .870, 1.110, 1.245, 1.280, 1.270, 1.230, 1.160,
     9 .770, .775, .795, .905, 1.145, 1.265, 1.300, 1.290, 1.255, 1.200,
     * .800, .800, .825, .950, 1.175, 1.285, 1.320, 1.320, 1.300, 1.270,
     1 .800, .800, .870, .995, 1.200, 1.300, 1.335, 1.340, 1.330, 1.315,
     2 .815, .820, .945,1.095, 1.245, 1.350, 1.380, 1.375, 1.360, 1.350/
      DATA ((DELALR(I,J),I= 1,10),J= 1,3)     /
     1  -2.2, -1.5, -1.1, -1.2, -2.3, -4., -4., -4., -4., -4.,
     2  0., 0., -.6, -1.2, -1.1, -.2, 0., -.2, -1.7, -4.,
     3  0., 0., 0., .4, 1.05, .65, 0., -.2, -1.7, -4./
      DATA ((ALCLMX(I,J),I=1,10),J=1,4)    /
     1  9.,  9., 9.5, 10.9, 13., 15.3, 16.4, 19., 18.2, 20.0,
     2 10., 10., 10.2, 11.5, 14.2, 16., 17., 17.7, 19., 10.8,
     3 11., 11., 11., 12.3, 14.8, 16.6, 17.8, 18.7, 20., 21.8,
     4 11.8, 11.6, 11.6, 13., 15.5, 17.3, 18.5, 19.5, 20.6, 22.4/
      DATA RN1 /1., 3., 9./
      DATA CLDSIN / 0., .2, .4, .6/
      DATA TR0 /  .04,  .06,  .08,  .10,  .12,  .14,  .16,  .18,
     1  .20,  .22/
      DATA RNO /  1.0,  1.2,  1.4,  1.6,  1.8,  2.0,  2.5,  3.0,
     1  4.0,  5.0,  6.0,  9.0/
      DATA CLMAX0 /   .8,  1.0,  1.2,  1.4,  1.6,  1.8/
      DATA DELAL0 /   0.,   4.0,   8.,  12.,  16.,  20., 24.,  28.,
     1  32./
      DATA ALPHA0 /0., 5., 10., 15., 20., 25., 30., 35., 40.,
     1 45., 50./
      IORDER(1)= IORDER(2)= 1
      CALL ATMOS (ALT,RHO,SOS,T)
      V= XM*SOS
      CHORD= COR*D/2.
C    XMUU= MU, BUT MU SHOULD BE DIVIDED BY 1 MILLION
C     ALSO REYNOLDS NUMBER WILL BE 1 MILLIONTH OF ITS ACTUAL VALUE
      XMUU= (.1E-09)*.3170*T**1.5*734.7/(T +216.)
      RN= (RHO*V*CHORD)/XMUU/(.1E 07)
      IPT(1)= -1
      CALL IBI (10,TR0,12,RNO,10,CLMXAR,IORDER,IPT,TR,RN,CLMAX,IERR)
      IPT(1)= -1
      CALL IBI (10,TR0,3,RN1,10,DELALR,IORDER,IPT,TR,RN,
```

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```
     1DALPRN,IERR)
      IPT(1)= -1
      CALL IBI (10,TR0,4,CLDSIN,10,ALCLMX,IORDER,IPT,
     1TR,CLDES,APCLMX,IERR)
      ALPCLM= APCLMX +DALPRN
      DELALP= ALPHA -ALPCLM
      IPT(1)= -1
      IF (DELALP.LE.0.0) GO TO 48
      WRITE(6,400)ALPHA
  400 FORMAT(*0*,F6.3,* IS AT OR BEYOND STALL.*/)
      CALL IBI (6,CLMAX0,9,DELAL0,6,CLARAY,IORDER,IPT,CLMAX,
     1DELALP,CL,IERR)
      IPT(1)= -1
   48 CONTINUE
      IF (ALPHA.LT.8.0) GO TO 50
      CALL IUNI (11,11,ALPHA0,1,CDARAY,IORDER,ALPHA,DELCD,IPT,IERR)
      CD= CDINPUT +DELCD
      RETURN
   50 CONTINUE
      CD= CDINPUT
      RETURN
      END


      SUBROUTINE ATMOS(ALT,RHO,SOS,T0)
C     INPUT:
C          ALTITUDE IN FEET; GEOPOTENTIAL.
C     OUTPUT:
C          T0= AMBIENT STATIC TEMPERATURE, DEG.,R.
C          P0= AMBIENT STATIC PRESSURE, PSF.
C          RHO= AMBIENT STATIC DENSITY, SLUGS/CUBIC FOOT.
C          SOS= SPEED OF SOUND IN FEET PER SECOND.
C
      DELTT=0.0
      XL=0.003567
      T00=518.69+DELTT
      T0=T00*(1.0-XL*ALT/T00)
      IF(ALT.GT.80000.0) WRITE 300
  300 FORMAT(1H0,50H BECAUSE THE ALTITUDE IS GREATER THAN 80 000 FEET,/
     161H CALCULATIONS CANNOT BE CARRIED OUT WITH SUFFICIENT ACCURACY.)
      IF(ALT.GT.36089.0)T0=T00*0.7518
      P0=2116.2*(1.0-XL*ALT/T00)**5.259805
      IF(ALT.GT.36089.0)P0=470.8563*(EXP((36089.0-ALT)/(53.3*T0)))
      RHO=P0/(53.3*32.2*T0)
      SOS=SQRT(1.4*53.3*32.2*T0)
      RETURN
      END


      FUNCTION MONO(M,VAR,IPOS)
C
C  FUNCTION MONO CHECKS TO INSURE THAT THE SEQUENCE VAR IS STRICTLY
C  INCREASING.  IF VAR IS A STRICTLY INCREASING SEQUENCE MONO RETURNS
```

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```
C  A POSITIVE VALUE.  IF VAR IS NOT A STRICTLY INCREASING SEQUENCE,
C  MONO RETURNS A NEGATIVE VALUE AND THE INDEX OF VAR WHERE VAR(N)
C  WAS NOT STRICTLY INCREASING.
C
C     M----THE NUMBER OF ELEMENTS IN VAR.
C
C     VAR--THE X,Y, OR Z ARRAY PASSED FROM IBI OR ITRI.
C
C     IPOS-IPT(1),IPT(2),OR IPT(3).
C
      DIMENSION VAR(M)
C
      MONO=1
      K=M-1
      DO 10 L=1,K
      N=L+1
      IF(VAR(N)-VAR(L).GT.0.)GOTO 10
      MONO=-1
      IPOS=N
   10 CONTINUE
      RETURN
      END


      SUBROUTINE FINDER(S,VAR,IPOS,NBND,IF,IERR)
C
C  FINDER DETERMINES THE INDEX OF THE X,Y, OR Z ARRAY(VAR) NEAREST TO
C  X0,Y0, OR Z0 (S).  IF S<VAR(1) OR S>VAR(NBND) IERR=-3 ON RETURN
C  AND IF CONTAINS A 0 OR NBND ACCORDING TO THE SITUATION, WHILE
C  IPOS RETURNS A 1 OR NBND.
C
C     S----X0,Y0, OR Z0.
C
C     VAR--X,Y, OR Z.
C
C     IPOS-IPT(1),IPT(2), OR IPT(3).  THE INDEX OF VAR NEAREST TO S.
C
C     NBND-THE NUMBER OF VALUES IN VAR.
C
C     IF---IPOS IF  VAR(1)@S@VAR(NBND).
C
C          0    IF  VAR(1)>S.
C
C          NBND IF  VAR(NBND)<S.
C
C     IERR-0    IF  VAR(1)@S@VAR(NBND).
C
C          -3   IF  VAR(1)>S OR VAR(NBND)<S.
C
      DIMENSION VAR(1)
C
      LOGICAL ABOVE,BELOW
      ABOVE=BELOW=.FALSE.
      IF(IPOS.EQ.0)IPOS=1
```

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```
   10 IF(S-VAR(IPOS))20,50,30
   20 ABOVE=.TRUE.
      IUP=IPOS
      IF(ABOVE.AND.BELOW)GOTO 40
      IPOS=IPOS-1
      IF(IPOS.GE.1)GOTO 10
      IERR=-3
      IPOS=1
      IF=0
      RETURN
   30 BELOW=.TRUE.
      LOW=IPOS
      IF(ABOVE.AND.BELOW)GOTO 40
      IPOS=IPOS+1
      IF(IPOS.LE.NBND)GOTO 10
      IERR=-3
      IF=IPOS=NBND
      RETURN
   40 IPOS=LOW
      IF(ABS(S-VAR(IUP)).LT.ABS(S-VAR(LOW)))IPOS=IUP
   50 IF=IPOS
      RETURN
      END


      SUBROUTINE LAGRAG(S,VAR1,VAR2,VAR3,Q,IORDER)
C
C  LAGRAG CALCULATES THE LAGRANGIAN COEFFICIENTS FOR FIRST OR SECOND
C  ORDER INTERPOLATION.
C
C     IORDER-IORDER(1),IORDER(2). OR IORDER(3).
C
C     S------X0,Y0, OR Z0.
C
C     Q------THE LAGRANGIAN COEFFICIENTS.
C
C     VAR1---THE VALUE OF X,Y, OR Z AT RIGHT END POINT OF INTERVAL.
C
C     VAR2---THE VALUE OF X,Y, OR Z AT MID-POINT OF INTERVAL(2-ND ORDER)
C
C     VAR3---THE VALUE OF X,Y, OR Z AT LEFT END POINT OF INTERVAL.
C
      DIMENSION Q(3)
C
      IF(IORDER.EQ.2)GOTO 10
C
C     FIRST ORDER COEFFICIENTS.
C
      T1=VAR3-VAR1
      T2=S-VAR1
      T3=S-VAR3
      Q(1)=T2/T1
      Q(2)=-T3/T1
      RETURN
```

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```
C
C     SECOND ORDER COEFFICIENTS.
C
   10 T1=S-VAR2
      T2=S-VAR1
      T3=S-VAR3
      Q(1)=T1*T2
      Q(2)=T3*T2
      Q(3)=T3*T1
      T1=VAR3-VAR2
      T2=VAR3-VAR1
      T3=VAR2-VAR1
      Q(1)=Q(1)/(T1*T2)
      Q(2)=Q(2)/(-T1*T3)
      Q(3)=Q(3)/(T2*T3)
      RETURN
      END


      SUBROUTINE INDIXR(IPT,IORDER,S,IL,IR,VAR,N)
C
C  INDIXR DETERMINES THE INDICES OF THE X,Y, Z ARRAY PASSED TO ARRAY VAR
C  TO BE USED IN TABLE LOOK UP.
C
C     IPT----THE X,Y,Z POINTER.
C
C     IORDER-THE ORDER OF INTERPOLATION IN X,Y, Z DIRECTION
C
C     S------X0,Y0,Z0.
C
C     IL-----THE INDEX OF ARRAY X,Y, OR Z GIVING THE LEFT E D POINT OF
C             THE INTERVAL CONTAINING S.
C
C     IR-----THE INDEX OF THE X,Y, OR Z ARRAY GIVING THE RI HT END POINT
C             OF THE INTERVAL CONTAINING S.
C
C     VAR----THE X,Y, OR Z ARRAY.
C
C     N------NX,NY, OR NZ.
C
      DIMENSION VAR(1)
C
      IF(S.LE.VAR(2))GOTO 10
      IF(S.GE.VAR(N-1))GOTO 20
      IL=IPT
      IF(S.LE.VAR(IPT))IL=IL-1
      IF(IORDER.LT.2)GOTO 30
      IF(ABS(S-VAR(IL-1)).LT.ABS(S-VAR(IL+2)))IL=IL-1
      GOTO 30
   10 IL=1
      GOTO 30
   20 IL=N-IORDER
   30 IR=IL+IORDER
      RETURN
```

```
      END
```

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```
      SUBROUTINE IUNI(NMAX,N,X,NTAB,Y,IORDER,X0,Y0,IPT,IERR)
C     E1.1
C*********************************************************************
C*                                                                   *
C*    PURPOSE:                                                       *
C*                SUBROUTINE IUNI USES FIRST OR SECOND ORDER         *
C*                LAGRANGIAN INTERPOLATION TO ESTIMATE THE VALUES    *
C*                OF A SET OF A SET OF FUNCTIONS AT A POINT X0.  IUNI *
C*                USES ONE INDEPENDENT VARIABLE TABLE AND A DEPENDENT *
C*                VARIABLE TABLE FOR EACH FUNCTION TO BE EVALUATED.  *
C*                THE ROUTINE ACCEPTS THE INDEPENDENT VARIABLES SPACED *
C*                AT EQUAL OR UNEQUAL INTERVALS.  EACH DEPENDENT     *
C*                VARIABLE TABLE MUST CONTAIN FUNCTION VALUES CORRES- *
C*                PONDING TO EACH X(I) IN THE INDEPENDENT VARIABLE   *
C*                TABLE.  THE ESTIMATED VALUES ARE RETURNED IN THE Y0 *
C*                ARRAY WITH THE N-TH VALUE OF THE ARRAY HOLDING THE *
C*                VALUE OF THE N-TH FUNCTION VALUE EVALUATED AT X0.  *
C*                                                                   *
C*        USE:                                                       *
C*                CALL IUNI(NMAX,N,X,NTAB,Y,IORDER,X0,Y0,IPT,IERR)   *
C*                                                                   *
C* PARAMETERS:                                                       *
C*                                                                   *
C*        NMAX    THE MAXIMUM NUMBER OF POINTS IN THE INDEPENDENT    *
C*                VARIABLE ARRAY.                                    *
C*                                                                   *
C*          N     THE ACTUAL NUMBER OF POINTS IN THE INDEPENDENT     *
C*                ARRAY,WHERE N .LE. NMAX.                           *
C*                                                                   *
C*           X    A ONE-DIMENSIONAL ARRAY, DIMENSIONED (NMAX) IN THE *
C*                CALLING PROGRAM, WHICH CONTAINS THE INDEPENDENT    *
C*                VARIABLES.  THESE VALUES MUST BE STRICTLY MONOTONIC. *
C*                                                                   *
C*        NTAB    THE NUMBER OF DEPENDENT VARIABLE TABLES            *
C*                                                                   *
C*           Y    A TWO-DIMENSIONAL ARRAY DIMENSIONED (NMAX,NTAB) IN *
C*                THE CALLING PROGRAM.  EACH COLUMN OF THE ARRAY     *
C*                CONTAINS A DEPENDENT VARIABLE TABLE                *
C*                                                                   *
C*      IORDER    INTERPOLATION PARAMETER SUPPLIED BY THE USER.      *
C*                                                                   *
C*                =0  ZERO ORDER INTERPOLATION: THE FIRST FUNCTION   *
C*                    VALUE IN EACH DEPENDENT VARIABLE TABLE IS      *
C*                    ASSIGNED TO THE CORRESPONDING MEMBER OF THE Y0 *
C*                    ARRAY.  THE FUNCTIONAL VALUE IS ESTIMATED TO   *
C*                    REMAIN CONSTANT AND EQUAL TO THE NEAREST KNOWN *
C*                    FUNCTION VALUE.                                *
C*                                                                   *
C*          X0    THE INPUT POINT AT WHICH INTERPOLATION WILL BE     *
C*                PERFORMED.                                         *
C*                                                                   *
```

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```
C*          Y0     A ONE-DIMENSIONAL ARRAY DIMENSIONED (NTAB) IN THE    *
C*                 CALLING PEOGRAM.  UPON RETURN THE ARRAY CONTAINS THE *
C*                 ESTIMATED VALUE OF EACH FUNCTION AT X0.              *
C*                                                                      *
C*         IPT     ON THE FIRST CALL IPT MUST BE INITIALIZED TO -1 SO   *
C*                 THAT MONOTONICITY WILL BE CHECKED. UPON LEAVING THE  *
C*                 ROUTINE IPT EQUALS THE VALUE OF THE INDEX OF THE X   *
C*                 VALUE PRECEDING X0 UNLESS EXTRAPOLATION WAS          *
C*                 PERFORMED.  IN THAT CASE THE VALUE OF IPT IS         *
C*                 RETURNED AS:                                         *
C*                 =0  DENOTES X0 .LT. X(1) IF THE X ARRAY IS IN        *
C*                     INCREASING ORDER AND X(1) .GT. X0 IF THE X ARRAY *
C*                     IS IN DECREASING ORDER.                          *
C*                 =N  DENOTES X0 .GT. X(N) IF THE X ARRAY IS IN        *
C*                     INCREASING ORDER AND X0 .LT. X(N) IF THE X ARRAY *
C*                     IS IN DECREASING ORDER.                          *
C*                                                                      *
C*                 ON SUBSEQUENT CALLS, IPT IS USED AS A POINTER TO     *
C*                 BEGIN THE SEARCH FOR X0.                             *
C*                                                                      *
C*        IERR     ERROR PARAMETER GENERATED BY THE ROUTINE             *
C*                 =0  NORMAL RETURN                                    *
C*                 =J  THE J-TH ELEMENT OF THE X ARRAY IS OUT OF ORDER  *
C*                 =-1 ZERO ORDER INTERPOLATION PERFORMED BECAUSE       *
C*                     IORDER =0.                                       *
C*                 =-2 ZERO ORDER INTERPOLATION PERFORMED BECAUSE ONLY  *
C*                     ONE POINT WAS IN X ARRAY.                        *
C*                 =-3 NO INTERPOLATION WAS PERFORMED BECAUSE           *
C*                     INSUFFICIENT POINTS WERE SUPPLIED FOR SECOND     *
C*                     ORDER INTERPOLATION.                             *
C*                 =-4 EXTRAPOLATION WAS PERFORMED                      *
C*                                                                      *
C*                 UPON RETURN THE PARAMETER IERR SHOULD BE TESTED IN   *
C*                 THE CALLING PROGRAM.                                 *
C*                                                                      *
C*    REQUIRED ROUTINES                  NONE                            *
C*                                                                      *
C*    SOURCE                             CMPB ROUTINE MTLUP MODIFIED     *
C*                                       BY COMPUTER SCIENCES CORPORATION*
C*                                                                      *
C*    LANGUAGE                           FORTRAN                         *
C*                                                                      *
C*                                                                      *
C*    DATE RELEASED                      AUGUST 1,1973                   *
C*                                                                      *
C*    LATEST REVISION                    AUGUST 1,1973                   *
C*                                                                      *
C************************************************************************
      DIMENSION X(1),Y(NMAX,1),Y0(1)
      NM1=N-1
      IERR=0
      J=1
      DELX=X(2)-X(1)
C
C               TEST FOR ZERO ORDER INTERPOLATION
```

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```
C
      IF (IORDER .EQ. 0) GO TO 10
      IF (N.LT. 2) GO TO 20
      GO TO 50
   10 IERR=-1
      GO TO 30
   20 IERR=-2
   30 DO 40 NT=1,NTAB
         Y0(NT)=Y(1,NT)
   40    CONTINUE
      RETURN
   50 IF (IPT .GT. -1) GO TO 65
C
C              CHECK FOR TABLE OF NODE POINTS BEING STRICTLY MONOTONIC
C              THE SIGN OF DELX SIGNIFIES WHETHER TABLE IS IN
C              INCREASING OR DECREASING ORDER.
C
      IF (DELX .EQ. 0) GO TO 190
      IF (N .EQ. 2) GO TO 65
C
C              CHECK FOR SIGN CONSISTENCY IN THE DIFFERENCES OF
C              SUBSEQUENT PAIRS
C
      DO 60 J=2,NM1
         IF (DELX * (X(J+1)-X(J))) 190,190,60
   60    CONTINUE
C
C              IPT IS INITIALIZED TO BE WITHIN THE INTERVAL
C
   65 IF (IPT .LT. 1) IPT=1
      IF (IPT .GT. NM1) IPT=NM1
      IN= SIGN (1.0,DELX *( X0-X(IPT)))
   70 P= X(IPT) - X0
      IF (P* (X(IPT +1)- X0)) 90,180,80
   80 IPT =IPT +IN
C
C              TEST TO SEE IF IT IS NECCESARY TO EXTRAPOLATE
C
      IF (IPT.GT.0 .AND. IPT .LT. N) GO TO 70
      IERR=-4
      IPT=IPT- IN
C
C              TEST FOR ORDER OF INTERPOLATION
C
C
   90 IF (IORDER .GT. 1) GO TO 120
C
C              FIRST ORDER INTERPOLATION
C
      DO 100 NT=1,NTAB
          Y0(NT)=Y(IPT,NT)+((Y(IPT+1,NT)- Y(IPT,NT))*(X0-X(IPT)))/
     1            (X(IPT+1)-X(IPT))
  100    CONTINUE
      IF (IERR .EQ. -4) IPT=IPT+IN
      RETURN
```

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```
C
C               SECOND ORDER INTERPOLATION
C
 120  IF (N .EQ. 2) GO TO 200
C
C               CHOOSING A THIRD POINT SO AS TO MINIMIZE THE DISTANCE
C               BETWEEN THE THREE POINTS USED TO INTERPOLATE
C
      IF (IPT .EQ. NM1) GO TO  140
      IF (IPT .EQ. 1) GO TO 130
      IF (DELX *(X0-X(IPT-1)).LT.DELX* (X(IPT+2)-X0)) GO TO 140
 130  L=IPT
      GO TO 150
 140  L=IPT -1
 150  V1=X(L)-X0
      V2=X(L+1)-X0
      V3=X(L+2)-X0
      DO 160 NT=1,NTAB
      YY1=(Y(L,NT) * V2 - Y(L+1,NT) * V1)/(X(L+1) - X(L))
      YY2=(Y(L+1,NT)*V3-Y(L+2,NT) *V2)/(X(L+2)-X(L+1))
 160  Y0(NT)=(YY1*V3 -YY2*V1)/(X(L+2)-X(L))
      IF (IERR .EQ. -4) IPT=IPT + IN
      RETURN
 180  IF(P .NE. 0) IPT=IPT +1
      DO 185 NT=1,NTAB
         Y0(NT)=Y(IPT,NT)
 185     CONTINUE
      RETURN
C
C               IERR IS SET TO THE SUBSCRIPT OF THE MEMBER OF THE TABLE
C               WHICH IS OUT OF ORDER
C
 190  IERR=J +1
      RETURN
 200  IERR=-3
      RETURN
      END
```

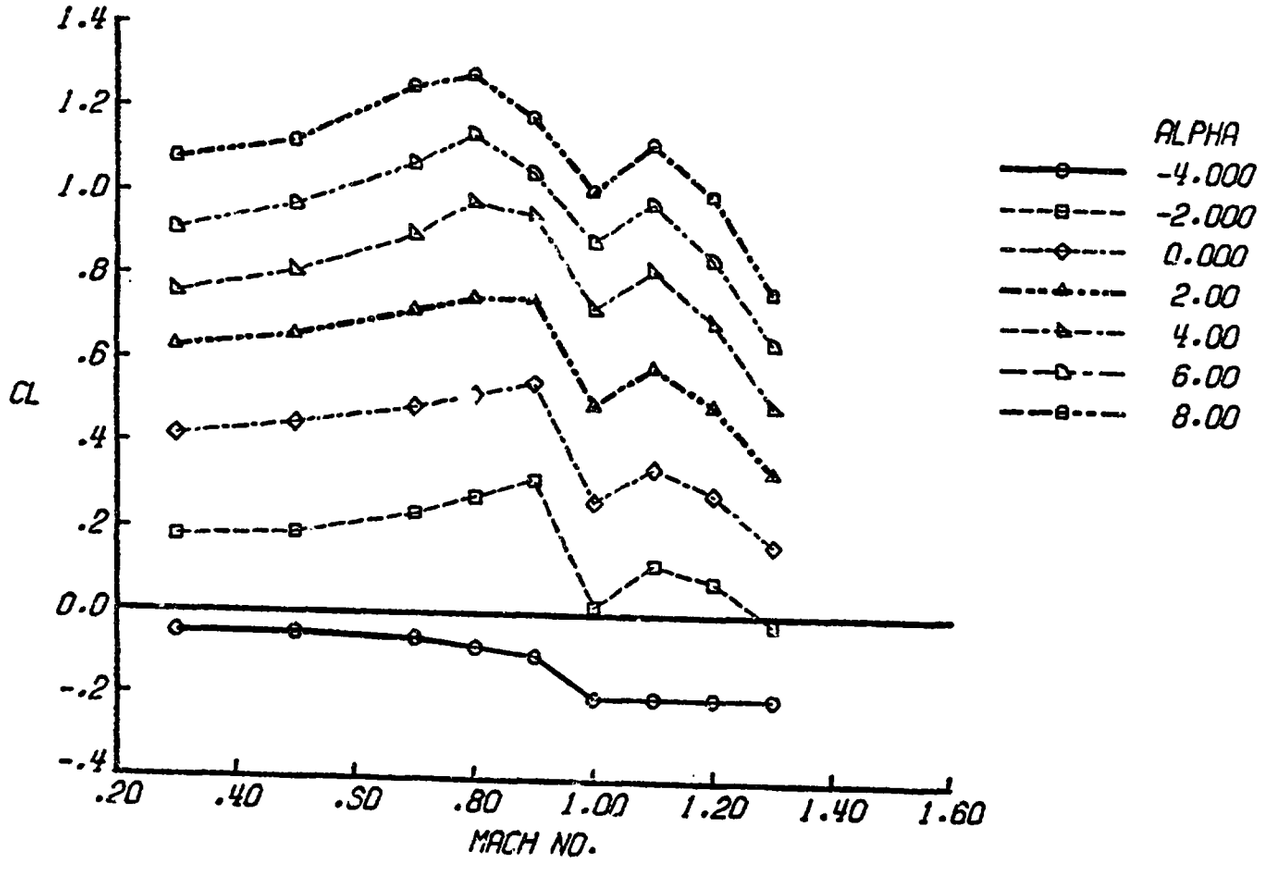

Figure 1.- Data points in lift coefficient table for 16-504, preliminary program.

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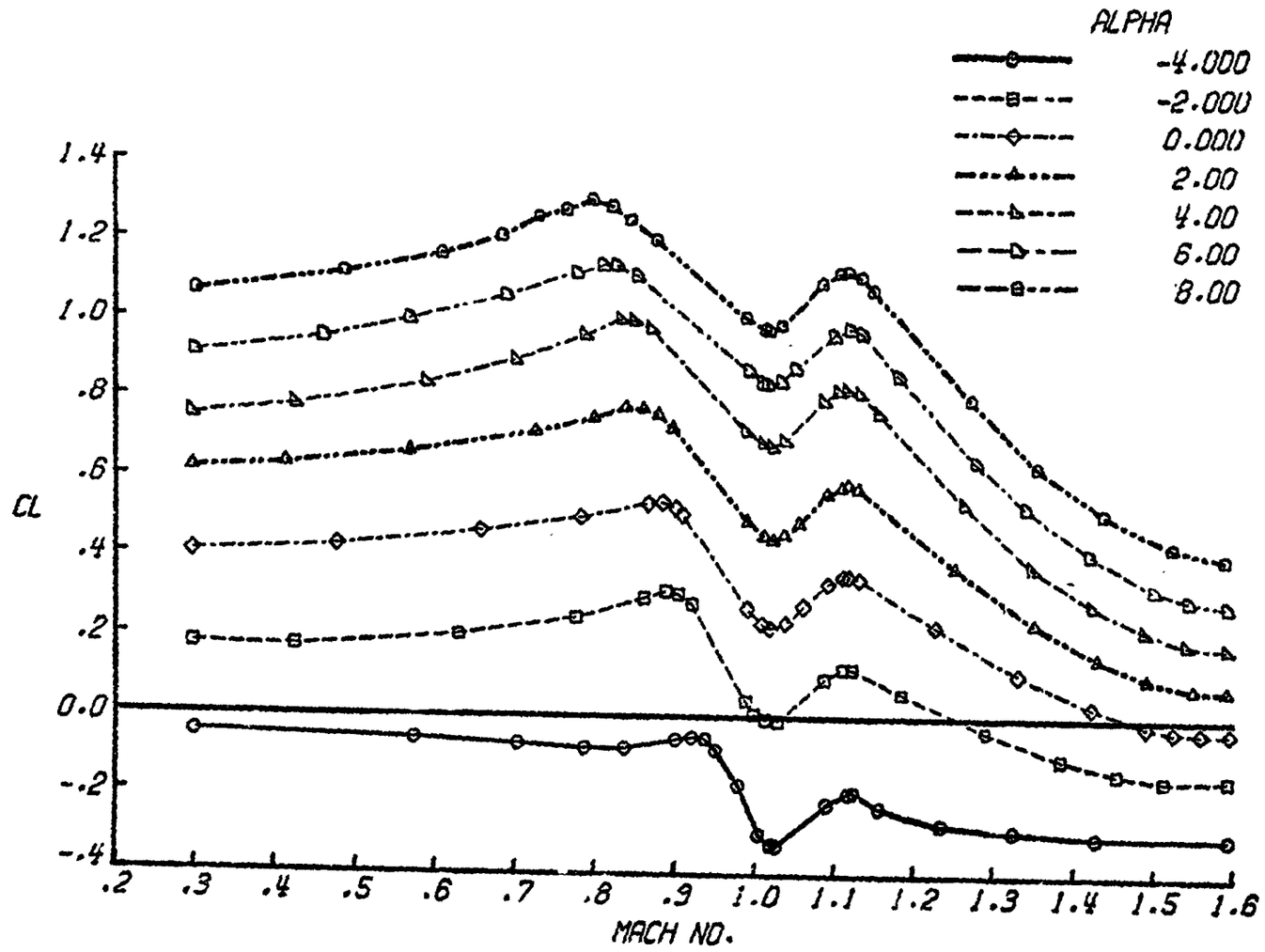

Figure 2.- Data points digitized from lift coefficient graph from reference 1 for 16-504.

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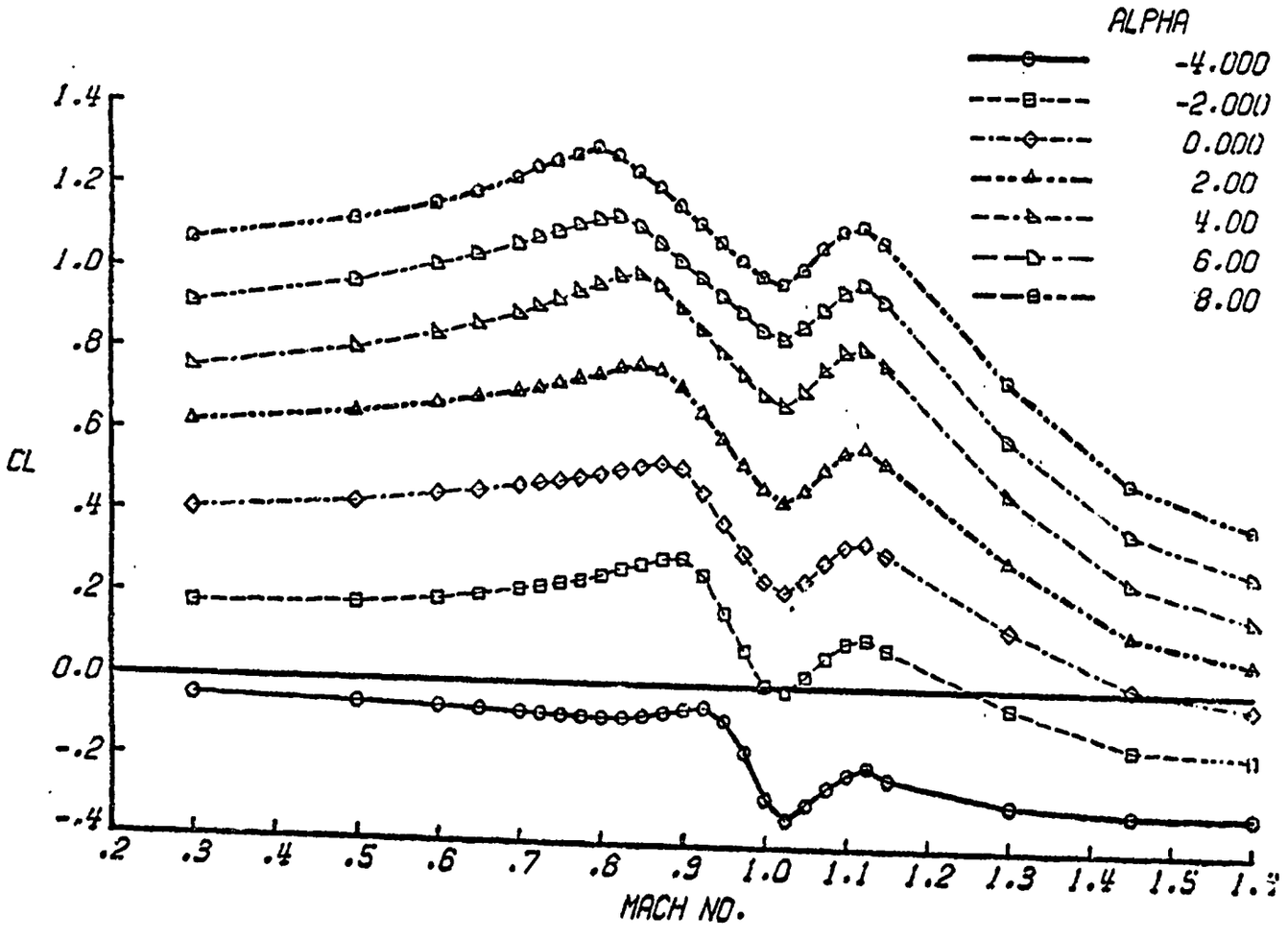

Figure 3.- Data points in lift coefficient table for 16-504, revised program.

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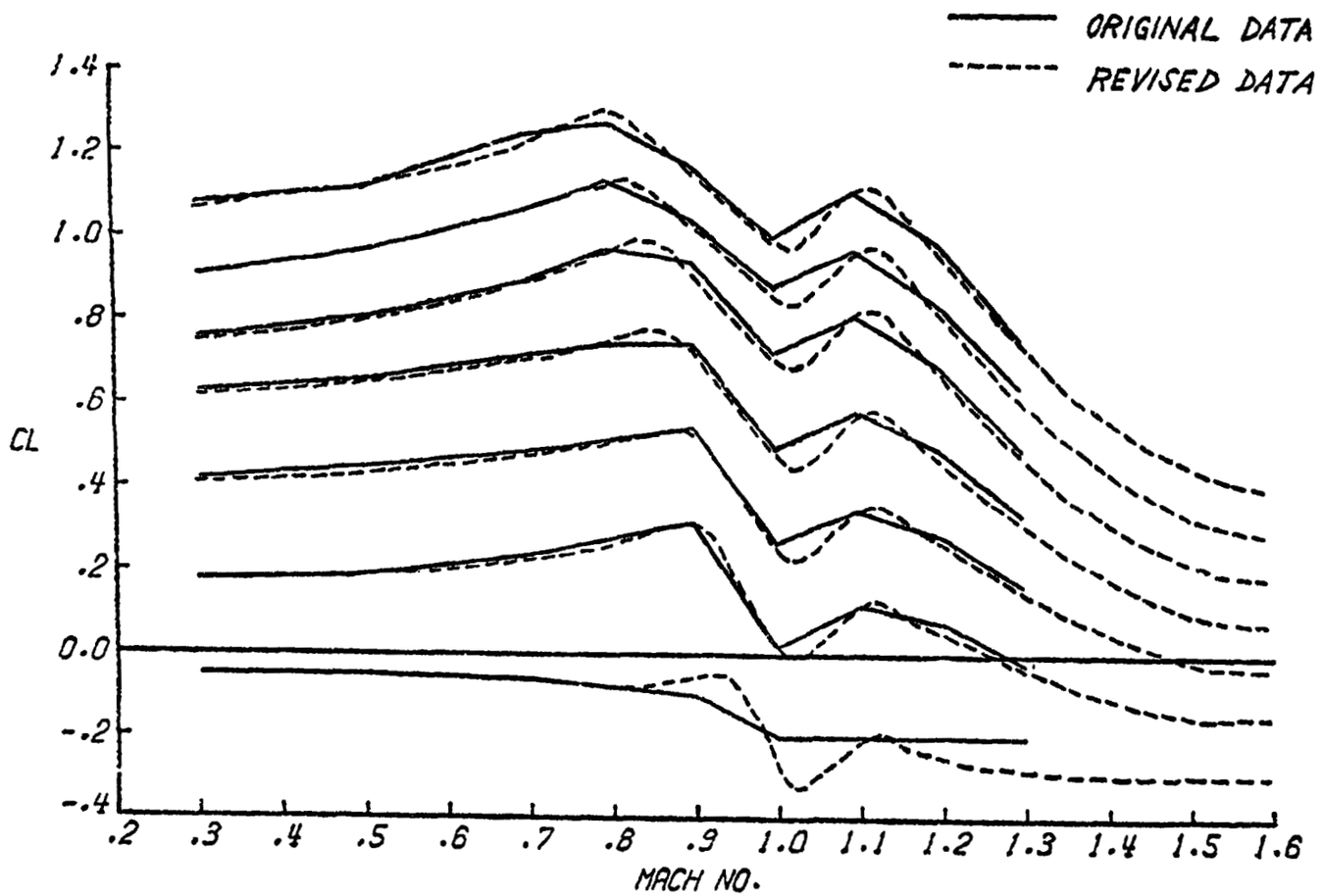

Figure 4.- Comparison of data declarations in original and revised programs.

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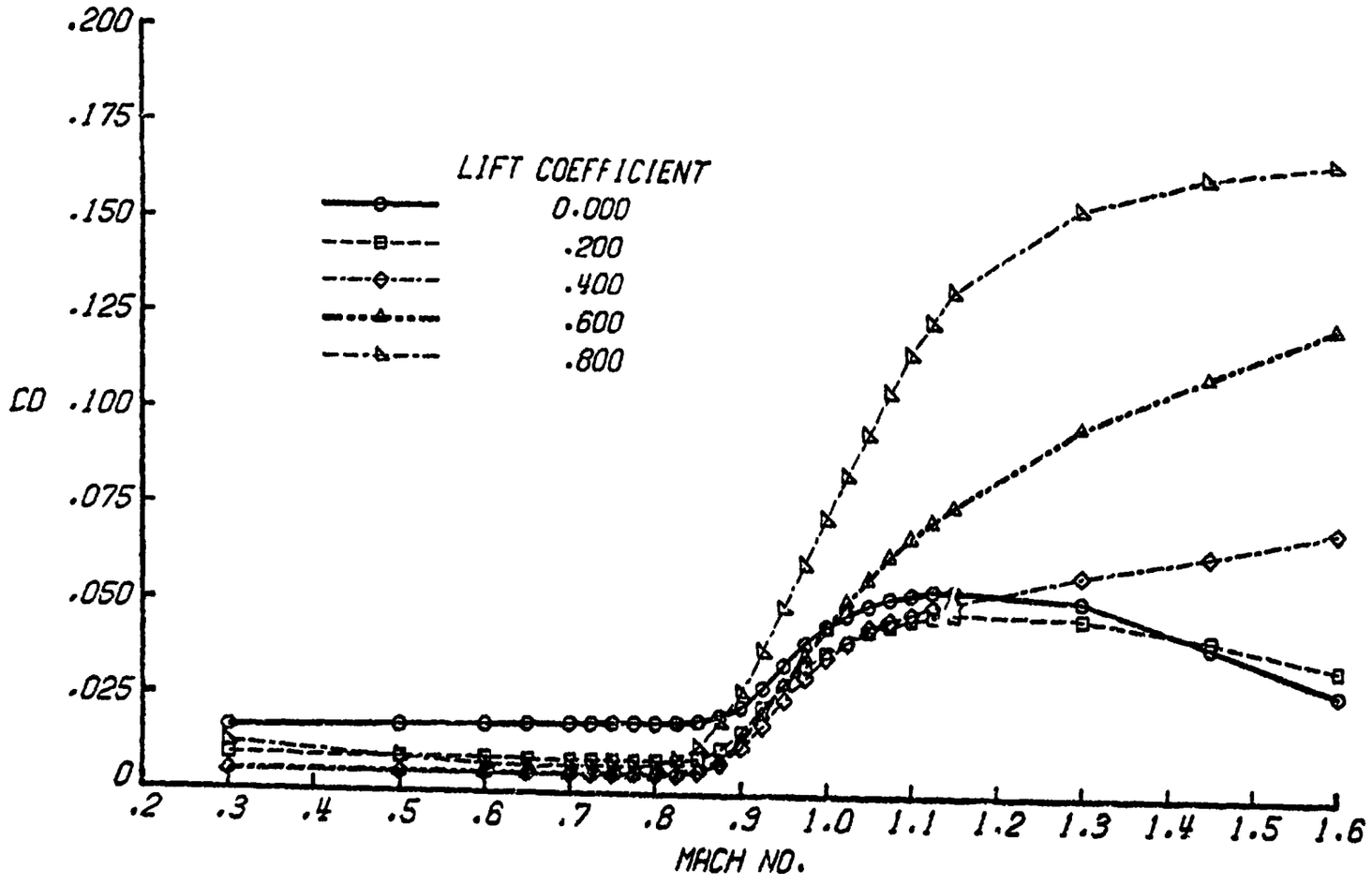

Figure 5.- Data points in drag coefficient table for 16-504, revised program.

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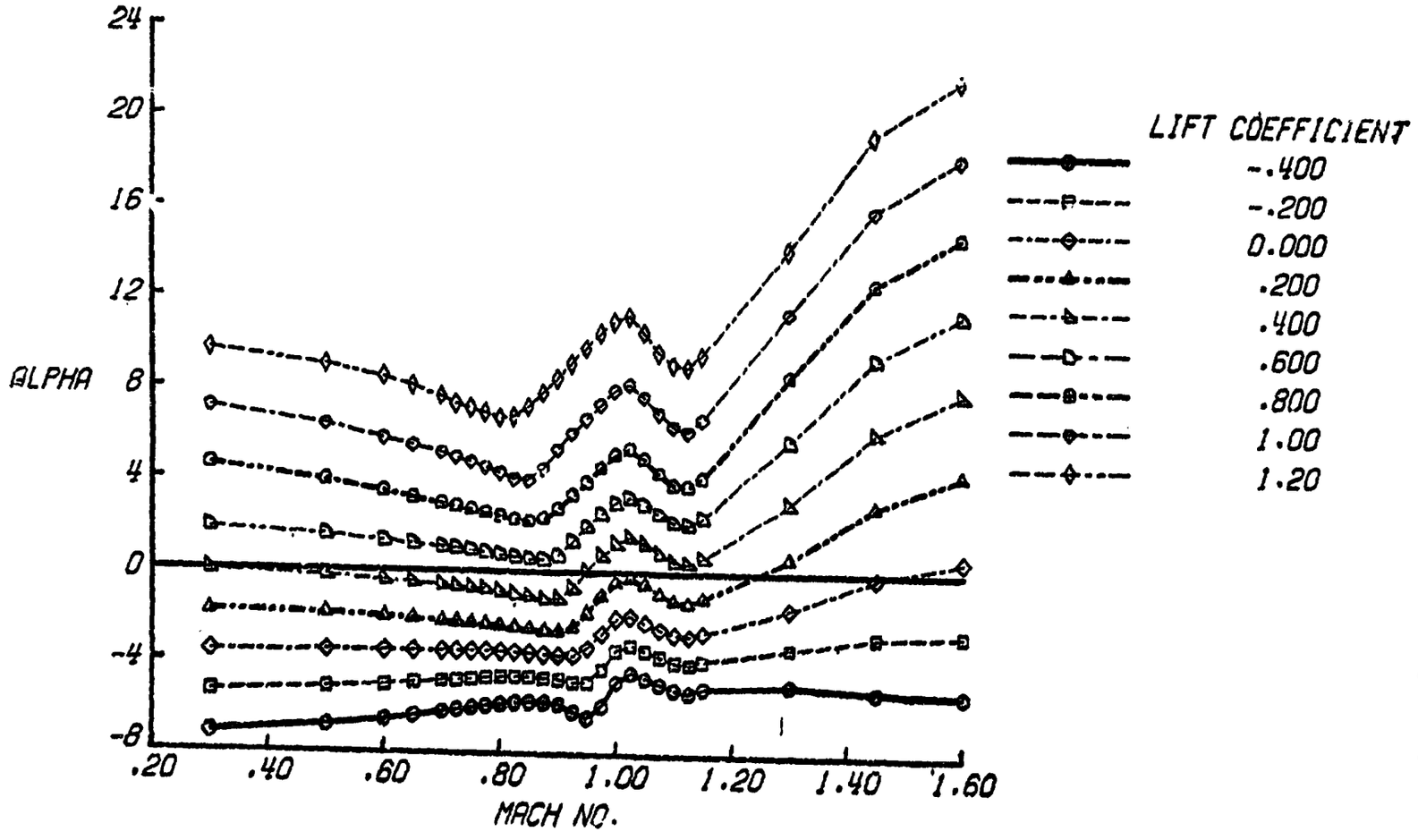

Figure 6.- Data points in angle of attack table for 16-504, revised program.

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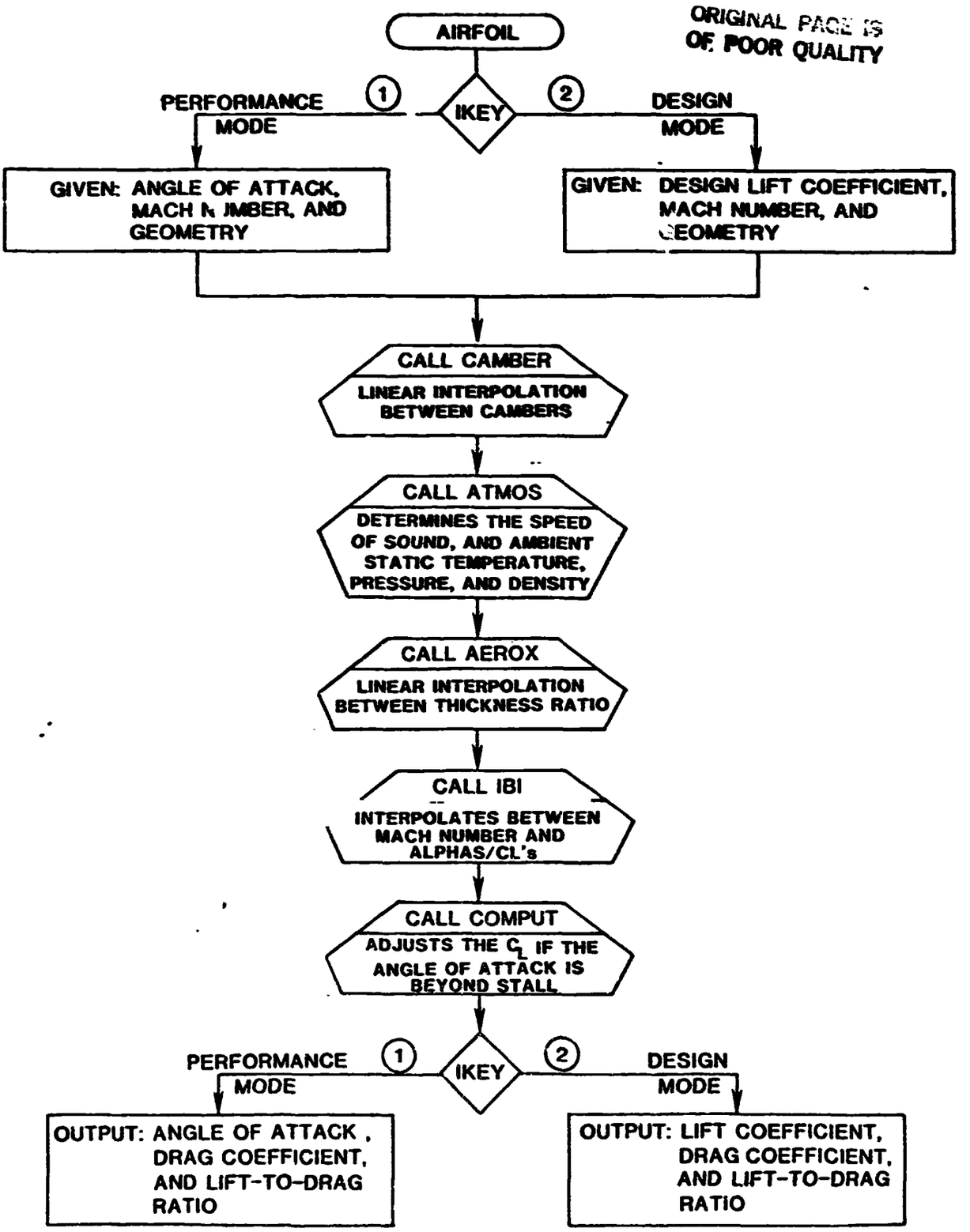

Figure 7. - Program Flowchart

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