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This FORTRAN source code calculates the parameters (n, kr, ka) of the and modified lot sentencing procedures proposed by Wang et al. (2022) Costa (2025) - "Improving the chain sampling plans based on Cpm index article from: Quality Reliability Engineering International

```
      USE MSIMSL
      DOUBLE PRECISION WUWU,ERRABS,ERRREL, RESULT,ERREST, LOW,HIGH,
&  Y, SL, UL, USL,LSL,SHIFT, LAMBDA,N ,ALPHA ,C0,C1 ,PA,PR,PIN,
&  KA,KR ,BHETA ,PP ,KRR,KAA

      EXTERNAL WUWU
      COMMON N, Y, SL ,UL

4000  CONTINUE

      WRITE(*,88)
88    FORMAT(//, " ORIGINAL CASE TYPE 1, MODIFIED CASE TYPE 2")

      READ(*,*) MNM

3000  CONTINUE
      KM=0
      MM=0

      WRITE(*,105)
105   FORMAT (" Give the values of M, N, Alpha, Betha, CAQL, CRQL" )

      READ(*,*) M,N,ALPHA, BHETA,C0,C1

1000  CONTINUE

      DO 567 IJ=1,40

      P=IJ*(ALPHA/40)

      PR=1-P

      DELTA=0.01
      PA=PR

251   CONTINUE

      PA=PA- DELTA

      PP=(PA**M)*PR + M*(PA**M)*(PR-PA)

      IF (MNM.EQ.1) THEN
        PP=PA**(M+1) + M*(PA**(M))*(PR-PA)
      ENDIF

      IF (PP.GT.(1.0-ALPHA)) THEN

        FAA=PA
        PRR=PR

        GOTO 251

      ELSE
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                                PA=PA+ DELTA
                                DELTA=DELTA/10
                                IF(DELTA .LT.0.0000001) GOTO 248
                                GOTO 251

                                ENDIF

248 CONTINUE

                                PA=PAA
                                PR=PRR

                                ERRABS=0.0D0
                                ERRREL=0.0001D0

                                DELTA=0.01

                                USL=3.0*C0
                                LSL=-USL

                                Y=3.0

                                DELTA=0.01

                                SHIFT=0
                                LAMBDA=1.0

                                SL=SHIFT/LAMBDA
                                UL=USL/LAMBDA

                                LOW=0.0D0
                                HIGH=UL*DSQRT(N) /(3*Y)

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                                KR

100 CONTINUE
                                IF(DELTA.LT.0.00000001) GOTO 200
                                HIGH=UL*DSQRT(N) /(3*Y)
                                CALL DQDAGS (WUWU,LOW,HIGH,ERRABS, ERRREL,RESULT, ERREST)

                                IF(result.LT.PR) THEN
                                Y=Y-DELTA
                                GOTO 100
                                ELSE
                                Y=Y+DELTA
                                DELTA=DELTA/2
                                Y=Y-DELTA

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GOTO 100
ENDIF
200 CONTINUE

PR=RESULT
KR=Y

101 FORMAT(3F14.9)

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C      ka
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C      Y=3.0
DELTA=0.01

SHIFT=0
LAMBDA=1.0

SL=SHIFT/LAMBDA
UL=USL/LAMBDA

LOW=0.0D0
HIGH=UL*DSQRT(N) /(3*Y)

102 CONTINUE
IF(DELTA.LT.0.00000001) GOTO 202
HIGH=UL*DSQRT(N) /(3*Y)
CALL DQDAGS (WUWU,LOW,HIGH,ERRABS, ERRREL,RESULT, ERREST)

IF(result.LT.PA) THEN
Y=Y-DELTA
GOTO 102
ELSE
Y=Y+DELTA
DELTA=DELTA/2
Y=Y-DELTA

GOTO 102
ENDIF
202 CONTINUE
PA=RESULT
KA=Y

PIN=(PA**M)*PR + M*(PA**M)*(PR-PA)
IF (MNM.EQ.1) THEN
PIN=PA**(M+1) + M*(PA**(M))*(PR-PA)
ENDIF

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LAMBDA=C0/C1
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SL=SHIFT/LAMBDA
UL=USL/LAMBDA

LOW=0.0D0
HIGH=UL*DSQRT(N) /(3*KR)
Y=KR

CALL DQDAGS (WUWU,LOW,HIGH,ERRABS, ERRREL,RESULT, ERREST)

PR=RESULT

LOW=0.0D0
HIGH=UL*DSQRT(N) /(3*KA)
Y=KA
CALL DQDAGS (WUWU,LOW,HIGH,ERRABS, ERRREL,RESULT, ERREST)

PA=RESULT

      PIN=(PA**M)*PR + M*(PA**M)*(PR-PA)
IF (MNM.EQ.1) THEN
      PIN=PA**(M+1) + M*(PA**(M))*(PR-PA)
ENDIF

      IF(PIN.LT.BHETA) THEN

          MM=0
          KM=1

          NM=N
          KRR=KR
          KAA=KA
          II=IJ

          N=N-1

          WRITE(*,10120,advance='no') NM
10120      FORMAT(I4)

          GOTO 1000

      ELSE

          MM=MM+1

          IF( MM.EQ.20) THEN
              GOTO 4589
          ENDIF

      ENDIF

567  CONTINUE

4589 CONTINUE

      IF(KM.EQ.0) THEN
          WRITE(*,1012)
          GOTO 3000
      ELSE

          WRITE(*,1011)NM,KAA,KRR

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                                ENDIF

GOTO 4000

1012 FORMAT(/," Restart the algorithm with a larger value of n")
1011 FORMAT(/," Solution:",/, " N=",I4," Ka=", F7.4, " Kr=", F7.4)

END

DOUBLE PRECISION FUNCTION WUWU(X)
USE MSIMSL
DOUBLE PRECISION N, Y,SL,UL, PI, X,A1,A2, A3,Q1,Q2 ,W

COMMON N, Y, SL,UL
      PI = 3.1415926536

W=((UL * UL*N) / (9 * Y *Y) -X*X)

      A1      = DCHIDF(W,N-1)
      Q1=      X+SL*DSQRT(N)
A2=(1.0D0/DSQRT(2*PI))*DEXP(-Q1*Q1/2.0D0)

      Q2=      X-SL*DSQRT(N)
A3=(1.0D0/DSQRT(2*PI))*DEXP(-Q2*Q2/2.0D0)

      WUWU = A1 * (A2 + A3)

END

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