ESTIMATION OF FINITE POPULATION VARIANCE USING SCRAMBLED RESPONSES IN THE PRESENCE OF AUXILIARY INFORMATION

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APPENDIX-B

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!PROGRAM: ARNAB5.F95 (USED FOR SIMULATION)
  USE NUMERICAL_LIBRARIES
  IMPLICIT NONE
  INTEGER I, J, NP, NS, IR(5000), IIII, NITR, KOUT1
  REAL E(5000), XP(5000), YP(5000)
  REAL TH1, TH2, G, R, ANP, SUMYP, SUMXP, YMP, XMP
  REAL VARYP, VARXP, AM22P, AM04P, YS(5000), XS(5000)
  REAL A, B, TH, G2, S(5000), ANS, SMEAN, VARS, SUMS
  REAL Z(5000), SZ, SZ2, ZM, VARZ, SYSTAR2
  REAL BV0, RBV0, BTRUE, SUMXS, XSM, VARXS, BV1
  REAL RBV1, V1, AM04S, AM22S, V2, RBV2, BV2, BEST
  REAL AMSEV0, AMSEV1, AMSEV2
  REAL RE01, RE02
  CHARACTER*20 OUT_FILE
  WRITE(*, '(A)') 'NAME OF THE OUTPUT FILE'
  READ(*, '(A20)') OUT_FILE
  OPEN(42, FILE=OUT_FILE, STATUS='UNKNOWN')
  NP = 3000
  G = 0.5
  R = 1.5
  TH1 = 2.2
  TH2 = 3.5
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      CALL RNGAM(NP,TH1,XP)
      CALL SSCAL(NP,TH2,XP,1)
      CALL RNNOR(NP,E)
      DO 11 I=1, NP
11    YP(I) = R*XP(I)+E(I)*XP(I)**G
!      DO 12 I=1, NP
!12    WRITE(42,101)I, YP(I),XP(I)
!101   FORMAT(2X,I4,2X,F9.2,2X,F9.2)
      ANP = NP
      SUMYP = 0.0
      SUMXP = 0.0
      DO 121 I = 1, NP
      SUMYP = SUMYP + YP(I)
121    SUMXP = SUMXP + XP(I)
      YMP = SUMYP/ANP
      XMP = SUMXP/ANP
!      WRITE(42,102)YMP,XMP
!102   FORMAT(2X,F9.3,2X,F9.3)
      VARYP = 0.0
      VARXP = 0.0
      AM22P = 0.0
      AM04P = 0.0
      DO 1 I=1, NP
      AM22P = AM22P + (YP(I)-YMP)**2*(XP(I)-XMP)**2
      AM04P = AM04P + (XP(I)-XMP)**4
      VARYP = VARYP + (YP(I)-YMP)**2
1    VARXP = VARXP + (XP(I)-XMP)**2
      AM22P = AM22P/(ANP-1)
      AM04P = AM04P/(ANP-1)
      VARYP = VARYP/(ANP-1)
      VARXP = VARXP/(ANP-1)
      BTRUE = (AM22P-VARYP*VARXP)/(AM04P-VARXP**2)
!      WRITE(42,103)AM22P,AM04P,VARYP, VARXP,BTRUE
!103   FORMAT(2X,F12.3,2X,F9.3,2X,F9.3,2X,F9.3,2X,F9.3)
      DO 7777 NS = 10, 170, 5
      ANS = NS
      BV1 = 0.0
      BV2 = 0.0
      BV0 = 0.0
      KOUT1 = 0
      AMSEV0 = 0.0
      AMSEV1 = 0.0
      AMSEV2 = 0.0
      NITR = 50000
      DO 9999 IIII=1,NITR
      CALL RNSRI(NS,NP,IR)

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DO 13 I=1, NS
  YS(I) = YP(IR(I))
13  XS(I) = XP(IR(I))
  SUMXS = 0.0
  DO 41 I=1, NS
41  SUMXS = SUMXS + XS(I)
  XSM = SUMXS/ANS
  VARXS = 0.0
  DO 42 I=1, NS
42  VARXS = VARXS + (XS(I)-XSM)**2
  VARXS = VARXS/(ANS-1)
!  DO 14 I = 1, NS
!14  WRITE(42,104)I,YS(I),XS(I)
!104  FORMAT(5X,I4,2X,F9.3,2X,F9.3)
  A = 6.5
  B = 0.5
  TH = A/(A+B)
  G2 = (A*B)/((A+B)**2*(A+B+1))
  CALL RNBET(NS,A,B,S)
  SUMS = 0.0
  DO 15 I=1, NS
15  SUMS = SUMS+S(I)
  SMEAN = SUMS/ANS
  VARS = 0.0
  DO 16 I=1, NS
16  VARS = VARS+(S(I)-SMEAN)**2
  VARS = VARS/(ANS-1)
!  WRITE(42,106)TH,G2,SMEAN,VARS
!106  FORMAT(2X,F8.2,1X,F8.4,1X,F8.2,1X,F8.4)
  DO 17 I = 1, NS
17  Z(I) = YS(I)*S(I)
  SZ = 0.0
  SZ2 = 0.0
  DO 18 I=1, NS
  SZ = SZ + Z(I)
18  SZ2 = SZ2 + Z(I)*Z(I)
  ZM = SZ/ANS
  VARZ = 0.0
  DO 19 I=1, NS
19  VARZ = VARZ + (Z(I)-ZM)**2
  VARZ = VARZ/(ANS-1)
  SYSTAR2 = (VARZ-G2*SZ2/(ANS*(G2+TH**2)))/(TH**2)
  V1 = SYSTAR2 + BTRUE*(VARXP-VARXS)
  BV0 = BV0 + SYSTAR2
  BV1 = BV1 + V1
!  WRITE(42,*)SYSTAR2,V1,BTRUE,VARXP,VARXS

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!      REGRESSION TYPE ESTIMATOR
      AM04S = 0.0
      AM22S = 0.0
      DO 51 I=1, NS
51      AM22S = AM22S + (Z(I)-ZM)**2*(XS(I)-XSM)**2
      AM04S = AM04S + (XS(I)-XSM)**4
      AM04S = AM04S/(ANS-1)
      AM22S = AM22S/((ANS-1))
      AM22S = AM22S/(G2+TH**2)
      BEST = (AM22S-SYSTAR2*VARXS)/(AM04S-VARXS**2)
      V2 = SYSTAR2 + BEST*(VARXP-VARXS)
      BV2 = BV2 + V2
      AMSEV0 = AMSEV0 +(SYSTAR2-VARYP)**2
      AMSEV1 = AMSEV1 +(V1-VARYP)**2
      AMSEV2 = AMSEV2 +(V2-VARYP)**2
9999  CONTINUE
      RBV0 = (BV0/DBLE(NITR)-VARYP)/VARYP*100
      RBV1 = (BV1/DBLE(NITR)-VARYP)/VARYP*100
      RBV2 = (BV2/DBLE(NITR)-VARYP)/VARYP*100
      RE01 = AMSEV0*100/AMSEV1
      RE02 = AMSEV0*100/AMSEV2
      WRITE (*,109)A,B,R,G,NS,RBV0,RBV1,RBV2,RE01,RE02
      WRITE (42,109)A,B,R,G,NS,RBV0,RBV1,RBV2,RE01,RE02
109   FORMAT(1X,F6.3,1X,F6.3,1X,F6.3,1X,F6.3,1X,I5,1X,F7.4,
11X, F7.4,1X,F7.4,1X,F7.2,1X,F7.2)
7777  CONTINUE
      STOP
      END

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