บรรณานุกรม

หนังสือ

ลุ่ยาติ ประสิทธิ์รัฐสินธุ์ และลัดดาวัลย์ รอดมณี "เทคนิคการวิเคราะห์ตัวแปรหลายตัวสำหรับการวิจัยทางสังคมศาสตร์", 2527 : 23 - 26

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ภาคผนวก

1. โปรแกรมสำหรับหาค่าเฉลี่ยความคลาดเคลื่อนกำลังสองของค่าประมาณสัมประสิทธิ์ความถดถอยพหุ และค่าประมาณตัวแปรตามด้วยวิธีริดจ์ รีเกรสชั่นเปรียบเทียบ กับวิธีวิเคราะห์ความถดถอยพหุ

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C     PROGRAM RIDE REGRESSION FOR ONLY ONE K ESTIMATE
C-----------------------------------------------------------------------
C      CHARACTER PR*4,PR1*2,OU=3=PROB=2
       DIMENSION B(20),D(20),S(20),T(20),XBAR(20)
       DIMENSION V(400),XX(15,15)
       DIMENSION R(210)
       DIMENSION TV(51)
       DIMENSION Y(9,200),Z(9),C(9,9),SUM(9),SMEAN(9),
      1COR(9,9),P(200),WP(9),INS(9,9),CORR(9,9),DA(9,9),
      2BB(9),CC(9,9),DD(9,9),YY(9,9),YI(9,9),RR(9,9),A(9,9),PA(9,9),
      3BX(1,9),F(9,9),VAZ(9,9),Q(9,9),ZK(9,9),SNVA(9,9),TS(9,9)
      4,TSVB(9,9),FI(9,9),ZA(9,9),VB(9,9),SNV(9,9),IRVAB(1),WI(9,9
      5),VV(9,9),AA(9,9),PIVOT(9),IPVOT(9),INDEX(9,2),SSE(9),WE(9,9),
      *YE(9,9),VAX(9,9),BQA(9),SP(200),SY(9,200),SX(200,9),CIN(9,9)
      *,SS(9,9),SC(9,9),SI(200),CQ(9,9),XB(200),BA(9),CA(9,9)
      *,TANT(200),TCV(9),TCVE(9),DEV(9),DCV(9),TMSE(9),IMS(9),JET(2),
      *XD(200),SH(6),SL(5),DEN(9,9)
C-----------------------------------------------------------------------
C      COMMON IPVOT,INDEX,PIVOT
       COMMON IA
       DOUBLE PRECISION DET
       REAL MEANY
       DATA SUM/9*0./
1      FORMAT(' FACTOR ANALYSIS.....',A4,A2,//,3X,'NO. OF CASES',4X,I6,3X
      1,'NO. OF VARIABLES',I6,/)
2      FORMAT(' MEAN',/,(8F15.5))
3      FORMAT(' STANDARD DEVIATIONS',/,(8F15.5))
4      FORMAT(' CORRELATION COEFFICIENTS')
5      FORMAT(' ROW',I3,/,(10F12.5))
6      FORMAT(' EIGENVALUES',/,(10F12.5))
7      FORMAT(' CUMULATIVE PERCENTAGE OF EIGENVALUES',/,(10F12.5))
8      FORMAT(' EIGENVECTORS')
9      FORMAT(' VECTOR',I3,/,(10F12.5))
18     FORMAT(A4,A2,15,I2,F6.0)
C     READ PROBLEM PARAMETER
100    READ(5,18) PR,PR1,N,M,CCN
       NO=1
C   PR....PROBLEM NUMBER (MAY BE ALPHAMETIC)
C   PR1...PROBLEM PARAMETER(CONTINUED)
C   N.....NUMBER OF CASES
C   M.....NUMBER OF VARIABLES
C   CCN...CONSTANT USED TO DECIDE HOW MANY EIGENVALUES TO RETAIN
C
 1111  WRITE(6,1) PR,PR1,N,M
       ID = 0
       X = 0.0
C
       CALL CORRE(N,M,ID,X,XBAR,S,V,R,D,B,T,SX)
C
C    PRINT MEAN
C
```

```
      WRITE(6,2) (XBAR(J),J=1,M)
C
C    PRINT STANDARD DEVIATIONS
C
      WRITE(6,3) (S(J),J=1,M)
C
C    PRINT CORRRELATION COEFFICIENTS
C
      WRITE(6,4)
      DO 120 I=1,M
      DO 110 J=1,M
      IF(I-J) 102,104,104
102   L = I + (J*J-J) / 2
      GO TO 110
104   L = J + (I*I-I) / 2
110   D(J) = R(L)
      DO 2000 J=1,M
2000  COR(I,J)=D(J)
120   WRITE(6,5) I,(D(J),J=1,M)
      WRITE(6,2003)
2003  FORMAT(2X,'----CORRELATION MATRIX------')
      DO 2001 I=1,M
2001  WRITE(6,2002)(COR(I,J),J=1,M)
2002  FORMAT(9(2X,F9.5))
      MV = 0
      CALL EIGEN(R,V,M,MV)
      CALL TRACE(M,R,CON,K,D)
C
C    PRINT EIGEN VALUES
      DO 130 I=1,K
      L = I + (I*I-I) / 2
130   S(I) = R(L)
      WRITE(6,6) (S(J),J=1,K)
C
C  PRINT CUMULATIVE PERCENTAGE OF EIGEN VALUES
C
      WRITE(6,7) (D(J),J=1,K)
C  PRINT EIGEN VECTORS
      WRITE(6,8)
      L = 0
      DO 150 J=1,K
      DO 140 I=1,M
      L = L + 1
140   D(I) = V(L)
      DO 160 K=1,M
160   XX(J,K)=D(K)
150   WRITE(6,9) J,(D(I),I=1,M)
      DO 170 I=1,M
170   WRITE(6,180)(XX(I,J),J=1,M)
180   FORMAT(9(2X,F9.5))
      K1=100
      K2=4
      AM=0.
      SH(1)=0.01
      SH(2)=0.1
      SH(3)=.5
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      SH(4)=1
      SH(5)=5
      SH(6)=10
      NO=0
      JET(1)=1
      JET(2)=K2
C-----------------------------------
      DO 31 J=1,K2
      DO 31 I=1,K1
   31 SY(J,I)=SX(I,J)
      DO 21 I=1,K2
      DO 21 J=1,K2
      A(I,J)=COR(I,J)
      CIN(I,J)=COR(I,J)
21    PA(I,J)=COR(I,J)
C-----------------------------------------------------------------
      NN=K2
      MM=0
      CALL CHAP8(A,NN,DD,MM,DET)
      DOT=DSQRT(DET)
      RATIO=S(1)/S(K2)
      WRITE(6,2105)DOT,RATIO
2105  FORMAT(2X,'DOT=',F9.5,2X,'RATIO=',F9.5)
      TRACE=0.
      DO 2100 I=1,K2
2100  TRACE=TRACE+A(I,I)
      TEST=20*((TRACE/K2)**(-1.3))
      RL=TRACE/K2
      WRITE(6,2101)TRACE,TEST,RL
2101  FORMAT(2X,'TRACE=',F9.5,2X,'TEST=',F9.5,2X,'RL=',F9.5)
      IT=0
      IY=IA
      DO 7000 IOK=1,2
      DO 7899 ILL=1,6
      CIFF=0
      DIFF=0
      DO 52 I=1,K2
      ICV(I)=0
   52 TCVE(I)=0
      IA=65539
 1000 DO 900 I=1,K1
      P(I)=0
      DO 901 J=1,K2
  901 P(I)=P(I)+SX(I,J)*XX(JET(IOK),J)
      CALL NORMAL(AM,SH(ILL),Z6)
      P(I)=P(I)+Z6
  900 CONTINUE
      SUMY=0.
      DO 74 I=1,K1
   74 SUMY=SUMY+P(I)
      MEANY=SUMY/K1
      STDY=0.
      DO 774 I=1,K1
      STDY=STDY+((P(I)-MEANY)**2)
  774 CONTINUE
      DO 775 I=1,K1
```

```
      SP(I)=(P(I)-MEANY)/SQRT(STDY)
  775 CONTINUE
      DO 811 I=1,K2
      WP(I)=0.
      DO 811 K=1,K1
  811 WP(I)=WP(I)+SY(I,K)*SP(K)
      DO 822 I=1,K2
      BA(I)=0.
      DO 822 K=1,K2
  822 BA(I)=BA(I)+A(I,K)*WP(K)
      DO 370 I=1,K1
      XB(I)=0
      DO 370 K=1,K2
  370 XB(I)=XB(I)+SX(I,K)*BA(K)
      ST=0.
      DO 380 I=1,K1
  380 ST=ST+((SP(I)-XB(I))**2)
      ST=ST/(K1-K2)
      KO=0
      NUM=1
      SUMB=0.
      DO 200 I=1,K2
  200 SUMB=SUMB+(BA(I)**2)
      SI(1)=(K2*ST)/SUMB
  260 DO 210 I=1,K2
      DO 210 J=1,K2
      IF(I-J)210,230,210
  230 PA(I,J)=PA(I,J)+SI(NUM)
  210 CONTINUE
C-----------------------------------
      MM=0
      CALL CHAP8(PA,NN,DA,MM,DET)
      DO 240 I=1,K2
      BB(I)=0.
      DO 240 K=1,K2
  240 BB(I)=BB(I)+PA(I,K)*WP(K)
      SUMM=0.
      DO 310 I=1,K2
  310 SUMM=SUMM+(BB(I)**2)
      KO=KO+1
      NUM=NUM+1
      SI(NUM)=(K2*ST)/SUMM
      SL(KO)=(SI(NUM)-SI(NUM-1))/SI(NUM-1)
      DO 343 I=1,K2
      DO 343 J=1,K2
  343 PA(I,J)=CIN(I,J)
      IF(KO.EQ.1)GOTO 242
      IF(SL(KO)-SL(KO-1))242,242,7001
  242 IF((SI(NUM)-SI(NUM-1))/SI(NUM-1).GT.TEST)GOTO 260
 7001 IT=IT+1
      DO 335 I=1,K2
  335 DEV(I)=((XX(JET(IJK),I)-BB(I))**2)
      DO 336 I=1,K2
  336 DOV(I)=((XX(JET(IJK),1)-BA(I))**2)
      DO 183 I=1,K2
  183 TOVE(I)=TOVE(I)+DEV(I)
```

```
      DO 221 I=1,K2
  221 TCV(I)=TCV(I)+DOV(I)
C-----------------------------------------------------------------------
      DO 184 I=1,K1
      XD(I)=0
      DO 184 K=1,K2
      XD(I)=XD(I)+SX(I,K)*BB(K)
  184 CONTINUE
      SST=0
      DO 158 I=1,K1
  158 SST=SST+(SP(I)-XD(I))**2
      RSQ=SST/(K1-K2)
      DIFF=DIFF+RSQ
      CIFF=CIFF+ST
      TANT(IT)=SI(NUM-1)
      IF(IT.LT.100)GOTO 1000
      DIFF=DIFF/IT
      CIFF=CIFF/IT
      DBC=(DIFF-CIFF)*100/CIFF
      DO 3333 I=1,K2
      TCVE(I)=TCVE(I)/IT
 3333 TCV(I)=TCV(I)/IT
      SED=0.
      SER=0.
      DO 4444 I=1,K2
      SED=SED+TCV(I)
 4444 SER=SER+TCVE(I)
      DOR=(SED-SER)
      DAR=(DOR*100)/SED
C------------FIND CONSTANT K AND VARIANCE-------------
      WRITE(6,444)SED,SER,DOR,DAR,JET(ICK),SH(ILL),DIFF,CIFF,DBC
  444 FORMAT(2(1X,F10.6),1X,F9.7,2X,F9.4,2X,I3,3(1X,F7.5),2X,F9.5)
      IT=0
 7899 CONTINUE
      IT=0
      DO 899 I=1,K2
      TCVE(I)=0
  899 TCV(I)=0
      DIFF=0
 7000 CONTINUE
      NO=NO+1
C     IT=0
      IF(NO.LT.30)GOTO 1111
      STOP
      END
```

2. โปรแกรมสำหรับหาค่าเฉลี่ยความคลาดเคลื่อนกำลังสองของค่าประมาณสัมประสิทธิ์ความถดถอยพหุ และค่าประมาณตัวแปรตามด้วยวิธีรีเกรสชั่นพรันซิเปิ้ลคอมโพเน้นท์ เปรียบเทียบกับวิธีวิเคราะห์ความถดถอยพหุ

```
C
C
      DIMENSION B(20),D(20),S(20),T(20),XBAR(20)
      DIMENSION V(400),XX(15,15)
      DIMENSION R(210)
      DIMENSION TV(51)
      DIMENSION Y(6,200),Z(6),C(6,6),SUM(6),SMEAN(6),
     1COR(6,6),TA(200),WP(6),CORR(6,6),SSD(6),BA(6),
     2BB(6),CC(6,6),DD(6,6),YI(6,6),RR(6,6),A(6,6),PP(6,6),
     3BX(1,6),F(6,6),VAZ(6,6),ZK(6,6),SNVA(6,6),TS(6,6),XP(200)
     4,TSVB(6,6),FI(6,6),VB(6,6),TRVAB(1),EE(6),WI(6,6
     5),VV(6,6),PIVOT(6),IPVOT(6),INDEX(6,2),SSE(6),WE(6,6),CUM(6,200),
     *YE(6,6),VAX(6,6),YS(6,200),SP(200),SY(6,200),SX(200,6),CVB(6)
     *,SS(6,6),XB(200),WI(200,6),WW(6,200),EI(6),TT(200),
     *TCV(6),TCVE(6),TMSE(6),TMS(6),SH(6),JET(2),WU(6,6),WX(6,6)
      COMMON IA
      DOUBLE PRECISION DET
      INTEGER TIME,Q,DIM
      REAL MEANY
 1    FORMAT(' FACTOR ANALYSIS.....',A4,A2,//,3X,'NO. OF CASES',4X,I6,3X
     1,'NO. OF VARIABLES',I6,/)
 2    FORMAT(' MEAN',/,(8F15.5))
 3    FORMAT(' STANDARD DEVIATIONS',/,(8F15.5))
 4    FORMAT(' CORRELATION COEFFICIENTS')
 5    FORMAT(' ROW',I3,/,(10F12.5))
 6    FORMAT(' EIGENVALUES',/,(10F12.5))
 7    FORMAT(' CUMULATIVE PERCENTAGE OF EIGENVALUES',/,(10F12.5))
 8    FORMAT(' EIGENVECTORS')
 9    FORMAT(' VECTOR',I3,/,(10F12.5))
 18   FORMAT(A4,A2,I5,I2,F6.0)
C
C
C     READ PROBLEM PARAMETER
C
 100  READ(5,18) PR,PR1,N,M,CON
      NO=1
C  PR....PROBLEM NUMBER (MAY BE ALPHAMETIC)
C  PR1...PROBLEM PARAMETER(CONTINUED)
C  N.....NUMBER OF CASES
C  M.....NUMBER OF VARIABLES
C  CON...CONSTANT USED TO DECIDE HOW MANY EIGENVALUES TO RETAIN
C
 1111 WRITE(6,1) PR,PR1,N,M
      ID = 0
      X = 0.0
C
      CALL CORRE(N,M,ID,X,XBAR,S,V,R,D,B,T,SX)
C
C    PRINT MEAN
C
      WRITE(6,2) (XBAR(J),J=1,M)
```

```
C
C    PRINT STANDARD DEVIATIONS
C
      WRITE(6,3) (S(J),J=1,M)
C
C    PRINT CORRRELATION COEFFICIENTS
C
      WRITE(6,4)
      DO 120 I=1,M
      DO 110 J=1,M
      IF(I-J) 102,104,104
  102 L = I + (J*J-J) / 2
      GO TO 110
  104 L = J + (I*I-I) / 2
  110 D(J) = R(L)
      DO 2000 J=1,M
 2000 COR(I,J)=D(J)
  120 WRITE(6,5) I,(D(J),J=1,M)
      WRITE(6,2003)
 2003 FORMAT(2X,'----CORRELATION MATRIX------')
      DO 2001 I=1,M
 2001 WRITE(6,2002)(COR(I,J),J=1,M)
 2002 FORMAT(9(2X,F9.5))
C
      MV = 0
      CALL EIGEN(R,V,M,MV)
      CALL TRACE(M,R,CON,K,D)
C
C    PRINT EIGEN VALUES
      DO 130 I=1,K
      L = I + (I*I-I) / 2
  130 S(I) = R(L)
      WRITE(6,6) (S(J),J=1,K)
C
C  PRINT CUMULATIVE PERCENTAGE OF EIGEN VALUES
C
      WRITE(6,7) (D(J),J=1,K)
C  PRINT EIGEN VECTORS
      WRITE(6,8)
      L = 0
      DO 150 J=1,K
      DO 140 I=1,M
      L = L + 1
  140 D(I) = V(L)
      DO 160 K=1,M
  160 XX(J,K)=D(K)
  150 WRITE(6,9) J,(D(I),I=1,M)
      DO 170 I=1,M
  170 WRITE(6,180)(XX(I,J),J=1,M)
  180 FORMAT(9(2X,F9.5))
      K1=100
      K2=4
      DO 8150 I=1,K2
      DO 8150 J=1,K2
      A(I,J)=COR(I,J)
 8150 PP(I,J)=COR(I,J)
```

```
C-----------------------------------------
      NN=K2
      MM=0
      CALL CHAP8(A,NN,DD,MM,DET)
      DOT=DSQRT(DET)
      RATIO=S(1)/S(K2)
      WRITE(6,2105)DOT,RATIO
2105  FORMAT(2X,'DOT=',F9.5,2X,'RATIO=',F9.5)
      TRACE=0.
      DO 2100 I=1,K2
2100  TRACE=TRACE+A(I,I)
      TEST=20*((TRACE/K2)**(-1.3))
      RL=TRACE/K2
      WRITE(6,2101)TRACE,TEST,RL
2101  FORMAT(2X,'TRACE=',F9.5,2X,'TEST=',F5.5,2X,'RL=',F9.5)
C-----------------------------------------
      IA=65539
      DO 52 I=1,K2
      ICV(I)=0
   52 ICVE(I)=0
      TIME=0
      AM=0
      SH(1)=.01
      SH(2)=.1
      SH(3)=.5
      SH(4)=1
      SH(5)=5
      SH(6)=10
      JET(1)=1
      JET(2)=K2
CCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      DO 7000 IOK=1,2
      DO 7899 ILL=1,6
      CIFF=0
      DIFF=0
      IA=65539
 5555 DO 61 I=1,K1
      TA(I)=0
      DO 56 J=1,K2
   56 TA(I)=TA(I)+SX(I,J)*XX(JET(IOK),J)
      CALL NORMAL(AM,SH(ILL),Z6)
      TA(I)=TA(I)+Z6
   61 CONTINUE
      SUMY=0.
      DO 74 I=1,K1
   74 SUMY=SUMY+TA(I)
      MEANY=SUMY/K1
      TIME=TIME+1
      STDY=0.
      DO 774 I=1,K1
      STDY=STDY+((TA(I)-MEANY)**2)
  774 CONTINUE
      DO 776 I=1,K1
  776 TT(I)=(TA(I)-MEANY)/SQRT(STDY)
C-----------------------------------------
      DO 31 J=1,K2
```

```
      DO 31 I=1,K1
31    SY(J,I)=SX(I,J)
      DO 811 I=1,K2
      WP(I)=0
      DO 811 K=1,K1
811   WP(I)=WP(I)+SY(I,K)*TT(K)
      NN=K2
      MM=0
      CALL CHAP8(COR,NN,DD,MM,DET)
      DO 828 I=1,NN
      BB(I)=0
      DO 828 K=1,NN
828   BB(I)=BB(I)+COR(I,K)*WP(K)
      DO 818 I=1,NN
818   SSD(I)=(XX(JET(IOK),I)-BB(I))**2
      DO 221 I=1,NN
221   TCV(I)=TCV(I)+SSD(I)
      DO 225 I=1,K1
      XP(I)=0
      DO 225 K=1,K2
      XP(I)=XP(I)+SX(I,K)*BB(K)
225   CONTINUE
      ST=0
      DO 226 I=1,K1
226   ST=ST+(TT(I)-XP(I))**2
      ST=ST/(K1-K2)
      H=1.00
      IF(S(2).LE.H)GOTO 911
      IF(S(3).LE.H)GOTO 912
      IF(S(4).LE.H)GOTO 913
911   DIM=1
      GOTO 907
912   DIM=2
      GOTO 907
913   DIM=3
907   NN=DIM
      DO 9000 I=1,NN
      BA(I)=0
      DO 9000 J=1,K2
9000  BA(I)=BA(I)+XX(I,J)*BB(J)
      DO 807 I=1,K2
      BE(I)=0
      DO 807 J=1,NN
807   BE(I)=BE(I)+XX(J,I)*BA(J)
C-----------------------------------------------
      DO 182 I=1,K2
182   SSE(I)=(XX(JET(IOK),I)-BE(I))**2
      DO 183 I=1,K2
183   TCVE(I)=TCVE(I)+SSE(I)
      DO 184 I=1,K1
      XB(I)=0
      DO 184 K=1,K2
      XB(I)=XB(I)+SX(I,K)*BE(K)
184   CONTINUE
      SST=0
      DO 158 I=1,K1
```

```
  158 SST=SST+(TT(I)-XB(I))**2
      RSQ=SST/(K1-K2)
      DIFF=DIFF+RSQ
      CIFF=CIFF+ST
C-----------------------------------------------------------------------
      DO 8140 I=1,K2
      DO 8140 J=1,K2
 8140 COR(I,J)=PP(I,J)
      IF(TIME.LT.100)GOTO 5555
      CIFF=CIFF/TIME
      DIFF=DIFF/TIME
      DBC=(DIFF-CIFF)*100/CIFF
      DO 415 I=1,K2
      TMSE(I)=TCVE(I)/TIME
  415 TMS(I)=TCV(I)/TIME
      CVE=0
      CV=0
      DO 416 I=1,K2
      CVE=CVE+TMSE(I)
  416 CV=CV+TMS(I)
      DOR=CV-CVE
      DAR=(DOR*100)/CV
      IA=IY
      WRITE(6,444)CVE,CV,DOR,DAR,JET(ICK),SH(ILL),DIFF,CIFF,DBC
  444 FORMAT(2X,'CVE=',F9.5,3X,'CV=',F9.5,3X,F10.7,1X,F10.4,1X,'JEI=',
     1I2,1X,'SH=',F5.2,1X,'DIFF=',F5.5,1X,'CIFF=',F9.5,1X,F10.5)
      TIME=0
      DO 899 I=1,4
      TCVE(I)=0
  899 TCV(I)=0
      DIFF=0
      CIFF=0
      NN=K2
 7899 CONTINUE
      DO 877 I=1,K2
      TCVE(I)=0
  877 TCV(I)=0
      DIFF=0
 7000 CONTINUE
      NO=NO+1
C     TIME=0
      IF(NO.LT.30)GOTO 1111
C-----------------------------------------
      STOP
      END
```

3. ซับโปรแกรมเพื่อหาค่าเมตริกซ์ความสัมพันธ์

```
      SUBROUTINE CORRE(N,M,ID,X,XBAR,STD,RX,R,B,D,T,SX)
      DIMENSION X(1),XBAR(1),STD(1),RX(1),R(1),B(1),D(1),T(1),SX(200,9)
C   INITIALIZATION
      DO 100 J=1,M
      B(J) = 0.0
100   T(J) = 0.0
      K = (M*M+M) / 2
      DO 102 I=1,K
102   R(I) = 0.0
      FN = N
      L = 0
C
127   IF (N-M) 130,130,135
130   KK = N
      GO TO 137
135   KK = M
C      WRITE(6,6000)KK
C6000  FORMAT(2X,'KK=',I5)
137   DO 140 I=1,KK
      CALL DATA(M,D)
      DO 5000 K=1,M
5000  SX(I,K)=D(K)
      DO 140 J=1,M
      T(J) = T(J) + D(J)
      L = L + 1
140   RX(L) = D(J)
      PKK = KK
      DO 150 J=1,M
      XBAR(J) = T(J)
150   T(J) = T(J) / PKK
C     DO 5000 I=1,K1
C     DO 5000 J=1,K2
C5000  SX(I,J)=D(J)
C
C  CALCULATE SUMS OF CROS PRODUCTS OF DEVIATIONS
C  FROM TEMPORARY MEANS FOR M OBSERVATIONS
C
      L = 0
      DO 180 I=1,KK
      JK = 0
      DO 170 J=1,M
      L = L + 1
 170  D(J) = RX(L) - T(J)
      DO 180 J=1,M
      B(J) = B(J) + D(J)
      DO 180 K=1,J
      JK = JK + 1
180   R(JK) = R(JK) + D(J) * D(K)
C
      IF (N-KK) 205,205,185
C
C   READ THE REST OF OBSERVATIONS ONE AT A TIME ,SUM THE OBSERVATIONS
C   AND CALCULATE SUMS OF CROSS-PRODUCTS OF DEVIATIONS FROM TEMPORARY
```

```
C   MEANS
C
185   KK = N - KK
      DO 200 I=1,KK
      JK = 0
      CALL DATA(M,D)
      DO 5010 LO=1,M
5010  SX(I+M,LO)=D(LO)
      DO 190 J=1,M
      XBAR(J) = XBAR(J) + D(J)
      D(J) = D(J) - T(J)
190   B(J) = B(J) + D(J)
      DO 200 J=1,M
      DO 200 K=1,J
      JK = JK + 1
200   R(JK) = R(JK) + D(J) * D(K)
C
C   CALCULATE MEANS
C
205   JK = 0
      DO 210 J = 1,M
      XBAR(J) = XBAR(J) / FN
C
C    ADJUST SUMS OF CROSS-PRODUCT OF DEVIATIONS FROM TEMPORARY MEANS
C
      DO 210 K=1,J
      JK = JK + 1
210   R(JK) = R(JK) - B(J) * B(K) /FN
C
C    CALCULATE CORELATION  COEFFICIENTS
C
      JK = 0
      DO 220 J=1,M
      JK = JK + J
220   STD(J) = SQRT(ABS(R(JK)))
C
C
      DO 230 J=1,M
      DO 230 K=J,M
      JK = J + (K*K-K) / 2
      L = M * (J-1) + K
      RX(L) = R(JK)
      L = M * (K-1) + J
      RX(L) = R(JK)
      IF (STD(J)*STD(K)) 225,222,225
222   R(JK) = 0.0
      GO TO 230
225   R(JK) = R(JK) / (STD(J) * STD(K))
230   CONTINUE
C
C   CALCULATE STANDARD DEVIATIONS
C
      FN = SQRT(FN-1.0)
      DO 240 J=1,M
240   STD(J) = STD(J) / FN
C
```

```
C    COPY THE DIAGONAL OF THE MATRIX OF SUM OF CROSS-PRODUCTS OF
C    DEVIATIONS FROM MEANS
C
      L = -M
      DO 250 I=1,M
      L = L + M + 1
250   B(I) = RX(L)
      RETURN
      END
```

4. ซับโปรแกรมหา eigenvelue และ eigenvector

```
C
      SUBROUTINE EIGEN(A,R,N,MV)
      DIMENSION A(1),R(1)
C
C   GENERATE IDENTITY MATRIX
C
      RANGE = 1.0 E-6
      IF(MV-1) 10,25,10
10    IQ = - N
      DO 20 J=1,N
      IQ = IQ + N
      DO 20 I=1,N
      IJ = IQ + I
      R(IJ) = 0.0
      IF(I-J) 20,15,20
15    R(IJ) = 1.0
20    CONTINUE
C
C  COMPUTE INITIAL AND FINAL NORMS(ANORM AND ANORMX)
C
25    ANORM = 0.0
      DO 35 I=1,N
      DO 35 J=1,N
      IF (I-J) 30,35,30
30    IA = I + (J*J-J) / 2
      ANORM = ANORM + A(IA) * A(IA)
35    CONTINUE
      IF (ANORM) 165,165,40
40    ANORM = 1.414 *SQRT(ANORM)
      ANORMX = ANORM * RANGE / FLOAT(N)
C
C  INITIALIZE INDICATEORS AND COMPUTE THRESHOLD, THR
C
      IND = 0
      THR = ANORM
45    THR = THR / FLOAT(N)
50    L = 1
55    M = L + 1
C
C  COMPUTE SIN AND COS
C
60    MQ = (M*M-M) / 2
      LQ = (L*L-L) / 2
      LM = L + MQ
62    IF (ABS(A(LM)) - THR) 130,65,65
65    IND = 1
      LL = L + LQ
      MM = M + MQ
      X = 0.5 * (A(LL) -A(MM))
68    Y = -A(LM) / SQRT(A(LM)*A(LM)+X*X)
      IF (X) 70,75,75
70    Y = - Y
75    SINX = Y / SQRT(2.0*(1.0+(SQRT(1.0-Y*Y))))
```

```
C
C    SORT EIGEN VALUES AND EIGENVECTORS
C
165    IQ = - N
       DO 185 I=1,N
       IQ = IQ + N
       LL = I + (I*1-I) / 2
       JQ = N * (I-2)
       DO 185 J = I,N
       JQ = JQ + N
       MM = J + (J*J-J) / 2
       IF ( A(LL) -A(MM)) 170,185,185
170    X = A(LL)
       A(LL) = A(MM)
       A(MM) = X
       IF ( MV-1) 175,185,175
175    DO 180 K=1,N
       ILR  = IQ + K
       IMR = JQ + K
       X = R(ILR)
       R(ILR) = R(IMR)
180    R(IMR) = X
185    CONTINUE
       RETURN
       END



C
C-------------------------------------------------------
      SUBROUTINE TRACE(M,R,CON,K,D)
      DIMENSION R(1),D(1)
C
      FM = M
      L = 0
      DO 100 I=1,M
      L = L + I
100   D(I) = R( L)
      K = 0
C
C TEST WHETHER I-TH EIGENVALUE IS GREATER THAN OR EQUAL TO THE CONSTANT
C
      DO 110 I=1,M
      IF(D(I)-CON) 120,105,105
105   K = K+ 1
110   D(I) = D(I) /FM
C
C  COMPUTE CUMULATIVE PERCENTAGE OF EIGENVALUES
C
120   DO 130 I=2,K
130   D(I) = D(I) + D(I-1)
      RETURN
      END
```

5. ซับโปรแกรมหาอินเวอร์เมตริกซ์

```
      SUBROUTINE CHAP8(A,N,B,M,DET)
      DIMENSION A(9,9),B(9,9),IPVOT(9),INDEX(9,2),PIVOT(9)
      DOUBLE PRECISION DET
C     COMMON IPVOT,INDEX,PIVOT
      EQUIVALENCE(IROW,JROW),(ICOL,JCOL)
   57 DET=1.
      DO 17 J=1,N
   17 IPVOT(J)=0
      DO 135 I=1,N
      T=0.
      DO 9 J=1,N
      IF(IPVOT(J).EQ.1) GOTO 9
   13 DO 23 K=1,N
      IF(IPVOT(K)-1) 43,23,81
   43 IF(ABS(T).GE.ABS(A(J,K))) GOTO 23
   83 IROW=J
      ICOL=K
      T=A(J,K)
   23 CONTINUE
    9 CONTINUE
      IPVOT(ICOL)=IPVOT(ICOL)+1
      IF(IROW.EQ.ICOL) GOTO 109
   73 DET=-DET
      DO 12 L=1,N
      T=A(IROW,L)
      A(IROW,L)=A(ICOL,L)
   12 A(ICOL,L)=T
      IF(M.LE.0) GO TO 109
   33 DO 2 L=1,M
      T=B(IROW,L)
      B(IROW,L)=B(ICOL,L)
    2 B(ICOL,L)=T
  109 INDEX(I,1)=IROW
      INDEX(I,2)=ICOL
      PIVOT(I)=A(ICOL,ICOL)
      DET=DET*PIVOT(I)
      A(ICOL,ICOL)=1.
      DO 205 L=1,N
  205 A(ICOL,L)=A(ICOL,L)/PIVOT(I)
      IF(M.LE.0) GO TO 347
   66 DO 52 L=1,M
   52 B(ICOL,L)=B(ICOL,L)/PIVOT(I)
  347 DO 135 LI=1,N
      IF(LI.EQ.ICOL) GO TO 135
   21 T=A(LI,ICOL)
      A(LI,ICOL)=0.
      DO 89 L=1,N
   89 A(LI,L)=A(LI,L)-A(ICOL,L)*T
      IF(M.LE.0) GOTO 135
   18 DO 68 L=1,M
   68 B(LI,L)=B(LI,L)-B(ICOL,L)*T
  135 CONTINUE
  222 DO 3 I=1,N
```

```
      SINX2 = SINX * SINX
78    COSX = SQRT(1.0-SINX2)
      COSX2 = COSX * COSX
      SINCS = SINX * COSX
C
C   ROTATE L AND M COLUMNS
C
      ILQ = N * (L-1)
      IMQ = N * (M-1)
      DO 125 I=1,N
      IQ = (I*I-I) / 2
      IF (I-L) 80,115,80
80    IF(I-M) 85,115,90
85    IM = I + MQ
      GO TO 95
90    IM = M + IQ
95    IF ( I-L) 100,105,105
100   IL = I + LQ
      GO TO 110
105   IL = L + IQ
110   X = A(IL) * COSX - A(IM) * SINX
      A(IM) = A(IL) * SINX + A(IM) * COSX
      A(IL) = X
115   IF (MV-1) 120,125,120
120   ILR = ILQ + 1
      IMR = IMQ + I
      X = R(ILR) * COSX - R(IMR) * SINX
      R(IMR) = R(ILR) * SINX + R(IMR) * COSX
      R(ILR) = X
125   CONTINUE
      X = 2.0 * A(LM) * SINCS
      Y = A(LL) * COSX2 + A(MM) * SINX2 - X
      X = A(LL) * SINX2 + A(MM) * COSX2 + X
      A(LM) = ( A(LL) - A(MM)) * SINCS + A(LM) * (COSX2 - SINX2)
      A(LL) = Y
      A(MM) = X
C
C   TEST FOR  COMPLETION
C   TEST FOR M = LAST COLUMN
C
130   IF (M-N) 135,140,135
135   M = M + 1
      GO TO 60
C
C  TEST FOR L = SECOND FROM LAST COLUMN
C
140   IF(L-(N-1)) 145,150,145
145   L = L + 1
      GO TO 55
150   IF(IND-1) 160,155,160
155   IND = 0
      GO TO 50
C
C  COMPARE THRESHOLD WITH FINAL NORM
C
160   IF(THR - ANORMX) 165,165,45
```

```
      L=N-I+1
      IF( INDEX(L,1).EQ.INDEX(L,2))GO TO  3
   19 JROW=INDEX(L,1)
      JCOL=INDEX(L,2)
      DO 549 K=1,N
      T=A(K,JROW)
      A(K,JROW)=A(K,JCOL)
      A(K,JCOL)=T
  549 CONTINUE
    3 CONTINUE
   81 RETURN
      END
```

6. ซับโปรแกรมหาผลคูณของเมตริกซ์

```
      SUBROUTINE MATMPY(A,N,M,B,L,C)
      DIMENSION A(9,200),B(200,9),C(9,9)
      DO 5 I=1,N
      DO 5 J=1,L
      C(I,J)=0.
      DO 5 K=1,M
    5 C(I,J)=C(I,J)+A(I,K)*B(K,J)
      RETURN
      END
```

7. ซับโปรแกรมสร้างข้อมูลให้มีการแจกแจงแบบปกติ

```
C-------------NORMAL DISTRIBUTION-------------
      SUBROUTINE NORMAL(EX,STD,Y1)
      COMMON IA
      SINT = 2.2160359
      A1=0.8840704
      A2=0.9733110
      A3=0.9587208
      A4=0.9113128
      CALL RANDUM(IA,IY,U)
      IF(U.LE.A1) GOTO 20
      IF(U.LE.A2) GOTO 4
    2 CALL RANDUM(IA,IY,V1)
      CALL RANDUM(IA,IY,W1)
      T = (SINT**2)/2 -ALOG(W1)
      C1 = (V1**2)*T
      C2 = (SINT**2)/2
      IF(C1.GT.C2) GOTO 2
      IF(U.LE..9866555)X =(2*T)**0.5
      IF(U.GT..9866555)X = -(2*T)**0.5
      GOTO 25
    4 IF(U.LE.A3) GOTO 6
C-------------------STEP 5-----------------
   12 CALL RANDUM(IA,IY,V1)
      CALL RANDUM(IA,IY,W1)
      CALL MXMN(V1,W1,RMAX,RMIN)
      Z = V1-W1
      T = SINT-.6308348*RMIN
      IF(RMAX.LE..7555915) GOTO 9
      RX = ABS(Z)*.0342405
      CALL F(T,SINT,FT)
      IF(RX.GT.FT) GOTO 12
      GOTO 9
    6 IF(U.LE.A4) GOTO 8
C-------------------STEP 7
   10 CALL RANDUM(IA,IY,V1)
      CALL RANDUM(IA,IY,W1)
      CALL MXMN(V1,W1,RMAX,RMIN)
      Z = V1-W1
      T = .4797274 + 1.1054737*RMIN
      IF(RMAX.LE..8728300) GOTO 9
      RX = ABS(Z)*.0492545
      CALL F(T,SINT,FT)
      IF(RX.LE.FT) GOTO 9
      GOTO 10
C--------------------STEP 8
    8 CALL RANDUM(IA,IY,V1)
      CALL RANDUM(IA,IY,W1)
      CALL MXMN(V1,W1,RMAX,RMIN)
      Z = V1-W1
      T = .4797274 - .5955071*RMIN
      IF(RMAX.LE..8055779)GO TO 9
      CALL F(T,SINT,FT)
      RX = .0533755*ABS(Z)
```

```
      IF(RX.LE.FT) GOTO 9
      GOTO 3
    9 IF(Z.LE.0.) GOTO 15
      X = -T
      GOTO 25
   15 X = T
      GOTO 25
   20 CALL RANDUM(IA,IY,V)
      X = SINT * ((1.13113164)*U-1+V)
   25 Y1 = EX+STD*X
      RETURN
      END


C
      SUBROUTINE MXMN(V1,N1,RMAX,RMIN)
      IF(N1.LE.V1) GO TO 6
      RMIN=V1
      RMAX=N1
      GO TO 2
    6 RMIN=N1
      RMAX=V1
    2 RETURN
      END


C
      SUBROUTINE FIT,SINT,FT)
      SINX =0.3989428D*EXP(-(T**2)/2.)
      FT   = SINX-1.8002519*(SINT-ABS(T))
      RETURN
      END
```

ประวัติผู้เขียน

นางสาว ดวงพร ชูรักษ์ เกิดเมื่อวันที่ 4 มกราคม พ.ศ. 2503 สำเร็จปริญญาวิทยาศาสตร์บัณฑิต (คณิตศาสตร์) จากมหาวิทยาลัยสงขลานครินทร์ เมื่อปีการศึกษา 2524 และเข้าศึกษาต่อที่แผนกสถิติ บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย เมื่อปีการศึกษา 2525 เข้าทำงานเป็นอาจารย์ที่มหาวิทยาลัยหอการค้าไทย เมื่อปีการศึกษา 2528 ปัจจุบันเป็นอาจารย์ประจำคณะวิทยาศาสตร์ มหาวิทยาลัยหอการค้าไทย