บรรณานุกรม

ภาษาไทย

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ภาคผนวก

โปรแกรมที่ใช้ในการวิจัย

```
C ------------------------------------------------------------
C          SET DIMENTION
C ------------------------------------------------------------
      DIMENTION X(900),Y(900),XPI1(9,100),XPI2(9,100),
     *WSUM1(9),WSUM2(9),WBAR1(9,1),WBAR2(9.1),H(100),W(100),
     *PROB(900),BDATA1(900),BDATA2(900),BOOT1(9,100),
     *BOOT2(9,100), BSUM1(9),BSUM2(9),BBAR1(9,1),BBAR2(9,1),
     *DIFF(900),POP(901),BH1(100),BH2(100)
C ------------------------------------------------------------
C          DOUBLE PRECISION
C ------------------------------------------------------------
      DOUBLE PRECISION SP(9,9),SJ1(9,9),S1(9,9),S2(9,9),
     *X1SUB3(9,100),X2SUB3(9,100),X1SUB1(100,9),X2SUB1(100,9),
     *WADDW(9,1),WSUBW(9,1),W1(9,1),W2(1,1),OP(1,9),
     *XPI(9,1),XTRAN(1,9),WSWTR(1,9),RR1(9,1),RR2(1,1),
     *X1AX2J(9,100),X1SX2J(9,100),XS12(9,1),
     *U1(9,100),UU1(9,1),UU2(1,9)
     *B1(1,9),B2(9,9),B3(9,9),B4(1,1),B5(9,9),B6(9,9),
     *C1(9,1),C2(9,100),
     *CTRAN(100,9),WSTAR(1,1),CT(1,9),F1(9,1),F2(1,9),F4(1,1),
     *F6(1,1),ONEMUE(9,1),B1SUB3(9,100),B2SUB3(9,100),
     *B1SUB1(100,9),B2SUB1(100,9),SS1(9,9),SS2(9,9),SSP(9,9),
     *BSUBB(9,1),BADDB(9,1),BW1(9,1),BTR1(1,9),BTR2(1,9),
     *B1W3(1,1),B2W3(1,1),BPI(9,1)BXPI(9,1)
C ------------------------------------------------------------
      REAL NORMAL
      REAL SQMEAN
      COMMON /SEED/IX/SELECT/KK
      ALPHA = 2.0
      IX = 973253
      KK = 0
      IP = 9
      NK = 100
      N = NK*IP
      GG6 = NK+NK-3.0
      GG2(NK+NK-2.0
      GG4 = NK/(NK-1.0)*GG2)
      RMSE = 0.0
      DMSE = 0.0
      UMSE = 0.0
```

```
      BMSE = 0.0
      DMEAM = 0.0
      SIGMA = 1.0
      IROUND = 100
      DO 803 I = 1,IP
        ONEMUE(I,1) = 0.0
  803 CONTINUE
      WRITE(6,101)DMEAN2
  101 FORMAT(2X,'====== DMEAN2 = DELTA ======',5X,F10.4)
      WRITE(6,121)IP
  121 FORMAT(2X,' === INDEPENDENT VARIABLE , IP ===',5X,I5)
      WRITE(6,141)NK
  141 FORMAT(2X,' ====== NO. OF SAMPLE ====== ',5X,I5)
C -------------------------------------------------------------
C                      GENERATE DATA X & Y
C -------------------------------------------------------------
      DO 2000 M = 1,IROUND
      DO 10 J3 = 1,N
      A1 = NORMAL(DMEAN,SIGMA)
      X(J3) = A1
   10 CONTINUE

      DO 11 J4 = 1,NK
      CALL SPECN(DMEAN2,SIGMA,A2)
      Y(J4) = A2
   11 CONTINUE
      DO 12 J5 = NK+1,N
      A2 = NORMAL(DMEAN,SIGMA)
      Y(J5) = A2
   12 CONTINUE
```

```
C ------------------------------------------------------------
C                          R - METHOD
C ------------------------------------------------------------
      I1 = 1
      DO 5 I3 = 1,IP
      DO 5 I2 = 1,NK
          XPI1(I3,I2) = X(I1)
          XPI2(I3,I2) = Y(I1)
          I1 = I1+1
    5 CONTINUE
      DO 30 I5 = 1,IP
          WSUM1(I5) = 0.0
          WSUM2(I5) = 0.0
      DO 30 I4 = 1,NK
          WSUM1(I5) = ESUM1(I5) + XPI1(I5,I4)
          WSUM2(I5) = WSUM2(I5) + XPI2(I5,I4)
   30 CONTINUE
      DO 33 I = 1,IP
          WBAR1(I,1) = 0.0
          WBAR2(I,1) = 0.0
          WSUBW(I,1) = 0.0
          WADDW(I,1) = 0.0
          WSWTR(I,1) = 0.0
   33 COMTINUE
      DO 40 I6 = 1,IP
          WBAR1(I6,1) = WSUM1(I6)/NK
          WBAR2(I6,1) = WSUM2(I6)/NK
   40 CONTINUE
      DO 100 I8 = 1,NK
      DO 100 I7 = 1,IP
          X1SUB3(I7,I8) = XPI1(I7,I8) - WBAR1(I7,1)
          X2SUB3(I7,I8) = XPI2(I7,I8) - WBAR2(I7,1)
          X1SUB1(I8,I7) = X1SUB3(I7,I8)
          X2SUB1(I8,I7) = X2SUB3(I7,I8)
  100 CONTINUE
```

```
      DO 332 I3 = 1,IP
      DO 332 J3 = 1,IP
          SP(I3,J3) = 0.0
          S1(I3,J3) = 0.0
          S2(I3,J3) = 0.0
  332 CONTINUE
      CALL MULT(IP,IP,NK,X1SUB3,X1SUB1,S1)
      CALL MULT(IP,IP,NK,X2SUB3,X2SUB1,S2)
      DO 335 I35 = 1,IP
      DO 335 J35 = 1,IP
           SP(I35,J35) = S1(I35,J35)+S2(I35,J35)/GG2
  335 CONTINUE
      CALL INVS(IP,SP)
      DO 110 I9 = 1,IP
           WSUBW(I9,1) = WBAR1(I9,1)-WBAR2(I9,1)
           WADDW(I9,1) = (WBAR1(I9,1)+WBAR2(I9,1))/2
  110 CONTINUE
      DO 120 II1 = 1,IP
           WSWTR(1,II1) = WSUBW(II1,1)
  120 CONTINUE
      DO 50 I21 = 1,IP
           W1(I21,1) = 0.0
   50 CONTINUE
      CALL MULT(IP,1,IP,SP,WSUBW,W1)
      DO 441 II08 = 1,NK
      DO 435 II008 = 1,IP
           XPI(II008,1) = 0.0
           XTRAN(1,II008) = 0.0
           XPI(II008,1) = XPI1(II008,II08)-WADDW(II008,1)
           XTRAN(1,II008) = XPI(II008,1)
  435 CONTINUE
      W2(1,1) = 0.0
      CALL MULT(1,1,IP,XTRAN,W1,W2)
      H(II00) = 1
      IF (W2(1,1) .GT. 0.0) H(II08) = 0
  441 CONTINUE
```

```
      RMIS = 0.0
      DO 462 II09 = 1,NK
           RMIS = RMIS+H(II09)
  462 CONTINUE
      RMIS = RMIS/NK
C -------------------------------------------------------
C                          U - METHOD
C -------------------------------------------------------
      DO 500 ITT = 1,IP
      DO 500 JTT = 1,NK
           U1(ITT,JTT) = 0.0
           X1AX2J(ITT,JTT) = 0.0
           X1SX2J(ITT,JTT) = 0.0
           C2(ITT,JTT) = 0.0
           CTRAN(JTT,ITT) = 0.0
  500 CONTINUE
      DO 520 JJ26 = 1,NK
      DO 510 II26 = 1,IP
           U1(II26,JJ26) = X1SUB3(II26,JJ26)/(NK-1.0)
           X1AX2J(II26,JJ26) = (WADDW(II26,1)*2)-U1(II26,JJ26)
           X1SX2J(II26,JJ26) = WSUBW(II26,1)-U1(II26,JJ26)
           C2(II26,JJ26) = XPI1(II26,JJ26)-(X1AX2J(II26,JJ26))/2
           CTRAN(JJ26,II26) = C2(II26,JJ26)
  510 CONTINUE
      WSTAR(1,1) = 0.0
      GETB4 = 0.0
      B4(1,1) = 0.0
      DO 525 M10 = 1,IP
      DO 525 N10 = 1,IP
           B2(M10,N10) = 0.0
           B3(M10,N10) = 0.0
           B5(M10,N10) = 0.0
           SJ1(M10,N10) = 0.0
  525 CONTINUE
      DO 526 M5 = 1,IP
           B1(1,M5) = 0.0
           C1(M5,1) = 0.0
           UU1(M5,1) = 0.0
           UU2(1,M5) = 0.0
```

```
          XS12(M5,1) = 0.0
          CT(1,M5) = 0.0
526 CONTINUE
      DO 580 I77 = 1,IP
          UU1(I77,1) = X1SUB3(I77,JJ26)
          UU2(1,I77) = X1SUB1(JJ26,I77)
          XS12(I77,1) = X1SX2J(I77,JJ26)
          CT(1,I77) = CTRAN(JJ26,I77)
580 CONTINUE
      CALL MULT(1,IP,IP,UU2,SP,B1)
      CALL MULT(IP,IP,1,UU1,B1,B2)
      CALL MULT(IP,IP,IP,SP,B2,B3)
      CALL MULT(1,1,IP,B1,UU1,B4)
      GETB4 = 1.0-(B4(1,1)*GG4)
      DO 530 I126 = 1,IP
      DO 530 J126 = 1,IP
          B5(I126,J126) = (B3(I126,J126)/GETB4)*GG4
          B6(I126,J126) = SP(I126,J126)+B5(I126,J126)
          SJ1(I126,J126) = (GG6/GG2)*B6(I126,J126)
530 CONTINUE
      CALL MULT(IP,1,IP,SJ1,XS12,C1)
      CALL MULT(1,1,IP,CT,C1,WSTAR)
      W(JJ26) = 1
      IF (WSTAR(1,1) .GT. 0.0) W(JJ26) = 0
520 CONTINUE
      UMIS = 0.0
      DO 600 I60 = 1,NK
          UMIS = UMIS+W(I60)
600 CONTINUE
      UMIS = UMIS/NK
C -------------------------------------------------------
C                          DS - METHOD
C -------------------------------------------------------
      DS = 0.0
      DSROOT = 0.0
      DSMIS = 0.0
      DOUT = 0.0
      RR2(1,1) = 0.0
```

```
      DO 700 I70 = 1,IP
           RR1(I70,1) = 0.0
  700 CONTINUE
      CALL MULT(IP,1,IP,SP,WSUBW,RR1)
      CALL MULT(1,1,IP,WSWTR,RR1,RR2)
      DS = ((NK+NK-IP-3.0)*RR2(1,1)/GG2
      DSROOT = SQRT(DS)
      DOUT = ((DS/2)*(-1)/DSROOT
      CALL NDTR(DOUT,DMIS)
C -------------------------------------------------------
C                  FINE CONDITIONAL ERROR RATE
C -------------------------------------------------------
      CRATE = 0.0
      FOUT = 0.0
      F7 = 0.0
      F8 = 0.0
      F4(1,1) = 0.0
      F6(1,1) = 0.0
      DO 800 I80 = 1,IP
           F1(I80,1) = 0.0
           F2(1,I80) = 0.0
           OP(1,I80) = 0.0
  800 CONTINUE
      DO 801 I = 1,IP
           F1(I,1) = -1*(ONEMUE(I,1)-WADDW(I,1)
  801 CONTINUE
      DO 802 I = 1,IP
           F2(1,I) = F1(I,1)
  802 CONTINUE
      CALL MULT(1,1,IP,F2,RR1,F4)
      CALL MULT(1,IP,IP,WSWTR,SP,OP)
      CALL MULT(1,1,IP,OP,RR1,F6)
      FOUT = F6(1,1)
      F7 = SQRT(FOUT)
      F8 = F4(1,1)/F7
      CALL NDTR(F8,CRATE)
```

```
C ------------------------------------------------------
C                              B - METHOD
C ------------------------------------------------------
      DO 1095 I00 = 1,50
      DIFF(I00) = 0.0
      DO 1000 I = 1,N
           PROB(I) = 0.0
           POP(I+1) = 0.0
           BDATA1(I) = 0.0
           BDATA2(I) = 0.0
1000 CONTINUE
      DO 1001 I = 1,N
           PROB(I) = 0.0
           POP(I+1)
           BDATA1(I) = 0.0
           BDATA2(I) = 0.0
1000 CONTINUE
      DO 1001 I = 1,IP
      DO 1001 J = 1,NK
           BOOT1(I,J) = 0.0
           BOOT2(I,J) = 0.0
1001 CONTINUE
      POP(1) = 0.0
      UU = 1.0/N
      DO 1002 I = 1,N
           PROB(I) = I*UU
           POP(I+1) = PROB(I)
1002 CONTINUE
      CALL REP(N,POP,BDATA1)
      CALL REP(N,Y,POP,BDATA2)
      I01 = 1
      DO 1005 I = 1,IP
      DO 1005 J = 1,NK
           BOOT1(I,J) = BDATA1(I01)
           BOOT2(I,J) = BDATA2(I,J)
           I01 = I01+1
1005 CONTINUE
```

```
      DO 1010 I = 1,IP
           BSUM1(I) = 0.0
           BSUM2(I) = 0.0
      DO 1010 J = 1,NK
           BSUM1(I) = BSUM1(I)+BOOT1(I,J)
           BSUM2(I) = BSUM2(I)+BOOT2(I,J)
1010  CONTINUE
      DO 1011 I11 = 1,IP
           BBAR1(I11,1) = 0.0
           BBAR2(I11,1) = 0.0
1011  CONTINUE
      DO 1015 I15 = 1,IP
           BBAR1(I15,1) = BSUM1(I15)/NK
           BBAR2(I15,1) = BSUM2(I15)/NK
1015  CONTINUE
      DO 1030 J30 = 1,NK
      DO 1030 I30 = 1,IP
           B1SUB3(I30,J30) = 0.0
           B2SUB3(I30,J30) = 0.0
           B1SUB1(J30,I30) = 0.0
           B2SUB1(J30,I30) = 0.0
1030  CONTINUE
      DO 1035 J = 1,NK
      DO 1035 I = 1,IP
           B1SUB3(I,J) = BOOT1(I,J)-BBAR1(I,1)
           B2SUB3(I,J) = BOOT2(I,J) - BBAR2(I,1)
           B1SUB1(J,I) = B2SUB3(I,J)
1035  CONTINUE
      DO 1045 I = 1,IP
      DO 1045 J = 1,IP
           SS1(I,J) = 0.0
           SS2(I,J) = 0.0
1045  CONTINUE
      CALL MULT(IP,IP,NK,B1SUB3,B1SUB1,SS1)
      CALL MULT(IP,IP,NK,B2SUB3,B2SUB1,SS2)
      DO 1050 I = 1,IP
           BSUBB(I,J) = 0.0
           BADDB(I,J) = 0.0
```

```
      DO 1050 J = 1,IP
           SSP(I,J) = 0.0
1050  CONTINUE

      DO 1055 I = 1,IP
           BSUBB(I,J) = BBAR1(I,J) - BBAR2(I,J)
           BADDB(I,J) = (BBAR1(I,1)+BBAR2(I,1))/2
      DO 1055 J = 1,IP
           SSP(I,J) = (SS1(I,J) + SS2(I,J))/GG2
1055  CONTINUE
      CALL INVS(IP,SSP)
      DO 1065 I65 = 1,IP
           BW1(I65,1) = 0.0
1065  CONTINUE
      CALL MULT(IP,1.IP,SSP,BSUBB,BW1)
      DO 1070 I70 = 1,NK
      DO 1072 J70 = 1,IP
           BPI(J70,1) = 0.0
           BXPI(J70,1) = 0.0
           BTR1(1,J70) = 0.0
           BTR2(1,J70) = 0.0
           BPI(J70,1) = BOOT1(J70,I70)-BADDB(J70,1)
           BXPI(J70,1) = XPI1(J70,I70)-BADDB(J70,1)
           BTR1(1,J70) = BPI(J70,1)
           BTR2(1,J70) = BXPI(J70,1)
1072  CONTINUE
      B1W3(1,1) = 0.0
      B2W3(1,1) = 0.0
      CALL MULT(1,1,IP,BTR1,BW1,B1W3)
      CALL MULT(1,1,IP,BTR2,BW1,B2W3)
      BH1(I70) = 1
      IF (B1W3(1,1) .GT. 0.0) BH1(I70) = 0.0
      BH2(I70) = 1
      IF (B1W3(1,1) .GT. 0.0) BH2(I70) = 0.0
1070  CONTINUE
      AMIS1 = 0.0
      AMIS2 = 0.0
```

```
      DO 1085 I85 = 1,NK
           AMIS1 = AMIS1 + BH1(I85)
           AMIS2 = AMIS2 + BH2(I85)
1085  CONTINUE
      AMIS1 = AMIS1/NK
      AMIS2 = AMIS2/NK
      DIFF(100) = AMIS2 - AMIS1
1095  CONTINUE
      BMIS = 0.0
      DIFBAR = 0.0
      DO 1100 I = 1,100
           DIFBAR = DIFBAR + DIFF(I)
1100  CONTINUE
      DIFBAR = DIFBAR/50
      BMIS = RMIS + DIFBAR
      RSQ = 0.0
      USQ = 0.0
      DSQ = 0.0
      BSQ = 0.0
      RSQ = SQMEAN(RMIS,CRATE)
      USQ = SQMEAN(UMIS,CRATE)
      DSQ = SQMEAN(DMIS,CRATE)
      BSQ = SQMEAN(BMIS,CRATE)
      RMSE = RMSE + RSQ
      UMSE = UMSE + USQ
      DMSE = DMSE + DSQ
      BMSE = BMSE + BSQ
2000  CONTINUE
C -------------------------------------------------
C                    END 4 - METHOD
C -------------------------------------------------
      RMSE = RMSE/IROUND
      UMSE = UMSE/IROUND
      DMSE = DMSE/IROUND
      BMSE = BMSE/IROUND
C -------------------------------------------------
```

```
      WRITE(6,1107)
1107  FORMAT(2X,'======= RMSE ====== ')
      WRITE(6,111)RMSE
 111  FORMAT(2X,F10.6)
      WRITE(6,1108)
1108  FORMAT(2X,'======= UMSE ====== ')
      WRITE(6,111)UMSE
      WRITE(6,1109)
1109  FORMAT(2X,'======= DMSE ====== ')
      WRITE(6,111)DMSE
      WRITE(6,1110)
1110  FORMAT(2X,'======= BMSE ====== ')
      WRITE(6,111)BMSE
C -------------------------------------------------------
C                END PROGRAM
C -------------------------------------------------------
      STOP
      END



C -------------------------------------------------------
C       SUBROUTINE RANDOM
C -------------------------------------------------------
      SUBROUTINE RAND(IX,IY,YFL)
      IY = IX * 65539
      IF (IY) 5,6,6
    5 IY = TY + 2147483647 + 1
    6 YFL = IY
      YFL = YFL / 2147483647
      IX = IY
      RETURN
      END
```

```
C ------------------------------------------------------
C   FUNCTION NORMAL DISTRIBUTION
C ------------------------------------------------------
      FUNCTION NORMAL( DMEAN , SIGMA )
      REAL NOMAL
      COMMON / SEED / IX / SELECT / kk
      PI = 3.1415926
      IF ( kk.EQ.1 ) GOTO 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 ------------------------------------------------------
C                      SUBROUTINE SPECN
C ------------------------------------------------------
      SUBROUTINE SPECN( DMEAN2,SIGMA2,AX )
      COMMON / SEED / IX / SELECT / kk
      A = 0.0
      DO 51 I = 1 , 12
         CALL RAND(IX , IY , YFL )
         A = A + YFL
   51 CONTINUE
      AX = ( A - 6 ) * SIGMA2 + DMEAN2
      RETURN
      END
```

```
C ------------------------------------------------------
C              SUBROUTINE SAMPLE WITH REPLACEMENT
C ------------------------------------------------------
      SUBROUTINE  REP( NN,ZE1,ZE2,ZE3 )
           COMMON / SEED / IX / SELECT / kk
           DIMENTION ZE1(NN) , ZE2(NN+1) , ZE3(NN)
           DO 5008 I08  =  1,NN
              ZE3(I08)  = 0.0
      5008 CONTINUE
           DO 5000 J = 1,NN
              CALL RAND( IX , IY , YFL )
                   DO 5005 I = 1 , NN
                   IF  ((  YFL . GT . ZE2(I)) .AND. ( YFL .
   LE . ZE2(I+1)) THEN
                        ZE3(J)  = ZE1(I)
                        GOTO 5000
                    END IF
       5005 CONTINUE
       5000 CONTINUE
            RETURN
            END


C ------------------------------------------------------
C          SUBROUTINE STANDARD NORMAL DIST. FUNCTION
C ------------------------------------------------------
      SUBROUTINE NDTR(X,D)
             DOUBLE PRECISION A(5) , WPX(5)
             PI = 3.1415926
             P  = 0.2316419
             FX = 0.0
             XAB = ABS(x)
             D  = 0.0
             A(1) =  0.3193815
             A(2) = -0.3565638
             A(3) =  1.781478
             A(4) = -1.821256
             A(5) =  1.330274
```

```
      DO 1500 I15 = 1,5
         WPX(I15) = 0.0
1500  CONTINUE
      WPX(1) =  1/(1+P*XAB)
      WPX(2) =  WPX(1)**2
      WPX(3) =  WPX(1)**3
      WPX(4) =  WPX(1)**4
      WPX(5) =  WPX(1)**5
      FX =  (EXP(-(XAB*XAB)/2.0))/SQRT(2.0*PI)
      PX =  0.0
      DO 1501  I = 1,5
         PX =  PX + A(I) * WPX(I)
1501  CONTINUE
      IF (X) 12 , 13 , 13
   12 D =  FX * PX
      GOTO 14

   13 D =  1 - ( FX * PX )
   14 RETURN
      END


C -------------------------------------------------------
C                      SUBROUTINE MULT
C -------------------------------------------------------
      SUBROUTINE MULT(III,KKK,LLL,AA1,BB1,CC1)
      DOUBLE PRECISION AA1(III,LLL),BB1(LLL,KKK),CC1(III,KKK)
      DO 11 III = 1,III
           DO 11 KK1 = 1,KKK
              CC1(III,KKK) = 0.0
                   DO 11 LL1 = 1,LLL
      CC1(III,KK1) = CC1(III,KK1)+AA1(III,LL1)*BB1(LL1,KK1)
   11 CONTINUE
      RETURN
      END
```

```
C -------------------------------------------------------
C                  SUBROUTINE INVERSE MATRIX
C -------------------------------------------------------
      SUBROUTINE INVS(M,A)
      DOUBLE PRECISION A(M,M)
      DO 20 K = 1,M
      A(K,K) = -1.0/A(K,K)
      DO 555 I = 1,M
      IF(I-K) 3,555,3
    3 A(I,K) = -A(I,K)*A(K,K)
  555 CONTINUE
      DO 10 IO1 = 1,M
      DO 10 JO1 = 1,M
      IF(( IO1-K )*( JO1-K )) 9,10,9
    9 A(IO1,JO1) = A(IO1,JO1)-A(IO1,K)*A(K,JO1)
   10 CONTINUE
      DO 20 J = 1,M
      IF (J-K) 18,20,18
   18 A(K,J) = -A(K,J)*A(K,K)
   20 CONTINUE
      DO 25 IO2 = 1,M
      DO 25 JO2 = 1,M
   25 A(IO2,JO2) = -A(IO2,JO2)
      CONTINUE
      RETURN
      END
```

ประวัติผู้เขียน

นางสาว ลลนา ทวีรุ่งโรจน์ สำเร็จการศึกษาวิทยาศาสตร์บัณฑิต (คณิตศาสตร์) จากมหาวิทยาลัยศรีนครินทรวิโรฒ ประสานมิตร เมื่อปีการศึกษา 2529 เข้าศึกษาต่อในภาควิชาสถิติ สาขาวิชาสถิติ บัณฑิตวิทยาลัยจุฬาลงกรณ์มหาวิทยาลัย เมื่อปีการศึกษา 2530 ปัจจุบันเป็นอาจารย์ประจำคณะบริหารธุรกิจ สาขาคอมพิวเตอร์ธุรกิจ มหาวิทยาลัยรังสิต