บรรณานุกรม

ภาษาไทย

ชะไมพร ธรรมวัฒน์ไพศาล "วิธีประมาณค่าที่ขาดหายไปในการวิเคราะห์การถดถอย" วิทยานิพนธ์ปริญญามหาบัณฑิต ภาควิชาสถิติบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย 2522.

มนตรี พิริยะกุล เทคนิคการวิเคราะห์สมการถดถอย เล่ม 1 ภาควิชาสถิติและคอมพิวเตอร์ มหาวิทยาลัยรามคำแหง.

พรศิริ หมื่นไชยศรี "การเปรียบเทียบวิธีการประมาณค่าสูญหายในการวิเคราะห์ตัวแปรพหุ" วิทยานิพนธ์ปริญญามหาบัณฑิต ภาควิชาสถิติบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย 2529.

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ภาคผนวก ก.

ในการสร้างตัวแปรให้มีคุณสมบัติตามต้องการ วิธีการหนึ่งที่สามารถทำได้คืออาศัยเทคนิคของการผลิตเลขสุ่มโดยการใช้โปรแกรม

1. โปรแกรมย่อยสำหรับสร้างตัวเลขสุ่ม

```
      SUBROUTINE RAND (IX, IY, YEL)
      IY  = IX * 65539
      IF (IY) 3, 4, 4
3     IY  = IY + 2147483647 + 1
4     YEL = IY
      YEL = YEL / 2147483647
      IX  = IY
      RETURN
      END
```

2. โปรแกรมย่อยสำหรับสร้างค่าสังเกตให้มีการแจกแจงปกติ

```
      SUBROUTINE INIT
      DO 200 J    = 1, N
200   X(1, J)     = 1.0
      DO 100 I    = 2, Me
      DO 100 J    = 1, N
100   X(I, J)     = NORMAL(DMEAN, SIGMA)
      RETURN
      END
```

```
      FUNCTION NORMAL (DMEAN, SIGMA)
      REAL NORMAL
      COMMON/SEED/IX,IX2/SELECT/KK
      PI    =  3.1415926
C
C     CHECK SSE N(0, 1) RANDOM VARIATE USE
C
      IF (KK.EQ.1) GO TO 10
C
C     GENNERATE TWO UNIFORM RANDOM NUMBERS
C
      CALL RAND (IX, IY, YEL
      RONE  =  YEL
      CALL RAND (IX, IY, YEL)
      RTWO  =  YEL
C
C     GENNERATE TWO NORMAL (0, 1) NORMAL VARIATES
C
      ZONE  =  SQRT(-2 X ALOG (RONE)) X COS (2 X PI X RTWO)
      ZTWO  =  SQRT(-2 X ALOG (RONE)) X SIN (2 X PI X RTWO)
      NORMAL =  ZONE X SIGGMA + DMEAN
      KK    =  1
      RETURN
10    NORMAL = ZTWO X SIGMA + DMEAN
      KK    = 0
      RETURN
      END
```

3. โปรแกรมย่อยสำหรับสร้างประชากรและค่าความผิดพลาด

```
      SUBROUTINE DATA
      REAL NORMAL
      DOUBLE PRECISION  E, Y, B
      COMMON /DATAY/Y(150)/COEFF/B(11)
      DIMENSION  E(150)
      DO 15 J    =  1, N
 15   E(J)       =  NORMAL(DEMEAN, SIGMA)
      DO 106 J   =  1, N
      Y(J)       =  0.0
      DO 105 I   =  2, M2
 105  Y(J)       =  Y(J) + X(I, J) * B(I)
 106  Y(J)       =  Y(J) + E(J)
      RETURN
      END
```

ภาคผนวก ข.

```
C*****************************************************************C
C     THESIS    : MULTIPLE REGRESSION ANALYSIS WITH MISSING      C
C                 OBSERVATIONS AMONG THE INDEPENDENT VARIABLES   C
C     AUTHOR    : MISS CHUTIMA CHAIMUSIG                         C
C     DEPARTMENT : STATISTICS                                    C
C*****************************************************************C
C                    MAIN PROGRAM                                *
C      M ; NUMBER OF VARIABLE                                    *
C      N ; NUMBER OF SAMPLE                                      *
C     MM ; % OF MISSING                                          *
C     A1 ; MULTIVARIATE DATA                                     *
C     AA ; COMPLETE DATA AFTER MISSING                           *
C  IPALG ; NUMBER OF MISSING                                     *
C     PB ; VALUE OF MISSING DATA                                 *
C  ICOUNT; NUMBER VALUE I + 1 MISSING                            *
C  ISEED ; 973253                                                *
C*****************************************************************C
      REAL MM
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                  /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *       /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *       /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
```

```
*         /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
*         /YWO/YS(200)/ERR/E(200)
*         /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
*        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
*          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
*          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
*          ,EE(12,200)
1     READ(5,2)SI,M,MM,N,SIG
2     FORMAT(F3.2,I1,F3.2,I3,F2.0)
      IF (N .EQ. 999) GO TO 9
      IY = 0
      JJJJ = 700
      SMSEC = 0.0
      YSUMC = 0.0
      SMSEM = 0.0
      YSUMM = 0.0
      SMSER = 0.0
      YSUMR = 0.0
      SMSEL = 0.0
      YSUML = 0.0
      SMSEA = 0.0
      YSUMA = 0.0
      SMSEE = 0.0
      YSUME = 0.0
      M2 = M + 1
      PP = 30
      KK = 0
      DEM = 2.0
```

```
      XBAR = 0.0
      CVV  = SI/2.0
      K =INT(FLOAT(N/2))
      WRITE(8,5) N,M,SIG ,CVV,MM
5     FORMAT (//,20X,'N ,M,SIG ,CVV,MM',/ ,2I4,2X,F5.1,2X,F5.2,2X,F5.2)
      DO 6 IIII = 1,JJJJ
      IX = 973253
      B(1) = 0.0
      B(2) = 0.5622
      B(3) = -0.0935
      B(4) = 0.0286
      B(5) = 0.0267
      B(6) = 0.0405
      B(7) = -0.0703
      B(8) = 0.03796
      B(9) = -0.0014
      B(10) =  0.0864
      B(11) = 0.3036
      CALL INITT
      CALL DATA
      CALL MISSNG(MM)
      CALL COMP
      CALL MISE
      CALL REGESS(MM)
      CALL MLE
      CALL MEAN
      CALL MEDIAN
6     CONTINUE
      SMSEC = SMSEC/JJJJ
```

```
      YSUMC = YSUMC/JJJJ
      SMSEM = SMSEM/JJJJ
      YSUMM = YSUMM/JJJJ
      SMSER = SMSER/JJJJ
      YSUMR = YSUMR/JJJJ
      SMSEL = SMSEL/JJJJ
      YSUML = YSUML/JJJJ
      SMSEA = SMSEA/JJJJ
      YSUMA = YSUMA/JJJJ
      SMSEE = SMSEE/JJJJ
      YSUME = YSUME/JJJJ
      WRITE(8,10)
10    FORMAT( //20X,'**** BEGIN SUBRUTINE COMPETE ***')
      WRITE(8,11) M2,N,M,MMM
11    FORMAT(//30X,'M2= ',I4,2X,'N= ',I4,2X,'M= ',I4,2X,'MMM= ',I4)
      WRITE(8,12)
12    FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,13)  SMSEC
13    FORMAT( ///,2X,  F15.5)
      WRITE(8,14)
14    FORMAT( //30X,'% OF ERROR    **************')
      WRITE(8,15) YSUMC
15    FORMAT( ///,2X,F15.5)
      WRITE(8,16)
16    FORMAT( //20X,'**** BEGIN SUBRUTINE INCOMPETE ***')
      WRITE(8,17)
17    FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,18)  SMSEM
18    FORMAT( ///,2X,  F15.5)
```

```
      WRITE(8,19)
19    FORMAT( //30X,'% OF ERROR    ***************')
      WRITE(8,20) YSUMM
20    FORMAT( ///,2X,F15.5)
      WRITE(8,21)
21    FORMAT( //20X,'**** BEGIN SUBRUTINE REGRESSION ***')
      WRITE(8,22)
22    FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,23)  SMSER
23    FORMAT( ///,2X,  F15.5)
      WRITE(8,24)
24    FORMAT( //30X,'% OF ERROR    ***************')
      WRITE(8,25) YSUMR
25    FORMAT( ///,2X,F15.5)
      WRITE(8,26)
26    FORMAT( //20X,'**** BEGIN SUBRUTINE  MLE       ***')
      WRITE(8,27)
27    FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,28)  SMSEL
28    FORMAT( ///,2X,  F15.5)
      WRITE(8,29)
29    FORMAT( //30X,'% OF ERROR    ***************')
      WRITE(8,30) YSUML
30    FORMAT( ///,2X,F15.5)
      WRITE(8,31)
31    FORMAT( //20X,'**** BEGIN SUBRUTINE  MEAN      ***')
      WRITE(8,32)
32    FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,33)  SMSEA
```

```
 33   FORMAT( ///,2X,  F15.5)
      WRITE(8,34)
 34   FORMAT( //30X,'% OF ERROR    ***************')
      WRITE(8,35) YSUMA
 35   FORMAT( ///,2X,F15.5)
      WRITE(8,36)
 36   FORMAT( //20X,'**** BEGIN SUBRUTINE  MEDAIN    ***')
      WRITE(8,37)
 37   FORMAT( //30X,'VALUE OF MEAN SQUARE ERROR')
      WRITE(8,38)  SMSEE
 38   FORMAT( ///,2X,  F15.5)
      WRITE(8,39)
 39   FORMAT( //30X,'% OF ERROR    ***************')
      WRITE(8,40) YSUME
 40   FORMAT( ///,2X,F15.5)
      GO TO 1
 9    STOP
      END
C     END MAIN PROGRAM                                          *
C*************************************************************C
      SUBROUTINE INITT
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                 ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                 ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
```

```
*         /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
*         /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
*     /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
*         /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
*         /YWO/YS(200)/ERR/E(200)
*       /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
*        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
*          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
*          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
*          ,EE(12,200)
C       GENERATE INDEPENDENT VARIABLE                *
      M2 = M + 1
      DMEAN = DEM
      SIGMA = SI
      DO  99 I = 1,M2
      DO  99 J = 1,N
 99   X(I,J)   = 0.0
      DO 200 J = 1,N
 200  X(1,J)   = 1.0
      DO 100 I = 2,M2
      DO 100 J = 1,N
      X(I,J) = NORMAL(DMEAN,SIGMA)
 100  CONTINUE
      RETURN
      END
C       GENERATE DEPENDENT VARIABLE                  *
      SUBROUTINE  DATA
      REAL NORMAL
```

```
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *       /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *       /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *       /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *       /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *         ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *         ,EE(12,200)
      DMEAN = XBAR
      SIGMA = SIG
      SY = 0.0
      DO 14 I = 2,M2
      SX(I) = 0.0
   14 CONTINUE
      DO 13 J = 1,N
      E(J)  = 0.0
   13 CONTINUE
      DO 15 J = 1 , N
   15 E(J) = NORMAL(DMEAN,SIGMA)
```

```
      DO 91 I = 1,M2
      DO 92 J = 1,N
      SX(I) = SX(I) + X(I,J)
 92   CONTINUE
      SX(I) = SX(I)/N
 91   CONTINUE
      DO 106 J = 1, N
      Y(J)  = 0.0
      DO 105 I = 1, M2
 105  Y(J) = Y(J) + X(I,J) *  B(I)
 106  Y(J) = Y(J)    + E(J)
      RETURN
      END
C      SUBROUTINE  RANDOM VARIABLE                    *
      SUBROUTINE RAND(IX,IY,YFL)
      IY = IX * 65539.
      IF (IY) 5,6,6
  5   IY = IY + 2147483647. + 1
  6   YFL = IY
      YFL = YFL / 2147483647.
      IX = IY
      RETURN
      END
C      FUNCTION NORMAL (DMEAN,SIGMA) DISTRIBUTION  *
      FUNCTION NORMAL(DMEAN,SIGMA)
      REAL NORMAL
      COMMON/SEED/IX,IX2/SELECT/KK
      PI = 3.1415926
      IF (KK.EQ.1) GO TO 10
```

```
      CALL RAND(IX,IY,YFL)
      RONE = YFL
      CALL RAND(IX,IY,YFL)
      RTWO = YFL
      ZONE = SQRT(-2*ALOG(RONE))*COS(2*PI*RTWO)
      ZTWO = SQRT(-2*ALOG(RONE))*SIN(2*PI*RTWO)
      NORMAL = ZONE*SIGMA+DMEAN
      KK = 1
      RETURN
10    NORMAL = ZTWO*SIGMA+DMEAN
      KK = 0
      RETURN
      END
C      SUBROUTINE INVERSE MATRIX X'X                    C
      SUBROUTINE INVS(M2,A)
      DOUBLE PRECISION A(12,12)
      DO 20 K = 1,M2
      A(K,K) = -1.0 / A(K,K)
      DO 5 I =1,M2
      IF ( I - K ) 3,5,3
3     A(I,K)  = -A(I,K) * A(K,K)
5     CONTINUE
      DO 10 I = 1,M2
      DO 10 J = 1,M2
      IF (( I - K)*( J - K)) 9,10,9
9     A(I,J) = A(I,J) - A(I,K) * A(K,J)
10    CONTINUE
      DO 20 J = 1,M2
      IF (J - K) 18,20,18
```

```
 18   A(K,J) = -A(K,J)*A(K,K)
 20   CONTINUE
      DO 25 I = 1,M2
      DO 25 J = 1,M2
      A(I,J) = -A(I,J)
 25   CONTINUE
      RETURN
      END
C      SUBROUTINE TO FIND THE POSITION OF MISSING  *
      SUBROUTINE MISSNG(MM1)
      REAL MM1
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *        /CONTA/P/CONST
     *        /XBAR,SIG,SIGM,DEM,SI,CORR
     *                 /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *        /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *        /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *        /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *        /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *         ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *         ,EE(12,200)
```

```
      MMO = 0
      RMO = 0.0
      DO 1902 K2 = 1,10
1902  ICOUNT(K2) = 0
      DO 1400 I = 1,M2
      DO 1400 J = 1,MMM
1400  IB(I,J) = 0.0
      MMO = (MM1 * N)
      RMO = (MM1 * N)
      IF (RMO .GT. MMO) GO TO 17
      MMM = MMO
      GO TO 18
17    MMM = MMO + 1
18    P = 100.
      IF(N.GT.100)      P = 1000.
      DO 211 I = 1,M2
      DO 111 J = 1,MMM
150   CALL RAND(IX,IY,YFL)
      IYY = INT(P * YFL)
      IF(IYY.GT.N.OR.IYY.LE.0) GO TO 150
      IB(I,J) = IYY
111   CONTINUE
211   CONTINUE
      CALL DUPL(N,M2,MMM,IB,P,IX)
      DO 350 I = 1,M2
      DO 350 J = 1,N
      PB(I,J) = 0.0
350   CONTINUE
      DO 360 I = 1,M2
```

```
      DO 360 J = 1,MMM
      PB(I,IB(I,J)) = 1.0
360   CONTINUE
      DO 400 J = 1,N
      JJ = 0
      DO 390 I = 1,M2
      IF (PB(I,J).EQ.1.0) JJ = JJ + 1
390   CONTINUE
      IPLAG(J) = JJ
      ICOUNT(JJ + 1) = ICOUNT( JJ+ 1) + 1
400   CONTINUE
      RETURN
      END
C       SUBROUTINE TO FIND EQUAL RANDOM NUMBER       C
      SUBROUTINE DUPL(N,M2,MMM,IADD,P,IX)
      DIMENSION IADD(12,200),KOUNT(12)
5     CALL SORT (N,M2,MMM,IADD,IX)
      DO 200 I = 1,M2
      KOUNT(I) = 0
      DO 100 L = 1,MMM
      II = 1
10    LL = L + II
      IF (LL.GT.MMM) GO TO 200
      IF(IADD(I,L).GT.IADD(I,LL)) GO TO 100
      IF(IADD(I,L).LT.IADD(I,LL)) GO TO 100
      CALL RAND(IX,IY,Y)
      IYY = INT(Y * P)
      IF(IYY.GT.N.OR.IYY.LE.0) GO TO 10
      IADD(I,LL) = IYY
```

```
      KOUNT(I) = KOUNT(I) + 1
      II = II + 1
      GO TO 10
  100 CONTINUE
  200 CONTINUE
      DO 400 I = 1,M2
      IF(KOUNT(I).GT.0) GO TO 5
  400 CONTINUE
      RETURN
      END
C      SUBROUTINE TO SORT RANDOM NUMBER                C
      SUBROUTINE SORT(N,M2,MMM,IADD,IX)
      DIMENSION IADD(12,200)
      MMM2 = MMM - 1
      DO 300 I = 1,M2
      DO 200 L = 1,MMM2
      L3 = L + 1
      DO 100 L2 = L3,MMM
      IF(IADD(I,L).LE.IADD(I,L2)) GO TO 100
      IP = IADD(I,L)
      IADD(I,L) = IADD(I,L2)
      IADD(I,L2) = IP
  100 CONTINUE
  200 CONTINUE
  300 CONTINUE
      RETURN
      END
```

```
C      SUBROUTINE ESTIMATE POSITION OF MISSING                *
       SUBROUTINE COMP
       REAL NORMAL
       DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
      *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
      *                ,IX,IY
       COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
      *        /CONTA/P/CONST
      *        /XBAR,SIG,SIGM,DEM,SI,CORR
      *                 /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
      *        /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
      *        /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
      *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
      *        /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
      *        /YWO/YS(200)/ERR/E(200)
      *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
      *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
       DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
      *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
      *        ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
      *         ,EE(12,200)
       DO 1189 I = 1,M2
       DO 1189 J = 1,N
1189   AA(I,J) =0.0
       DO 1180 J = 1,N
1180   AA(1,J) =1.0
       DO 118 J = 1,N
       DO 117 I = 2,M2
       AA(I,J) =  X(I,J)
```

```
 117  CONTINUE
 118  CONTINUE
C       CALCULATE X'X        FOR SUBROUTINE OLS COMP *
      DO 1201 I = 1,M2
      DO 1201 J = I,M2
 1201 S(I,J) = 0.0
      DO 1200 I = 1,M2
      DO 1200 K = I,M2
      SIK       = 0.0
      DO 1100 J = 1,N
 1100 SIK     = SIK     + AA(I,J)*AA(K,J)
      S(I,K) = SIK
 1200 S(K,I) = SIK
C       CALCULATE INVERSE MATRIX OF X'X FOR COMP     *
      DO 140 I = 1,M2
      DO 140 J =I,M2
      A(I,J) = S(I,J)
 140  A(J,I) = S(I,J)
      DO 145 K = 1,M2
      IF ( A(K,K) ) 145,146,145
 146  WRITE(8,150)
 150  FORMAT('A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
      STOP
 145  CONTINUE
      CALL INVS(M2,A)
C       CALCULATE X'Y  FOR SUBROUTINE OLS COMP       *
      DO 1202 I = 1,M2
      DO 1202 J = I,M2
 1202 S3(I,J) = 0.0
```

```
      DO 120 I  = 1,M2
      DO 120 K = 1,M2
      SIKK      = 0.0
      DO 110 J = 1,N
  110 SIKK    = SIKK   + AA(I,J)* Y(J)
      S3(I,K)   = SIKK
  120 S3(K,I)  = SIKK
C           FIND  LEAST SQUARE (B)                    C
      DO 60 I = 1,M2
   60 B2(I)   = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
   50 B2(I)   =  B2(I) + A(I,J) * S3(J,L)
      DO 1131 J = 1,N
      YHAT(J) = 0.0
      YS(J)   = 0.0
 1131 CONTINUE
      DO 1121 J =1,N
      DO 1111 I =1,M2
      YHAT(J) =  YHAT(J) + AA(I,J) * B2(I)
      YS(J)   = YHAT(J)
 1111 CONTINUE
 1121 CONTINUE
      SE = 0.0
      DO 1022 I =1,N
      SE =  SE + (Y(I) - YHAT(I)) ** 2
 1022 CONTINUE
      SMSEC = SMSEC + SE/(N-M-1)
```

```
      DO 2341 J = 1,N
 2341 YSUMC = YSUMC + (ABS((YS(J) - YHAT(J))/YS(J)))
      RETURN
      END
C      SUBROUTINE ESTIMATE POSITION OF MISSING WITH MISE  *
      SUBROUTINE MISE
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *         /CONTA/P/CONST
     *         /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *         /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *         /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *         /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *         /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *         ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *         ,EE(12,200),YM(200),YW(200)
      DO 1189 I = 1,M2
      DO 1189 J = 1,N-MMM
 1189 AA(I,J) =0.0
      DO 1180 J = 1,N-MMM
```

```
      AA(1,J) = 1.0
1180  CONTINUE
      DO 23 I = 2,M2
      T = 0.0
      DO 24 J = 1,N
      IF(PB(I,J).EQ.1.0) GO TO 24
      T = T + 1
      AA(I,T) = X(I,J)
      YM(T) = Y(J)
      YW(T) = YS(J)
 24   CONTINUE
 23   CONTINUE
C      CALCULATE X'X       FOR SUBROUTINE OLS MISE *
      DO 1201 I = 1,M2
      DO 1201 J = I,M2
 1201 S(I,J) = 0.0
      DO 1200 I = 1,M2
      DO 1200 K = I,M2
      SIK       = 0.0
      DO 1100 J = 1,N-MMM
 1100 SIK    = SIK    + AA(I,J)*AA(K,J)
      S(I,K) = SIK
 1200 S(K,I) = SIK
C      CALCULATE INVERSE MATRIX OF X'X FOR MISE    *
      DO 140 I = 1,M2
      DO 140 J = I,M2
      A(I,J) = S(I,J)
 140  A(J,I) = S(I,J)
      DO 145 K = 1,M2
```

```
      IF ( A(K,K) ) 145,146,145
  146 WRITE(8,150)
  150 FORMAT('A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
      STOP
  145 CONTINUE
      CALL INVS(M2,A)
C      CALCULATE X'Y  FOR SUBROUTINE OLS MISE      *
      DO 1203 I = 1,M2
      DO 1203 J = I,M2
 1203 S3(I,J) = 0.0
      DO 120 I  = 1,M2
      DO 120 K = 1,M2
      SIKK      = 0.0
      DO 110 J = 1,N-MMM
  110 SIKK    = SIKK   + AA(I,J)* YM(J)
      S3(I,K)   = SIKK
  120 S3(K,I)   = SIKK
C           FIND  LEAST SQUARE (B)                C
      DO 60 I = 1,M2
   60 B2(I)   = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
   50 B2(I)   = B2(I) + A(I,J) * S3(J,L)
      DO 1131 J = 1,N
      YHAT(J) = 0.0
 1131 CONTINUE
      DO 1121 J =1,N
      DO 1111 I =1,M2
```

```
      YHAT(J) =  YHAT(J) +  X(I,J) * B2(I)
 1111 CONTINUE
 1121 CONTINUE
      SE = 0.0
      DO 1022 I =1,N
      SE =  SE + (Y(I) - YHAT(I)) ** 2
 1022 CONTINUE
      SMSEM  =  SMSEM + SE/(N-M-1)
      DO 2341 J = 1,N
 2341 YSUMM = YSUMM + (ABS((YS(J) - YHAT(J))/YS(J)))
      RETURN
      END
C     SUBROUTINE FOR FIND REGRESSION EQUATION          C
      SUBROUTINE REGESS(MM1)
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *       /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *       /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *       /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *       /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
```

```
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(11,200),YE(200)
     *          ,EE(11,200),RX(200),YR(200),XRE(12,200),YRE(200)
     *          ,RREG(12,200)
C*************************************************************************
      YREG = 0.0
      BO   = 0.0
      DO 1800 I = 1,M2
      DO 1800 J = 1,N
 1800 BB(I,J)  = 0.0
      DO 180 J = 1,N
 180  BB(1,J) = 1.0
      DO 17 I = 2,M2
      L = 0.0
      DO 18 J = 1,N
      IF(PB(I,J).EQ.1.0) GO TO 18
      L = L + 1
      BB(I,L) = X(I,J)
      YR(L) = Y(J)
 18   CONTINUE
 17   CONTINUE
      DO 210  I = 2,M2
 210  RX(I)     = 0.0
      DO 21   I = 2,M2
      DO 22   J = 1,N-MMM
      RX(I) = RX(I) + BB(I,J)
 22   CONTINUE
      RX(I) = RX(I)/(N-MMM)
```

```
21    CONTINUE
      DO 261 J = 1,N-MMM
      YREG = YREG + YR(J)
261   CONTINUE
      YREG = YREG/(N-MMM)
      DO 199 I = 2,M2
      DO 199 J = 1,N-MMM
      XRE(I,J) = (BB(I,J) - RX(I))
199   CONTINUE
      DO 1988 J = 1,N-MMM
1988  YRE(J) = 0.0
      DO 198 J = 1,N-MMM
      YRE(J) = (YR(J) - YREG)
198   CONTINUE
      SUMXRE = 0.0
      DO 510 I = 2,M2
      B1(I)  = 0.0
      DO 509 J = 1,N-MMM
      B1(I)    = B1(I)    + (XRE (I,J) * YRE(J))
509   SUMXRE   = SUMXRE + (XRE(I,J)**2)
510   B2(I) = B1(I)/SUMXRE
      BOX = 0.0
      DO 197  I = 2,M2
      BOX = BOX +(B2(I)*RX(I))
197   CONTINUE
      BO = YREG - BOX
      DO 19 I = 2,M2
      DO 20 J = 1,N
      IF(PB(I,J).NE.1.0) GO TO 20
```

```
      RREG(I,J) =  ((Y(J)- BO))/B2(I)
20    CONTINUE
19    CONTINUE
      DO 249 I = 1,M2
      DO 249 J = 1,N
249   AA(I,J) = 0.0
      DO 2401 J = 1,N
2401  AA(1,J) = 1.0
      DO 23 I = 2,M2
      DO 24 J = 1,N
      IF(PB(I,J).EQ.1.0) GO TO 25
      AA(I,J) = X(I,J)
      GO TO 24
25    AA(I,J) = RREG(I,J)
24    CONTINUE
23    CONTINUE
      DO 1203 I = 1,M2
      DO 1203 J = I,M2
1203  S(I,J) =0.0
      DO 1201 I = 1,M2
      DO 1201 K = I,M2
      SIK     = 0.0
      DO 1101 J = 1,N
1101  SIK     = SIK     + AA(I,J)*AA(K,J)
      S(I,K) = SIK
1201   S(K,I) = SIK
C      CALCULATE INVERSE MATRIX OF X'X FOR REGRESS *
      DO 1400 I = 1,M2
      DO 1400 J =I,M2
```

```
      A(I,J) = S(I,J)
 1400 A(J,I) = S(I,J)
      DO 1450 K = 1,M2
      IF ( A(K,K) ) 1450,1460,1450
 1460 WRITE(8,1500)
 1500 FORMAT(' A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
      STOP
 1450 CONTINUE
C       CALCULATE        X'Y FOR SUBROUTINE OLS       *
      DO 1204 I = 1,M2
      DO 1204 J = I,M2
 1204 S1(I,J) =0.0
      DO 120 I  = 1,M2
      DO 120 K = 1,M2
      SKKK      = 0.0
      DO 110 J = 1,N
 110  SKKK  = SKKK    + AA(I,J)* Y(J)
      S1(I,K)   = SKKK
 120  S1(K,I)  = SKKK
C           FIND  LEAST SQUARE (B)                    C
      DO 60 I = 1,M2
 60   B2(I)   = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
 50   B2(I)   =  B2(I) + A(I,J) * S1(J,L)
C           FIND  ESTIMATE PARAMETER                  C
      DO 1131 J = 1,N
      YHAT(J) = 0.0
```

```
1131 CONTINUE
     DO 112 J =1,N
     DO 111 I =1,M2
     YHAT(J) =  YHAT(J) + AA(I,J) * B2(I)
111  CONTINUE
112  CONTINUE
     SE = 0.0
     DO 10 I =1,N
     SE = SE +  (Y(I) - YHAT(I)) ** 2
10   CONTINUE
     SMSER =  SMSER + SE/(N-M-1)
     DO 2341 J = 1,N
2341 YSUMR = YSUMR + (ABS((YS(J) - YHAT(J))/YS(J)))
     RETURN
     END
C      SUBROUTINE FOR FIND MLE EQUATION                *
     SUBROUTINE MLE
     REAL NORMAL
     DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
    *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
    *                ,IX,IY
     COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
    *        /CONTA/P/CONST
    *        /XBAR,SIG,SIGM,DEM,SI,CORR
    *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
    *        /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
    *        /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
    *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
    *        /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
```

```
*         /YWO/YS(200)/ERR/E(200)
*       /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
*        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
*          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
*          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
*          ,EE(12,200),YES(200),UX(200)
      YMLE = 0.0
      STY  = 0.0
      CALL MISSY(MM)
      DO 170 I = 2,M2
      DO 170 J = 1,N
170   CC(I,J) = 0.0
      DO 17 I = 2,M2
      DO 18 J = 1,N
      IF(PB(I,J).EQ.1.0) GO TO 18
      CC(I,J) = X(I,J)
18    CONTINUE
17    CONTINUE
      DO 1711 I = 2,M2
      L = 0
      DO 1711 J = 1,N
      IF(CC(I,J).EQ.0.0) GO TO 1711
      L = L + 1
      EE(I,L) = CC(I,J)
1711  CONTINUE
      DO 600 I = 2,M2
600   SX(I)    = 0.0
      DO 21 I = 2,M2
```

```
      DO 22 J = 1,N-MMM
      SX(I) = SX(I) + EE(I,J)
 22   CONTINUE
      SX(I) = SX(I)/(N-MMM)
 21   CONTINUE
C      ESTIMATE Y FOR SUBROUTINE MLE                    *
      L = 0
      DO  269 J = 1,N
      IF (YB(J).EQ.1.0)  GO TO 269
      L = L + 1
      YE(L) = Y(J)
 269  CONTINUE
      DO  2690 J = 1,N
      STY    =  STY + Y(J)
 2690 CONTINUE
      YST  = STY/N
      DO  26 J = 1,N-MMM
      YMLE = YMLE + YE(J)
 26   CONTINUE
      YMLE = YMLE/(N-MMM)
      DO 28 I = 2,M2
      DO 28 J = 1,N-MMM
      XEST(I,J) =  (EE(I,J) - SX(I)
 28   CONTINUE
      DO 280 J = 1,N-MMM
      YEST(J) =  (YE(J) -YMLE)
 280  CONTINUE
      DO 2801 J = 1,N
      YES(J)  = (Y(J) - YST)
```

```
 2801 CONTINUE
C            FIND  LEAST SQUARE (B)                    C
      SUMYES = 0.0
      DO 510 I = 2,M2
      B1(I) = 0.0
      DO 509 J = 1,N-MMM
      B1(I) = B1(I) + (YEST(J)*XEST(I,J))
 509  SUMYES = SUMYES + (YEST(J) ** 2)
 510  B2(I)   = B1(I)/SUMYES
C            FIND  LEAST SQUARE (B)                    C
      DO 61 I = 2,M2
      UX(I) = SX(I) + B2(I)* (YST - YMLE)
 61   CONTINUE
      DO 62 I = 1,M2
      DO 62 J =1,N
 62   AA(I,J) = 0.0
      DO 63 J = 1,N
 63   AA(1,J) = 1.0
      DO 64 I = 2,M2
      DO 65 J = 1,N
      IF(PB(I,J).EQ.1.0) GO TO 66
      AA(I,J) = X(I,J)
      GO TO 65
 66   AA(I,J) = UX(I)
 65   CONTINUE
 64   CONTINUE
C      CALCULATE X'X        FOR SUBROUTINE OLS MLE  *
      DO 1204 I = 1,M2
      DO 1204 J = I,M2
```

```
1204 S(I,J) =0.0
     DO 1200 I = 1,M2
     DO 1200 K = I,M2
     SIK       = 0.0
     DO 1100 J = 1,N
1100 SIK     = SIK     + AA(I,J)*AA(K,J)
     S(I,K) = SIK
1200 S(K,I) = SIK
C       CALCULATE INVERSE MATRIX OF X'X FOR MLE      *
     DO 140 I = 1,M2
     DO 140 J =I,M2
     A(I,J) = S(I,J)
140  A(J,I) = S(I,J)
     DO 145 K = 1,M2
     IF ( A(K,K) ) 145,146,145
146  WRITE(8,150)
150  FORMAT('A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
     STOP
145  CONTINUE
     CALL INVS(M2,A)
C       CALCULATE X'Y  FOR SUBROUTINE OLS MLE       *
     DO 1205 I = 1,M2
     DO 1205 J = I,M2
1205 S3(I,J) =0.0
     DO 120 I  = 1,M2
     DO 120 K = 1,M2
     SIKK      = 0.0
     DO 110 J = 1,N
110  SIKK     = SIKK    + AA(I,J)* Y(J)
```

```
      S3(I,K)    = SIKK
 120  S3(K,I)    = SIKK
C              FIND  LEAST SQUARE (B)                    C
      DO 60 I = 1,M2
 60   B2(I)    = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
 50   B2(I)    =  B2(I) + A(I,J) * S3(J,L)
C       CALCULATE MEAN OF Y FOR C.V.                     *
      DO 1131 J = 1,N
      YHAT(J) = 0.0
 1131 CONTINUE
      DO 1121 J =1,N
      DO 1111 I =1,M2
      YHAT(J) = YHAT(J) + AA(I,J) * B2(I)
 1111 CONTINUE
 1121 CONTINUE
      SE = 0.0
      DO 1022 I =1,N
      SE =  SE + (Y(I) - YHAT(I)) ** 2
 1022 CONTINUE
      SMSEL = SMSEL + SE/(N-M-1)
      DO 2341 J = 1,N
 2341 YSUML = YSUML + (ABS((YS(J) - YHAT(J))/YS(J)))
      RETURN
      END
C       SUBROUTINE ESTIMATE POSITION OF MISSING WITH MEAN  *
      SUBROUTINE MEAN
```

```
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                 ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                 ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *       /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *       /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *       /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *       /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *       /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *         ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *         ,EE(12,200)
      DO 107 I = 1,M2
      SX(I) = 0.0
  107 CONTINUE
      DO 91 I = 2,M2
      DO 92 J = 1,N
      IF (PB(I,J).EQ.1.0) GO TO 92
      SX(I) = SX(I) + X(I,J)
   92 CONTINUE
      SX(I) = SX(I)/(N-MMM)
   91 CONTINUE
```

```
      DO 1189 I = 1,M2
      DO 1189 J = 1,N
 1189 AA(I,J) =0.0
      DO 1180 J = 1,N
 1180 AA(1,J) =1.0
      DO 118 J = 1,N
      DO 117 I = 2,M2
      IF (PB(I,J).EQ.1.0) GO TO 220
      AA(I,J) =  X(I,J)
      GO TO  117
  220 AA(I,J) = SX(I)
  117 CONTINUE
  118 CONTINUE
C      CALCULATE X'X       FOR SUBROUTINE OLS MEAN *
      DO 1205 I = 1,M2
      DO 1205 J = I,M2
 1205 S(I,J) =0.0
      DO 1200 I = 1,M2
      DO 1200 K = I,M2
      SIK    = 0.0
      DO 1100 J = 1,N
 1100 SIK    = SIK    + AA(I,J)*AA(K,J)
      S(I,K) = SIK
 1200 S(K,I) = SIK
C      CALCULATE INVERSE MATRIX OF X'X FOR MEAN    *
      DO 140 I = 1,M2
      DO 140 J =I,M2
      A(I,J) = S(I,J)
  140 A(J,I) = S(I,J)
```

```
      DO 145 K = 1,M2
      IF ( A(K,K) ) 145,146,145
  146 WRITE(8,150)
  150 FORMAT('A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
      STOP
  145 CONTINUE
      CALL INVS(M2,A)
C      CALCULATE X'Y  FOR SUBROUTINE OLS MEAN      *
      DO 1206 I = 1,M2
      DO 1206 J = I,M2
 1206 S3(I,J) =0.0
      DO 120 I  = 1,M2
      DO 120 K = 1,M2
      SIKK      = 0.0
      DO 110 J = 1,N
  110 SIKK    = SIKK   + AA(I,J)* Y(J)
      S3(I,K)   = SIKK
  120 S3(K,I)  = SIKK
C           FIND  LEAST SQUARE (B)                C
      DO 60 I = 1,M2
   60 B2(I)   = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
   50 B2(I)   =  B2(I) + A(I,J) * S3(J,L)
      DO 1131 J = 1,N
      YHAT(J) = 0.0
 1131 CONTINUE
      DO 1121 J =1,N
```

```
      DO 1111 I =1,M2
      YHAT(J) =  YHAT(J) + AA(I,J) * B2(I)
 1111 CONTINUE
 1121 CONTINUE
      SE = 0.0
      DO 1022 I =1,N
      SE =  SE + (Y(I) - YHAT(I)) ** 2
 1022 CONTINUE
      SMSEA  =  SMSEA + SE/(N-M-1)
      DO 2341 J = 1,N
 2341 YSUMA = YSUMA + (ABS((YS(J) - YHAT(J))/YS(J)))
      RETURN
      END
C       SUBROUTINE FOR FIND MEDIAN                    C
      SUBROUTINE MEDIAN
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *        /CONTA/P/CONST
     *        /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *        /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *        /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *        /YWO/YS(200)/ERR/E(200)
     *      /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
```

```
     *        /WOS/S4(12,12)
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *         ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *         ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *         ,EE(12,200)
      CALL SORTME
      NM = N-MMM
      ND = NM/2
      NI = ND * 2
      DO 1135 I = 2,M2
      DO 1135 J = 1,N
1135  CC(I,J)    = 0.0
      DO 1134 J = 1,N
1134  CC(1,J) = 1.0
      DO 1131 I = 2,M2
      L = 0.0
      DO 1141 J = 1,N
      IF (PB(I,J).EQ.1.0) GO TO 1141
      L = L + 1
      CC(I,L) = X(I,J)
1141  CONTINUE
1131  CONTINUE
      DO 113 I = 2,M2
      IF (NI.NE.NM) GO TO 223
      SME(I)    = (CC(I,ND+1) + CC(I,ND))/2
      GO TO 113
223   SME(I)    =  CC(I,((NM+1)/2))
113   CONTINUE
      DO 1151 I = 1,M2
```

```
      DO 1151 J = 1,N
1151  AA(I,J) = 0.0
      DO 1150 J = 1,N
1150  AA(1,J) = 1.0
      DO 115 I = 2,M2
      DO 116 J = 1,N
      IF (PB(I,J).EQ.1.0) GO TO 225
      AA(I,J)  = X(I,J)
      GO TO 116
225   AA(I,J)  = SME(I)
116   CONTINUE
115   CONTINUE
C      CALCULATE X'X  FOR SUBROUTINE OLS MEDIAN    *
      DO 1206 I = 1,M2
      DO 1206 J = I,M2
1206  S(I,J) =0.0
      DO 1200 I = 1,M2
      DO 1200 K = I,M2
      SIK      = 0.0
      DO 1100 J = 1,N
1100  SIK    = SIK    + AA(I,J)*AA(K,J)
      S(I,K) = SIK
1200  S(K,I) = SIK
C      CALCULATE INVERSE MATRIX OF X'X FOR MEDIAN  *
      DO 1431 I = 1,M2
      DO 1431 J =I,M2
1431  A(I,J) = 0.0
      DO 140 I = 1,M2
      DO 140 J =I,M2
```

```
      A(I,J) = S(I,J)
  140 A(J,I) = S(I,J)
      DO 145 K = 1,M2
      IF ( A(K,K) ) 145,146,145
  146 WRITE(8,150)
  150 FORMAT(' A(K,K) HAS ZERO ON DIAGONAL CANNOT USE MATRIX ')
      STOP
  145 CONTINUE
C*************************************************************************
      CALL INVS(M2,A)
C       CALCULATE X'Y  FOR SUBROUTINE OLS MEDIAN    *
      DO 1207 I = 1,M2
      DO 1207 J = I,M2
 1207 S4(I,J) =0.0
      DO 120 I  = 1,M2
      DO 120 K = 1,M2
      SIKK      = 0.0
      DO 110 J = 1,N
  110 SIKK    = SIKK   + AA(I,J)* Y(J)
      S4(I,K)   = SIKK
  120 S4(K,I)   = SIKK
C*************************************************************************
      DO 60 I = 1,M2
   60 B2(I)   = 0.0
      DO 50 L = 1,1
      DO 50 I = 1,M2
      DO 50 J = 1,M2
   50 B2(I)   =  B2(I) + A(I,J) * S4(J,L)
C       CALCULATE MEAN OF Y FOR C.V.                *
```

```
      DO 1139 J = 1,N
      YHAT(J) = 0.0
 1139 CONTINUE
      DO 1121 J =1,N
      DO 1111 I =1,M2
      YHAT(J) =  YHAT(J) + (AA(I,J) * B2(I))
 1111 CONTINUE
 1121 CONTINUE
      SE = 0.0
      DO 1022 J =1,N
      SE =  SE + (Y(J) - YHAT(J))**2
 1022 CONTINUE
      SMSEE  =  SMSEE + SE/(N-M-1)
      DO 2341 J = 1,N
 2341 YSUME = YSUME + (ABS((YS(J) - YHAT(J))/YS(J)))
      RETURN
      END
C       SUBROUTINE FOR SORT MEDIAN                    C
      SUBROUTINE SORTME
      REAL NORMAL
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
     *       /CONTA/P/CONST
     *       /XBAR,SIG,SIGM,DEM,SI,CORR
     *                    /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *       /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
```

```
     *         /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *         /YWO/YS(200)/ERR/E(200)
     *       /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *          ,EE(12,200)
      K = N - 1
      DO 5 I = 2,M2
      DO 6 J = 1,K
      L = J + 1
      DO 100 O = L,N
      IF (X(I,J).LE.X(I,O)) GO TO 100
      SAVE = X(I,J)
      X(I,J) = X(I,O)
      X(I,O) = SAVE
  100 CONTINUE
    6 CONTINUE
    5 CONTINUE
      RETURN
      END
C  SUBROUTINE TO FIND THE POSITION OF MISSING OF Y *
      SUBROUTINE MISSY(MM1)
      REAL MM1
      DOUBLE PRECISION E,A,S,B,B1,X,Y,B2,A2,AA,PB,IB,YS
     *                 ,SME,XREG,S1,BB,CC,YB,JB,DD,XEST,YEST,S3
     *                 ,IX,IY
      COMMON /REGS/A(12,12),S(12,12),S1(12,12)/COEFF/B(12)
```

```
     *         /XBAR,SIG,SIGM,DEM,SI,CORR
     *                         /DATAX/X(12,200)/SEED/IX,IX2/SELECT/KK
     *         /VARIAB/N,M,M2,MM/WEIGHT/W(200)/DATAY/Y(200),A2(200)
     *         /WORK/PB(12,200),AA(12,200),IB(12,200),SME(12),XREG(200)
     *    /CON/MMM,MMY/AREA/BB(12,200),CC(12,200),XEST(12,200)
     *         /EST/YB(200),JB(200),DD(200),YEST(200)/WOR/S3(12,12)
     *         /YWO/YS(200)/ERR/E(200)
     *       /WORP/SMSEC,YSUMC,SMSEM,YSUMM,SMSER,YSUMR,SMSEL,YSUML
     *        /WORPP/SMSEA,YSUMA,SMSEE,YSUME
      DIMENSION B1(12),B2(12),IPLAG(200),MISS(200)
     *          ,COUNT(15),ICOUNT(15),SX(200),YHAT(200),XX(12,200)
     *          ,YHA(200),JCOUNT(200),JPLAG(200),VAB(12,200),YE(200)
     *          ,EE(12,200)
      DO 1902 K2 = 1,10
1902  JCOUNT(K2) = 0
      P = 100.
      IF(N.GT.100)      P = 1000.
      DO 111 J = 1,MMM
150   CALL RAND(IX,IY,YFL)
      JYY = INT(P * YFL)
      IF(JYY.GT.N.OR.JYY.LE.0) GO TO 150
      JB(J) = JYY
111   CONTINUE
211   CONTINUE
      CALL DUPL(N,M2,MMM,JB,P,IX)
      DO 350 J = 1,N
      YB(J) = 0.
350   CONTINUE
      DO 360 J = 1,MMM
```

```
      YB(JB(J)) = 1.0
360   CONTINUE
      M1 = M2-1/2
      DO 400 J = 1,N
      JJ = 0
      IF (YB(J).EQ.1.0) JJ = JJ + 1
      JPLAG(J) = JJ
      JCOUNT(JJ + 1) = JCOUNT( JJ+ 1) + 1
400   CONTINUE
      DO 90 J = 1,N
90    DD(J) = 1.0
      RETURN
      END
```

ประวัติผู้เขียน

ร.ต.ท.หญิงชุดิมา ชัยมุสิก เกิดเมื่อวันที่ 29 ธันวาคม พ.ศ. 2504 ที่จังหวัดนครศรีธรรมราช สำเร็จปริญญาตรีวิทยาศาสตร์บัณฑิต(สถิติศาสตร์) จาก มหาวิทยาลัยรามคำแหง เมื่อปีการศึกษา 2525 และเข้าศึกษาต่อระดับปริญญาโท ในภาควิชาสถิติ บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย ปีการศึกษา 2530 ปัจจุบันรับราชการที่ กองบังคับการกองวิจัยและวางแผน กองกำกับการศูนย์ประมวลข่าวสาร กรมตำรวจ กรุงเทพมหานคร