

บรรณานุกรม

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เทส และ แวนเดอ แวร์เคน นอร์มอล-สก็อต เทส ภายใต้ลักษณะการแจก
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ภาคผนวก

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ภาคผนวก ก.

การคำนวณช่วงความเชื่อมั่นของอัตราความคลาดเคลื่อนที่ระบุ (T)

วิธีคำนวณเกณฑ์ในการตัดสินอัตราความคลาดเคลื่อนที่ระบุ (nominated) ซึ่งสามารถคำนวณจากช่วงความเชื่อมั่นของ p เมื่อ p หมายถึงโอกาสที่เกิดจากความคลาดเคลื่อนประเภทที่ 1 ดังนี้

$$\hat{p} - z_{\alpha/2} \frac{\hat{p}\hat{q}}{n} \leq p \leq \hat{p} + z_{\alpha/2} \frac{\hat{p}\hat{q}}{n}$$

เมื่อ $\alpha = .05$ ได้ว่า $\hat{p} = .05$, $\hat{q} = 1 - \hat{p} = .95$, $n = 1,000$ และ $z_{\alpha/2} = 1.96$ เพราะฉะนั้น

$$.05 - 1.96x \frac{(.05)(.95)}{1000} \leq p \leq .05 + 1.96x \frac{(.05)(.95)}{1000}$$

$$.05 - .0135083 \leq p \leq .05 + .0135083$$

$$0.0364917 \leq p \leq 0.0635083$$

เมื่อ $\alpha = .01$ ได้ว่า $\hat{p} = .01$, $\hat{q} = 1 - \hat{p} = .99$, $n = 1,000$ และ $z_{\alpha/2} = 2.576$ เพราะฉะนั้น

$$.01 - 2.576x \frac{(.01)(.99)}{1000} \leq p \leq .01 + 2.576x \frac{(.01)(.99)}{1000}$$

$$0.0081051 \leq p \leq 0.01181051$$

สรุปช่วงของความเชื่อมั่นสำหรับ $p = .05$ คือ $.036 \leq p \leq .064$

$$p = .01 \text{ คือ } .008 \leq p \leq .018$$

หมายเหตุ เกณฑ์ของโคแตรนกำหนดช่วงของความเชื่อมั่นดังนี้

$$\text{สำหรับ } p = .05 \text{ คือ } .004 \leq p \leq .060$$

$$p = .01 \text{ คือ } .007 \leq p \leq .015$$

เพราะเหตุที่เกณฑ์ของโคแตรนนเป็นช่วงที่สั้นกว่าช่วงความเชื่อมั่นที่คำนวณได้ และ Ramsey ได้ใช้เกณฑ์ของโคแตรนในการตัดสินอัตราความคลาดเคลื่อนประเภทที่ 1 ของการทดสอบที่ การวิจัยครั้งนี้จึงเลือกใช้เกณฑ์ของโคแตรนตัดสินการเปรียบเทียบอัตราความคลาดเคลื่อนประเภทที่ 1 จากผลการทดลองกับอัตราความคลาดเคลื่อนที่ระบุ

การทดสอบความแตกต่างกันของอำนาจของการทดสอบ

การทดสอบความแตกต่างอย่างมีนัยสำคัญทางสถิติของอำนาจของการทดสอบเมื่อกำหนดอัตราความคลาดเคลื่อนที่ระบุ .05 ซึ่งสามารถคำนวณได้จากสูตร

$$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}}$$

เมื่อ \hat{p}_1 คือสัดส่วนของอำนาจของการทดสอบของ t

\hat{p}_2 คือสัดส่วนของอำนาจของการทดสอบของ KS

\hat{q}_1 คือ $(1 - \hat{p}_1)$

n_1 คือจำนวนครั้งของการทดสอบหาค่าของอำนาจของการทดสอบของ t

n_2 คือจำนวนครั้งของการทดลองหาค่าของการทดสอบของ KS

ตัวอย่างของการทดสอบความแตกต่างอย่างมีนัยสำคัญทางสถิติของอำนาจของการทดสอบด้วยการทดสอบ t จากการทดลองทำการซิมูเลชัน 1000 ครั้ง ของอำนาจของการทดสอบ t-NN(10,10) กับ KS-NN(10,10) เมื่อเคลต้ามี่ค่าเท่ากับ 0.75 และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .05 ดังนี้

$$\begin{aligned} Z &= \frac{0.368 - 0.313}{\sqrt{\frac{(.368)(.632)}{1000} + \frac{(.313)(.687)}{1000}}} \\ &= 2.599646249 \end{aligned}$$

สรุปได้ว่า อำนาจของการทดสอบ t -NN(10,10) กับ KS-NN(10,10) ณ จุดนี้
แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .30 คือเมื่อเดลต้ามีค่าเท่ากับ 0.750
และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .05 การทดสอบของ t -NN(10,10) กับ
KS-NN(10,10) มีอำนาจของการทดสอบใกล้เคียงกัน

ทดสอบความแตกต่างอย่างมีนัยสำคัญของอำนาจของการทดสอบของ t -NN(10,10)
กับ KS-NN(10,10) เมื่อเดลต้ามีค่าเท่ากับ 0.750 และกำหนดอัตราความคลาด
เคลื่อนที่ระบุ .01

จากสูตร

$$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}}$$

$$Z = \frac{.164 - .132}{\sqrt{\frac{(.164)(.836)}{1000} + \frac{(.132)(.868)}{1000}}}$$

$$= 2.017091623$$

สรุปได้ว่าอำนาจของการทดสอบของ t -NN(10,10) กับ KS-NN(10,10)
ณ จุดนี้แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .20 นั่นคือเดลต้ามีค่าเท่ากับ 0.750
และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .01 KS-NN(10,10) มีอำนาจของการทดสอบ
เหนือกว่า t -NN(10,10)

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ภาคผนวก ข.

THE COMPUTER PROGRAM , USED IN THIS STUDY IS WRITTEN IN FORTRAN IV. IT IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR WHEN DELTA IS 0.0 BESIDES COMPUTING THE POWER OF TESTS WHEN DELTA'S ARE 0.25S.D., 0.50 S.D., 0.75 S.D., 1.00 S.D., 1.25 S.D., 1.50 S.D., 1.75 S.D. AND 2.00 S.D. AND THE POPULATION VARIANCES ARE 100.

DISCRIPTION OF PARAMETERS

N1 = SAMPLE SIZE FORM POPULATION 1

N2 = SAMPLE SIZE FORM POPULATION 2

EX = MEAN OF POPULATION

STD = STANDARD DEVIATION OF POPULATION

จุฬาลงกรณ์มหาวิทยาลัย

```

C *****
C *
C *          NI: SAMPLE SIZE (6,9)
C *
C *****
1  DIMENSION NODAT(15),H(15),G(15),C(15),SKS(15)
2  COMMON IA
3  REAL NODAT,KS,N1,N2,MEAN1,MEAN2
4      NI = 6
5      N2 = 9
6      Y = 0.
7      IA = 65539
8      CTT05 = 0.
9      CTT01 = 0.
10     CKS05 = 0.
11     CKS01 = 0.
12     ACRS01 = 0.
13     DO 55 IK= 1,10 JJ
14         STD= SQRT(100.)
15         SUM1 = 0.
16         SUM2 = 0.
17         SUMX1 = 0.
18         SUMX2 = 0.
C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C     WHEN DELTA IS 5.0 S.D.
19     EX = 500.
20     DO 10 I = 1,6
21         NODAT(I)=0.
22         IF(Y.NE.JTGO TO 2
23         CALL NORMAL(EX,STD,X,Y)
24         GO TO 3
25     2      X = Y
26            Y = 0.
27     3      NODAT(I)=X
28     10     CONTINUE
29     EX = 500.
30     DO 11 J = 7,15
31         NODAT(J)=0.
32         IF(Y.NE.JTGO TO 4
33         CALL NORMAL(EX,STD,X,Y)
34         GO TO 5
35     4      X = Y
36            Y = 0.
37     5      NODAT(J)=X
38     11     CONTINUE
C-----T TEST-----
39     DO 3 IQ = 1,6
40     1      SUM1 = SUM1+NODAT(IQ)
41     MEAN1 = SUM1/IQ
42     DO 8 JQ = 1,6
43     8      SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
44     DO 22 IB = 7,15
45     22     SUMX1 = SUMX1+NODAT(IB)
46     MEAN2 = SUMX1/12
47     DO 21 KQ = 7,15
48     21     SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
49     XX = (SUM2+SUMX2)/(NI+N2-2.)*(1./NI+1./N2)
50     TEST = (MEAN1-MEAN2)/SQRT(XX)
51     TTEST = ABS(TEST)
52     IF(TTEST.GE.2.160)CTT05 = CTT05+1
53     IF(TTEST.GE.3.012)CTT01 = CTT01+1
C-----KS TEST-----
54     DO 100 NI = 1,15
55     100    H(NI) = NODAT(NI)
56     CALL RANK(H,NI)
57     D=0.
58     DO 51 KJ = 1,15
59     51     G(KJ) = 0.0
60     DO 31 IJ = 1,15
61     DO 32 KI = 1,6
62     IF(H(IJ).EQ.NODAT(KI))GO TO 33
63     D = D+0.
64     GO TO 34
65     33    D = D+(1./NI)
66     34    G(IJ) = D
67     32    CONTINUE
68     31    CONTINUE

```

```

69      E=0.
70      DO 52 NJ =1,15
71      52  C(NJ) =0.0
72      DO 41 JJ =1,15
73      DO 42 JI =7,15
74      IF(H(JJ).E2.NJJ)AT(JI)GO TO 43
75      E = E+0.
76      GO TO 44
77      43  E = E+(1./N2)
78      44  C(JJ) = E
79      42  CONTINUE
80      41  CONTINUE
81      DO 101 MJ =1,15
82      101  SKS(MJ) = ABS((S(MJ)-C(MJ)))
83      DMAX = SKS(1)
84      DO 24 LJ =1,15
85      IF(DMAX-SKS(LJ))13,24,24
86      13  DMAX = SKS(LJ)
87      24  CONTINUE
88      IF(DMAX.GE.0.558)CKSC5 = CKSC5+1
89      IF(DMAX.GE.0.777)CKSC1 = CKSC1+1
90      IF(DMAX.GE.0.959)ACKSC1 = ACKSC1+1
91      55  CONTINUE
92      WRITE(6,60)
93      60  FORMAT(2X,'CTTJ5',5X,'CKSC5',5X,'CTT01',5X,'CKSC1',5X,'ACKSC1')
94      WRITE(6,40)CTTJ5,CKSC5,CTT01,CKSC1,ACKSC1
95      40  FORMAT(12X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
96      STOP
97      END

```

C-----FANDUM-----

```

93      SUBROUTINE RANDOM(IX,IY,RN)
94      COMMON IA
100      IY = IX * 65539
101      IF(IY)5,6,5
102      5  IY = IY+2147483647+1
103      6  RN = IY
104      RN = RN * .4656613E-9
105      IX = IY
106      IA = IX
107      RETURN
108      END

```

C-----RANDOM-----

```

109      SUBROUTINE JDR4AL(EX,STD,X,Y)
110      COMMON IA
111      1  CALL RANDOM (I1,IY,RN)
112      V1=2.*RN-1.
113      CALL RANDOM (I1,IY,RN)
114      V2=2.*RN-1.
115      S =V1*V1+V2*V2
116      IF(S.GE.1)GO T J 1
117      FNN1=V1*SQRT((-2.*ALOG(S))/S)
118      RNN2=V2*SQRT((-2.*ALOG(S))/S)
119      X = EX+RNN1*STD
120      Y = EX+RNN2*STD
121      RETURN
122      END

```

C-----RANK-----

```

123      SUBROUTINE RANK(H,N)
124      DIMENSION H(15)
125      N = 15
126      LL = N-1
127      DO 23 I = 1,LL
128      N = N-1
129      DO 22 J =1,N
130      IF(H(I)-H(J+1))22,22,21
131      21  SAVE = H(J)
132      H(J) = H(J+1)
133      H(J+1) = SAVE
134      22  CONTINUE
135      23  CONTINUE
136      RETURN
137      END

```

```

C *****
C *
C *          (U):SAMPLE SIZE(15,15)
C *
C *****
ISN      1      DIMENSION NODAT(30),H(30),S(30),C(30),KS(30)
ISN      2      COMMON IA
ISN      3      REAL NODAT,N1,N2,MEAN1,MEAN2,KS
ISN      4      N1 = 15
ISN      5      N2 = 15
ISN      6      IA = 65539
ISN      7      CTT05 = 0.
ISN      8      CTT01 = 1.
ISN      9      CKS05 = 1.
ISN     10      CKS01 = 1.
ISN     11      ACKS01 = 1.
ISN     12      DO 55 IK = 1,3000
ISN     13          STD = 0.
ISN     14          SUM1 = 0.
ISN     15          SUM2 = 0.
ISN     16          SUMX1 = 0.
ISN     17          SUMX2 = 0.
C      THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C      WHEN DELTA IS 0.0 S.D.
ISN     18      FX = 500.
ISN     19      B = EX+(STD*SQRT(3.))
ISN     20      A = (2.*EX)-B
ISN     21      DO 11 J = 1,15
ISN     22          CALL UNIFM(A,B,Z)
ISN     23      10  NODAT(I) = Z
ISN     24          FX = 500.
ISN     25          B = EX+(STD*SQRT(3.))
ISN     26          A = (2.*EX)-B
ISN     27          DO 11 J = 1,30
ISN     28              CALL UNIFM(A,B,Z)
ISN     29      11  NODAT(J) = Z
C      -----T TEST-----
ISN     30      DO 8 JQ = 1,15
ISN     31      1  SUM1 = SUM1+NODAT(IQ)
ISN     32          MEAN1 = SUM1/N1
ISN     33          DO 8 JQ = 1,15
ISN     34      8  SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
ISN     35          DO 22 IJ = 1,30
ISN     36      22  SUMX1 = SUMX1+NODAT(IJ)
ISN     37          MEAN2 = SUMX1/N2
ISN     38          DO 21 KJ = 1,30
ISN     39      21  SUMX2 = SUMX2+(NODAT(KJ)-MEAN2)**2
ISN     40          XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+(1./N2))
ISN     41          TEST = (MEAN1-MEAN2)/SQRT(XX)
ISN     42          TTES1 = ABS(TEST)
ISN     43          IF(TTES1.GE.2.048)CTT05 = CTT05+.
ISN     44          IF(TTES1.GE.2.763)CTT01=CTT01+.
C      -----KS TEST-----
ISN     47      DO 100 IJ = 1,30
ISN     48      100 H(N1) = NODAT(IJ)
ISN     49          CALL RANK(H,N)
ISN     50          D = 0.
ISN     51          DO 51 KJ = 1,30
ISN     52      51  G(KJ) = 0.
ISN     53          DO 31 IJ = 1,30
ISN     54      31  DO 32 KI = 1,15
ISN     55          IF(H(IJ).EQ.NODAT(KI))GO TO 33
ISN     56          D = D+.
ISN     57          GO TO 34
ISN     58      33  D = D+(1./15.)
ISN     59      34  G(IJ) = D
ISN     60      32  CONTINUE
ISN     61      31  CONTINUE

```

```

ISN      62      F = 0.
ISN      63      DO 52 JJ = 1,30
ISN      64      52      C(INJ) = 0.
ISN      65      DO 41 JJ = 1,30
ISN      66      DO 42 JJ = 16,30
ISN      67      IF(H(JJ).EQ.NODAT(JJ))GO TO 43
ISN      68      F = E+.
ISN      69      GO TO 44
ISN      70      43      E = E+(./5.)
ISN      71      44      C(JJ) = F
ISN      72      42      CONTINUE
ISN      73      4      CONTINUE
ISN      74      DO 101 MJ = 1,30
ISN      75      101      SKS(MJ) = 7BS((G(MJ)-C(MJ)))
ISN      76      DMAX = SKS(1)
ISN      77      DO 24 LJ = 1,30
ISN      78      IF(DMAX-SKS(LJ))3,24,24
ISN      79      13      DMAX = SKS(LJ)
ISN      80      24      CONTINUE
ISN      81      IF(DMAX.GE.0.467)CKS.5 = CKS05+1
ISN      83      IF(DMAX.GE.0.523)CKS03 = CKS01+
ISN      85      IF(DMAX.GE.0.594)CKS04 = ACKS01+1
ISN      87      55      CONTINUE
ISN      88      WRITE(5,50)
ISN      89      60      FORMAT(12X,'CT105',5X,'CKS05',5X,'CTT01',5X,'CKS03',5X,'ACKS01')
ISN      90      WRITE(5,40)CT105,CKS05,CTT01,CKS03,ACKS01
ISN      91      40      FORMAT(12X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
ISN      92      STOP
ISN      93      END

```

C-----RANDOM-----

```

ISN      1      SUBROUTINE RANDOM(IX,IY,RN)
ISN      2      COMMON IA
ISN      3      IY = IX * 65539
ISN      4      IF(IY)5,6,6
ISN      5      5      IY = IY+2147483647+1
ISN      6      6      RN = IY
ISN      7      RN = RN * .4656612E-9
ISN      8      IX = IY
ISN      9      IA = IX
ISN     10      RETURN
ISN     11      END

```

C-----UNIFORM-----

```

ISN      1      SUBROUTINE UNIFM(A,B,Z)
ISN      2      COMMON IA
ISN      3      CALL RANDOM (IA,IY,RN)
ISN      4      Z = A+(B-A)*RN
ISN      5      RETURN
ISN      6      END

```

C-----RANK-----

```

ISN      1      SUBROUTINE RANK(H,N)
ISN      2      DIMENSION H(30)
ISN      3      N = 30
ISN      4      LL = N-1
ISN      5      DO 23 I = 1,LL
ISN      6      N = N-1
ISN      7      DO 22 J = 1,N
ISN      8      IF(H(J)-H(J+1))22,22,23
ISN      9      23      SAVE = H(J)
ISN     10      H(J) = H(J+1)
ISN     11      H(J+1) = SAVE
ISN     12      22      CONTINUE
ISN     13      23      CONTINUE
ISN     14      RETURN
ISN     15      END

```

```

C *****
C *
C *          S1S1: SAMPLE SIZE(5,6)
C *
C *****
1  DIMENSION NDATA(3,1),H(11),G(11),C(1,1),SKS(11)
2  COMMON IA
3  REAL NODAT,NI,N2,MEAN1,MEAN2
4      N1 = 5
5      N2 = 6
6      Y = 0.
7      AM = 0.
8      SD = 1.
9      A1=499.293749671
10     B1=10.103925233
11     C1=0.706250329
12     D1=-3.0572249
13     IA = 65539
14     CTT05 = 0.
15     CTTC1 = 0.
16     CKSC5 = 0.
17     CKSL1 = 0.
18     ACKS01 = 0.
19     DG 55IK=1,100)
20 C   STD = 10.
21     SUM1 = 0.
22     SUM2 = 0.
23     SUMX1 = 0.
24     SUMX2 = 0.
25 C   THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
26 C   WHEN DELTA IS 0.0 S.D.
27 C   EX = 500.
28     DO 10 I =1,5
29       NODAT(1)=0.
30       IF(Y.NE.0)GO TO 2
31       CALL SNORML(A1,SD,X,Y1)
32       X = (((D1*X1+C1)*X1+B1)*X1+A1)
33       Y = (((D1*Y1+C1)*Y1+B1)*Y1+A1)
34     GO TO 3
35     X = Y
36     Y = 0.
37     NODAT(1)=X
38   10 CONTINUE
39 C   EX = 500.
40     DO 11 J =6,11
41       NODAT(J)=0.
42       IF(Y.NE.0)GO TO 4
43       CALL SNORML(A1,SD,X1,Y11)
44       X = (((D1*X1+C1)*X1+B1)*X1+A1)
45       Y = (((D1*Y1+C1)*Y1+B1)*Y1+A1)
46     GO TO 5
47     X = Y
48     Y = 0.
49     NODAT(J)=X
50   11 CONTINUE
51 C-----T TEST-----
52     DO 1 IQ =1,5
53       SUM1 = SUM1+NODAT(IQ)
54     MEAN1 = SUM1 / 11
55     DO 8 JQ =1,5
56       SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
57     DO 22 IB =0,11
58       SUMX1 = SUMX1+NODAT(IB)
59     MEAN2 = SUMX1/N2
60     DO 21 KQ =6,11
61       SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
62     XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
63     TEST = (MEAN1-MEAN2)/SQRT(XX)
64     TTEST = ABS(TEST)
65     IF(TTEST.GE.2.262)CTT15 = CTT15+1
66     IF(TTEST.GE.3.250)CTT01 = CTT01+1
67 C-----KS TEST-----
68     DO 100 NI =1,11
69       H(NI) = NODAT(NI)
70       CALL RANK(H,N)
71       D=0.
72     DO 51 KJ =1,11
73       G(KJ) = 0.0
74     DO 31 IJ =1,11
75     DO 32 KI =1,5

```



```

69      IF(H(IJ).EQ.NDDA(IK))GO TO 33
70      D = D+C
71      GO TO 34
72  53   D = D+(1./N)
73  34   G(IJ) = D
74      CONTINUE
75  31   CONTINUE
76      E=D
77      DO 52 NJ =1,11
78  52   C(NJ) = C
79      DO 41 JJ =1,11
80      DO 42 JI =0,11
81      IF(H(JJ).EQ.NDDA(IJ))GO TO 43
82      E = E+D
83      GO TO 44
84  43   E = E+(1./N2)
85  44   C(JJ) = E
86  42   CONTINUE
87  41   CONTINUE
88      DO 101 MJ =1,11
89  101  SKS(MJ) = ABS((G(MJ)-C(MJ)))
90      DMAX = SKS(1)
91      DO 24 LJ =1,11
92      IF(DMAX-SKS(LJ))13,24,24
93  13   OMAX = SKS(LJ)
94  24   CONTINUE
95      IF(DMAX.GE.J.307)CKSO5 = CKSO5+1
96      IF(DMAX.GE.J.333)CKSO1 = CKSO1+1
97      IF(DMAX.GE.J.387)ACKSO1 = ACKSO1+1
98  55   CONTINUE
99      WRITE(6,6C)
100     FORMAT(12X,'CTTJ5',5X,'CKSO5',5X,'CTTL1',5X,'CKSO1',5X,'ACKSO1',7)
101     WRITE(6,4U)CTTJ5,CKSO5,CTTL1,CKSO1,ACKSO1
102  4U   FORMAT(12X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
103     STOP
104     END
-----FANDUM-----
105     SUBROUTINE RANDJUM(IX,IY,RN)
106     COMMON IA
107     IY = IX * 65539
108     IF(IY)5,6,6
109     IY = IY+2147483647+1
110     RN = IY
111     RN = RN * .4656613E-9
112     IX = IY
113     IA = IX
114     RETURN
115     END
-----STANDARD NORMAL-----
116     SUBROUTINE SNDRML(AM,SD,X1,Y1)
117     COMMON IA
118     1   CALL RANDUM(IA,IY,RN)
119     V1=2.*RN-1.
120     CALL RANDUM(IA,IY,RN)
121     V2=2.*RN-1.
122     S =V1*V1+V2*V2
123     IF(S.GE.1)GO TO 1
124     RNN1=V1*SQRT((-2.*ALOG(S))/S)
125     RNN2=V2*SQRT((-2.*ALOG(S))/S)
126     X1 = AM+RNN1*SD
127     Y1 = AM+RNN2*SD
128     RETURN
129     END
-----RANK-----
130     SUBROUTINE RANK(H,N)
131     DIMENSION H(11)
132     N = 11
133     LL = N-1
134     DO 23 II =1,LL
135     N = N-1
136     DO 22 J =2,N
137     IF(H(J)-H(J+1))22,22,21
138  21   SAVE = H(J)
139     H(J) = H(J+1)
140     H(J+1) = SAVE
141  22   CONTINUE
142  23   CONTINUE
143     RETURN
144     END

```

```

$JGB          IAJC9527
C          1AQC9527*****WASANA THONGKARUJN
C *****
C *
C *          S2S2: SAMPLE SIZE(8,16)
C *
C *****
1  DIMENSION NODAT(24),G(24),H(24),C(24),SKS(24)
2  COMMON IA
3  REAL NODAT,N1,J2,MEAN1,MEAN2
4  N1 = 8
5  N2 = 16
6  Y = 0.
7  AM = 0.
8  SD = 1.
9  A2 = 497.434751088

10 B2 = 11.666552535
11 C2 = 2.51524372
12 D2 = -0.920133941
13 IA = 65539
14 CTT(5) = 0.
15 CTT(1) = 0.
16 CKS(5) = 0.
17 CKS(1) = 0.
18 CKSC(1) = 0.
19 DO 55IK=1,100
C STD = 1.
20 SUM1 = 0.
21 SUM2 = 0.
22 SUMX1 = 0.
23 SUMX2 = 0.
C THIS IS DESIGNED TO COMPURE THE ACTUAL TYPE I ERROR
C WHEN DELTA IS 0.0 S.D
C EX = 500.
24 DO 0 J = 1,3
25 NODAT(I)=J.
26 IF(Y.NE.0)GO TO 2
27 CALL SNORML(A1,SD,X,,Y)
28 X = (((D2*X1+C2)*X1+B2)*X1+A2)
29 Y = (((D2*Y1+C2)*Y1+B2)*Y1+A2)
30 GO TO 3
31 2 X = Y
32 Y = 0.
33 3 NODAT(I)=X
34 10 CONTINUE
C EX = 500.
35 DO 1 J = 9,24
36 NODAT(J)=J.
37 IF(Y.NE.0)GO TO 4
38 CALL SNORML(A4,SD,X1,Y1)
39 X = (((D2*X1+C2)*X1+B2)*X1+A2)
40 Y = (((D2*Y1+C2)*Y1+B2)*Y1+A2)
41 GO TO 5
42 4 X = Y
43 Y = 0.
44 5 NODAT(J)=X
45 11 CONTINUE
C-----T TEST-----
46 DO 1 IQ = 1,8
47 1 SUM1 = SUM1+NODAT(IQ)
48 MEAN1 = SUM1/N1
49 DO 8 JQ = 1,8
50 8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
51 DO 22 IB = 9,24
52 22 SUMX1 = SUMX1+NODAT(IB)
53 MEAN2 = SUMX1/N2
54 DO 21 KQ = 9,24
55 21 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
56 XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
57 TEST = (MEAN1-MEAN2)/SQRT(XX)
58 TTEST = ABS(TEST)
59 IF(TTEST.GE.2.374)CTT(5) = CTT(5)+1
60 IF(TTEST.GE.2.3)CTTC(1) = CTTC(1)+1
C-----KS TEST-----
61 DO 100 NI = 1,24
62 100 H(NI) = NODAT(NI)
63 CALL RANK(H,N)
64 D=0.
65 DO 51 KJ = 1,24
66 51 G(KJ) = 0.0

```

```

57      DO 31 IJ = 1, 24
58      DO 32 KJ = 1, 3
59      IF (H(IJ).EQ.NODAT(KJ)) GO TO 35
70      D = D+0.
71      GO TO 34
72      D = D+(1./8.)
73      G(IJ) = D
74      CONTINUE
75      CONTINUE
76      E = 0.
77      DO 52 NJ = 1, 24
78      C(NJ) = 0.0
79      DO 41 JJ = 1, 24
80      DO 42 JI = 9, 24
81      IF (H(JJ).EQ.NODAT(JI)) GO TO 43
82      E = E+0.
83      GO TO 44
84      E = E+(1./16.)
85      C(JJ) = E
86      CONTINUE
87      CONTINUE
88      DO 101 MJ = 1, 24
89      SKS(MJ) = ABS((G(MJ)-C(MJ)))
90      DMAX = SKS(1)
91      DO 24 LJ = 1, 24
92      IF (DMAX-SKS(LJ)) 13, 24, 24
93      DMAX = SKS(LJ)
94      CONTINUE
95      IF (DMAX.GE.0.562) CKS05 = CKS05+1
96      IF (DMAX.GE.0.625) CKS01 = CKS01+1
97      IF (DMAX.GE.0.705) ACKS01 = ACKS01+1
98      CONTINUE
99      WRITE(6,60)
100     60  FORMAT(12X,'CTT05',5X,'CKS05',5X,'CTT01',5X,'CKS01',5X,'ACKS01')
101     WRITE(6,40)CTT05,CKS05,CTT01,CKS01,ACKS01
102     40  FORMAT(12X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
103     STOP
104     END

```

C-----RANDOM-----

```

105     SUBROUTINE RANDUM(IX,IY,RN)
106     COMMON IA
107     IY = IX * 55539
108     IF (IY) 5, 6, 5
109     5   IY = IY+2147483647+1
110     6   RN = IY
111     RN = RN * .4656613E-9
112     IX = IY
113     IA = IX
114     RETURN
115     END

```

C-----STANDARD NORMAL-----

```

116     SUBROUTINE SNJRM1(AM,SD,X1,Y1)
117     COMMON IA
118     1   CALL RANDUM (IA,IY,RN)
119     V1=2.*RN-1.
120     CALL RANDUM (IA,IY,RN)
121     V2=2.*RN-1.
122     S = V1*V1+V2*V2
123     IF (S.GE.1) GOTO 1
124     RNN1=V1*SQRT((-2.*ALOG(S))/S)
125     RNN2=V2*SQRT((-2.*ALOG(S))/S)
126     X1 = AM+RNN1.*SD
127     Y1 = AM+RNN2.*SD
128     RETURN
129     END

```

C-----RANK-----

```

130     SUBROUTINE RANK(H,N)
131     DIMENSION H(24)
132     N = 24
133     LL = N-1
134     DO 23 I = 1, LL
135     N = N-1
136     DO 22 J = 1, N
137     IF (H(J)-H(J+1)) 22, 22, 21
138     21  SAVE = H(J)
139     H(J) = H(J+1)
140     H(J+1) = SAVE
141     22  CONTINUE
142     23  CONTINUE
143     RETURN
144     END

```

```

C *****
C *
C *          JJ: SAMPLE SIZE(5,6)
C *
C *****
1  DIMENSION NODAT(L1),H(L1),G(11),C(11),SKS(11)
2  COMMON IA
3  REAL NODAT,N1,I2,MEAN1,MEAN2
4  N1 = 5.
5  N2 = 6.
6  Y = 0.
7  IA = 65539
8  CTT05 = 1.
9  CTT01 = 0.
10 CKS05 = 0.
11 CKS01 = 0.
12 ACKS01 = 0.
13 DO 55 IK = 1,100)
14 STD = 10.
15 SUM1 = 0.
16 SUM2 = 0.
17 SUMX1 = 0.
18 SUMX2 = 0.
C THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C WHEN DELTA IS 0.0 S.D.
19 EX = 500.
20 DO 10 I = 1,5
21 NODAT(I) = 0.
22 IF(Y,NE,0) GO TO 2
23 CALL NORMAL(EX,STD,X,Y)
24 GO TO 3
25 2 X = Y
26 Y = 0.
27 3 NODAT(I) = X
28 10 CONTINUE
29 EX = 500.
30 B = EX + (ST)*SQRT(3.1)
31 A = (2.*EX) - 1
32 DO 11 J = 6,11
33 CALL UNIFM(A,3,2)
34 11 NODAT(J) = Z
C-----T TEST-----
35 DO 1 IQ = 1,3
36 1 SUM1 = SUM1 + NODAT(IQ)
37 MEAN1 = SUM1 / 11
38 DO 8 JQ = 1,5
39 8 SUM2 = SUM2 + (NODAT(IQ) - MEAN1)**2
40 DO 22 IB = 6,11
41 22 SUMX1 = SUMX1 + NODAT(IB)
42 MEAN2 = SUMX1 / 12
43 DO 21 KQ = 6,11
44 21 SUMX2 = SUMX2 + (NODAT(KQ) - MEAN2)**2
45 XX = (SUM2 + SUMX2) / (N1 + N2 - 2.1*(1./N1 + 1./N2))
46 TEST = (MEAN1 - MEAN2) / SQRT(XX)
47 TTEST = ABS(TEST)
48 IF(TTEST.GE.2.252) CTT05 = CTT05 + 1
49 IF(TTEST.GE.3.250) CTT01 = CTT01 + 1
C-----KS TEST-----
50 DO 100 NI = 1,11
51 100 H(NI) = NODAT(NI)
52 CALL RANK(H,N)
53 D = 0.
54 DO 51 KJ = 1,11
55 51 G(KJ) = 0.0
56 DO 31 IJ = 1,11
57 DO 32 KI = 1,5
58 IF(H(IJ).EQ.NODAT(KI)) GO TO 33
59 D = D + 0.
60 GO TO 34
61 33 D = D + (1./5.)
62 34 G(IJ) = D
63 32 CONTINUE
64 31 CONTINUE
65 E = 0.
66 DO 52 NJ = 1,11
67 52 C(NJ) = 0.0
68 DO 41 JJ = 1,11
69 DO 42 JI = 6,11
70 IF(H(IJ).EQ.NODAT(JI)) GO TO 43
71 E = E + 0.

```

```

72      GO TO 44
73      43      E = E+(1./6.)
74      44      C(JJ) = E
75      42      CONTINUE
75      41      CONTINUE
77      DO 30 MJ = 1,11
78      111     SKS(MJ) = ABS(S(MJ)-C(MJ))
79      DMAX = SKS(1)
80      DO 24 LJ = 1,11
81      IF(DMAX-SKS(LJ))15,24,24
82      13      DMAX = SKS(LJ)
83      24      CONTINUE
84      IF(DMAX.GE.1.557)CKSL5 = CKS05+1
85      IF(DMAX.GE.1.333)CKS01 = CKS01+1
86      IF(DMAX.GE.1.917)ACKS01 = ACKS01 + 1
87      55      CONTINUE
88      WRITE(6,60)
89      60      FORMAT(12X,'CT(05)',5X,'CKS05',5X,'CT(01)',5X,'CKS01',5X,'ACKS01'/)
90      WRITE(6,40)CT(5),CKS05,CT(1),CKS01,ACKS01
91      40      FORMAT(12X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
92      STOP
93      END

```

C-----RANDOM-----

```

94      SUBROUTINE RANDJM(IX,IY,RN)
95      COMMON IA
96      IY = IX * 5529
97      IF(IY15,6,3)
98      5      IY = IY+21*7+83647+1
99      6      RN = IY
100     RN = RN * 1056612E-9
101     IX = IY
102     IA = IX
103     RETURN
104     END

```

C-----NORMAL-----

```

105     SUBROUTINE NOR4AL(EX,STD,X,Y)
106     COMMON IA

```

```

107     1      CALL RANDOM(IA,IY,RN)
108     V1=2.*RN-1.
109     CALL RANDOM(IA,IY,RN)
110     V2=2.*RN-1.
111     S =V1*V1+V2*V2
112     IF(S.GE.1)GOTO 1
113     RNN1=V1*SQRT((-2.*ALOG(S))/S)
114     RNN2=V2*SQRT((-2.*ALOG(S))/S)
115     X = EX+RNN1*ST
116     Y = EX+RNN2*ST
117     RETURN
118     END

```

C-----UNIFORM-----

```

119     SUBROUTINE UNIF4(A,B,Z)
120     COMMON IA
121     CALL RANDOM(IA,IY,RN)
122     Z = A+(B-A)*RN
123     RETURN
124     END

```

C-----RAJK-----

```

125     SUBROUTINE RAJK(H,N)
126     DIMENSION H(11)
127     N = 11
128     LL = N-1
129     DO 23 II = 1,LL
130     N = N-1
131     DO 22 J = 1,N
132     IF(H(J)-H(J+1))22,22,21
133     21      SAVE = H(J)
134     H(J) = H(J+1)
135     H(J+1) = SAVE
136     22      CONTINUE
137     23      CONTINUE
138     RETURN
139     END

```



```

C *****
C *
C *
C *
C *
C *****
1  DIMENSION NDDAT(20),H(20),G(20),C(20),SKS(20)
2  COMMON IA
3  REAL NDDAT,N1,N2,MEAN1,MEAN2
4  N1 = 10
5  N2 = 10
6  Y = 0.
7  AM = 0.
8  SD = 1.
9  A1 = 499.29374967
10 B1 = 17.163925233
11 C1 = 0.706251329
12 D1 = -0.2572239
13 IA = 65539
14 CTT05 = 0.
15 CTT01 = 0.
16 CKS05 = 0.
17 CKS01 = 0.
18 DO 50 IK = 1,1000
19 STD = 10.
20 SUM1 = 0.
21 SUM2 = 0.
22 SUMX1 = 0.
23 SUMX2 = 0.
C THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C WHEN DELTA IS 0.5 S.D.
24 FX = 500.
25 DO 10 I = 1,10
26 NDDAT(I) = 0.
27 IF(Y.NE.3)GO TO 2
28 CALL NORMAL(EX,STD,X,Y)
29 GO TO 3
30 2 X = Y
31 Y = 0.
32 3 NDDAT(I) = X
33 10 CONTINUE
C STD = 10.
C FX = 500.
34 DO 10 J = 1,20
35 NDDAT(J) = 0.
36 IF(Y.NE.3)GO TO 4
37 CALL SNORMAL(A1,SD,X1,Y1)
38 X = (((D1*X1+C1)*X1+B1)*X1+A1)
39 Y = (((D1*Y1+C1)*Y1+B1)*Y1+A1)
40 GO TO 5
41 4 X = Y
42 Y = 0.
43 5 NDDAT(J) = X
44 10 CONTINUE
C -----T TEST-----
45 DO 1 IQ = 1,10
46 SUM1 = SUM1+NDDAT(IQ)
47 MEAN1 = SUM1/IQ
48 DO 8 JQ = 1,10
49 SUM2 = SUM2+(NDDAT(JQ)-MEAN1)**2
50 DO 22 IB = 1,20
51 SUMX1 = SUMX1+NDDAT(IB)
52 MEAN2 = SUMX1/20
53 DO 21 KQ = 1,20
54 SUMX2 = SUMX2+(NDDAT(KQ)-MEAN2)**2
55 XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
56 TEST = (MEAN1-MEAN2)/SQRT(XX)
57 TTEST = ABS(TEST)
58 IF(TTEST.GE.2.101)CTT05 = CTT05+1
59 IF(TTEST.GE.2.878)CTT01 = CTT01+1
C -----KS TEST-----
60 DO 100 NI = 1,20
61 100 H(NI) = NDDAT(NI)
62 CALL RANKI(H,N)
63 G = 0.
64 DO 51 KJ = 1,20
65 51 G(KJ) = 0.
66 DO 31 IJ = 1,20
67 DO 32 KI = 1,10
68 IF(H(IJ).EQ.NDDAT(KI))GO TO 33
69 B = 0+0.
70 GO TO 34
71 33 B = 0+(1./10.)
72 34 G(IJ) = B
73 32 CONTINUE
74 31 CONTINUE
75 F = 0.
76 DO 52 NJ = 1,20
77 52 C(NJ) = 0.
78 DO 41 JJ = 1,20
79 DO 42 JI = 1,20
80 IF(H(JI).EQ.NDDAT(JJ))GO TO 43

```



```

31      E = E+A.
82      GO TO 44
33      43      F = F+(1./I.).
84      44      C(JJ) = F
85      42      CONTINUE
86      4       CONTINUE
87      DO 43 MJ = 1,2
88      401      SKS(MJ) = ABS((S(MJ)-C(MJ)))
89      DMAX = SKS(1)
91      DO 24 LJ = 1,2
91      IF(DMAX-SKS(LJ)) 3,24,24
92      13      DMAX = SKS(LJ)
93      24      CONTINUE
C      THE CALCULATION OF MULTIPLE AND QUOTIENT WILL BE DIFFERENT FROM
C      EXACT VALUE D.D. WHEN IT CALCULATES 3 FLOATING POINTS.
94      DDMAX = DMAX+.001
95      IF(DDMAX.GE.1.5) CKS05 = CKS05+1
96      IF(DDMAX.GE.1.7) CKS01 = CKS01+1
97      55      CONTINUE
98      WRITE(6,20)
99      20      FORMAT(12X,'CCT05',12X,'CKS05',12X,'CT01',12X,'CKS01')
C      WRITE(6,30)CT05,CKS05,CT01,CKS01
101      30      FORMAT(12X,F6.1,12X,F6.1,12X,F6.1,12X,F6.1)
102      STOP
103      END

```

C-----RANDJM-----

```

104      SUBROUTINE RANDJM(IY,RY,RN)
105      COMMON IA
106      IY = IY*65533
107      IF(IY)5,6,6
108      5      IY = IY+2147433547+1
109      6      RN = IY
110      RN = RN*.4656513E-9
111      IX = IY
112      IA = IX
113      RETURN
114      END

```



C-----NORMAL-----

```

115      SUBROUTINE NORMAL(FX,STD,X,Y)
116      COMMON IA
117      1      CALL RANDJM(IA,IY,RN)
118      V1 = ?.*RN-1.
119      CALL RANDJM(IA,IY,RN)
120      V2 = ?.*RN-1.
121      S = V1*V1+V2*V2
122      IF(S.GE.1)GO T)
123      RNN1 = V1*SQRT((-2.*ALOG(S))/S)
124      RNN2 = V2*SQRT((-2.*ALOG(S))/S)
125      X = FX+RNN1*STD
126      Y = FX+RNN2*STD
127      RETURN
128      END

```

C-----STANDARD-NORMAL-----

```

129      SUBROUTINE SNORMAL(A,SD,X,Y)
130      COMMON IA
131      1      CALL RANDJM(IA,IY,RN)
132      V1 = ?.*RN-1.
133      CALL RANDJM(IA,IY,RN)
134      V2 = ?.*RN-1.
135      S = V1*V1+V2*V2
136      IF(S.GE.1)GO T)
137      RNN1 = V1*SQRT((-2.*ALOG(S))/S)
138      RNN2 = V2*SQRT((-2.*ALOG(S))/S)
139      X = A+RNN1*SD
140      Y = A+RNN2*SD
141      RETURN
142      END

```

C-----RANK-----

```

143      SUBROUTINE RANK(H,N)
144      DIMENSION I(2)
145      N = 20
146      LL = N-1
147      DO 23 I = 1,LL
148      N = N-1
149      DO 22 J = 1,N
150      IF(H(J)-H(J+1))22,22,21
151      21      SAVE = H(J)
152      H(J) = H(J+1)
153      H(J+1) = SAVE
154      22      CONTINUE
155      23      CONTINUE
156      RETURN
157      END

```

```

C *****
C *
C *          JS1: SAMPLE SIZE (5,6)
C *
C *****
1  DIMENSION NODAT(11),H(11),G(11),C(11),SKS(11)
2  COMMON JA
3  REAL NODAT,N1,N2,MEAN1,MEAN2
4      N1 = 5
5      N2 = 6
6      Y = 0.
7      AM = 0.
8      SD = 1.
9      A1 = 499.293749671
10     B1 = 10.53225233
11     C1 = 0.705233329
12     D1 = -0.572289
13     I1 = 65539
14     CTT5 = 0.
15     CTT1 = 0.
16     CXS5 = 0.
17     CXS1 = 1.
18     ACKS1 = 1.
19     DD 55IK = 1,100)
C     STD = 10.
20     SUM1 = 0.
21     SUM2 = 0.
22     SUMX1 = 0.
23     SUMX2 = 0.
C     THIS IS DESIGNED TO COMPARE THE ACTUAL TYPE I ERROR
C     WHEN DELTA IS 0.05.D
24     EX = -500.
25     STD = 10.
26     R = EX+(STD*SQRT(3.))
27     A = (2.*EX)-B
28     DO 13 I = 1,5
29     CALL UNIFM(A,B,Z)
30     NODAT(I) = Z
C     EX = 500.
31     DO 11 J = 6,11
32     NODAT(J) = 0.
33     IF(Y.NE.0) GO TO 4
34     CALL SNORML(A1,SD,XI,YI)
35     X = (((D1*X1+C1)*X1+B1)*X1+A1)
36     Y = (((D1*Y1+C1)*Y1+B1)*Y1+A1)
37     GO TO 5
38     4     X = Y
39     Y = 0.
40     5     NODAT(J) = X
41     11     CONTINUE
C-----T TEST-----
42     DO 1 IQ = 1,5
43     1     SIM1 = SJM1+NODAT(IQ)
44     MEAN1 = SJM1/N1
45     DO 8 JQ = 1,5
46     8     SUM2 = SJM2+(JQ)*((JQ)-MEAN1)**2
47     DO 22 IB = 5,11
48     22     SUMX1 = SUMX1+NODAT(IB)
49     MEAN2 = SJM2/N2
50     DO 21 KQ = 5,11
51     21     SUMX2 = SJM2+(KQ)-MEAN2)**2
52     XX = (SUM2+SUMX2)/(N1+N2-2.)*((1./N1+1./N2)
53     TTEST = (MEAN1-MEAN2)/SQRT(XX)
54     TTEST = ABS(TTEST)
55     IF(TTEST.GE.2.26)CTT5 = CTT5+1
56     IF(TTEST.GE.3.25)CTT1 = CTT1+1
C-----KS TEST-----
57     DO 30 NI = 1,11
58     100     H(NI) = NODAT(NI)
59     CALL RANK(1,N)
60     D = 0.
61     DO 51 KJ = 1,11
62     51     G(KJ) = 0.
63     DO 31 IJ = 1,11
64     DO 32 JI = 1,5
65     IF(H(IJ).EQ.N)DAT(KI)GO TO 33
66     D = D+D.
67     GO TO 34
68     33     D = D+(1./N1)
69     34     G(IJ) = D
70     32     CONTINUE
71     31     CONTINUE

```

```

72      E = 0.
73      DO 52 NJ = 1, 11
74      C(NJ) = 0.
75      DO 41 JJ = 1, 11
76      DO 42 JT = 5, 11
77      IF (H(JJ).EQ.NODAT(JJ)) GO TO 42
78      E = F+0.
79      GO TO 44
80      43      E = F+(1./N2)
81      44      C(JJ) = E
82      42      CONTINUE
83      43      CONTINUE
84      DO 101 MJ = 1, 11
85      103      SKS(MJ) = ABS((G(MJ)-C(MJ)))
86      DMAX = SKS(1)
87      DO 24 LJ = 1, 11
88      IF (DMAX-SKS(LJ)) 13, 24, 24
89      13      DMAX = SKS(LJ)
90      24      CONTINUE
91      IF (DMAX.GE.0.557) CKS05 = CKS05+1
92      IF (DMAX.GE.0.333) CKS01 = CKS01+1
93      IF (DMAX.GE.0.997) ACKS01 = ACKS01+1
94      55      CONTINUE
95      WRITE (6, 63)
96      63      FORMAT(12X, 'CTTJ5', 5X, 'CKS05', 5X, 'CTT01', 5X, 'CKS01', 5X, 'ACKS01')
97      WRITE (5, 43) CTTJ5, CKS05, CTT01, CKS01, ACKS01
98      43      FORMAT(12X, F5.1, 5X, F5.1, 5X, F5.1, 5X, F5.1, 5X, F5.1)
99      STOP
100     END
101     C-----RANDOM-----
102     SUBROUTINE RANDOM(IX, IY, RN)
103     COMMON IA
104     IY = -IX * 65539
105     IF (IY) 5, 5, 5
106     IY = IY+2147483647+1
107     6      RN = IY
108     RN = RN * .4656613E-9
109     IX = IY
110     I6 = IX
111     RETURN
112     END
113     C-----STANDARD NORMAL-----
114     SUBROUTINE SDRML(A, SD, X1, Y1)
115     COMMON IA
116     CALL RANDJM(IA, IY, RN)
117     V1 = 2.*RN-.
118     CALL RANDJM(IA, IY, RN)
119     V2 = 2.*RN-.
120     S = V1*V1+V2*V2
121     IF (S.GE.1) GO TO 1
122     RNN = V1*SQRT((-2.*ALOG(S))/S)
123     RNN2 = V2*SQRT((-2.*ALOG(S))/S)
124     X1 = A+RNN!*SD
125     Y1 = A+RNN2*SD
126     RETURN
127     END
128     C-----UNIFORM-----
129     SUBROUTINE UNIFM(A, B, Z)
130     COMMON IA
131     CALL RANDJM(IA, IY, RN)
132     Z = A+(B-A)*RN
133     RETURN
134     END
135     C-----RANK-----
136     SUBROUTINE RANK(H, N)
137     DIMENSION H(11)
138     N = 11
139     LL = N-1
140     DO 23 I = 1, LL
141     N = N-1
142     DO 22 J = 1, N
143     IF (H(J)-H(J+1)) 22, 22, 21
144     21      SAVE = H(J)
145     H(J) = H(J+1)
146     H(J+1) = SAVE
147     22      CONTINUE
148     23      CONTINUE
149     RETURN
150     END

```

```

C *****
C *                                     * *
C *                               IS2: SAMPLE SIZE (1, 9) * *
C *                                     * *
C *****
1  DIMENSION N, NJ, I, J, IAT(15), H(15), G(15), C(15), SKS(15)
2  COMMON I, J
3  REAL NODAT, I1, I2, MEAN1, MEAN2
4  N1 = 6
5  N2 = 9
6  Y = 0.
7  A1 = 0.
8  S1 = 1.
9  A2 = 497.43+751.68
10 B2 = 11.65332535
11 C2 = 2.5152+3912
12 D2 = -0.92013394
13 A = 65539
14 C1C5 = 0.
15 C1C1 = 0.
16 C1S1 = 0.
17 C1S1 = 0.
18 C1S1C1 = 0.
19 DO 55 IK=1, (N1)
20 STD = 10.
21 SUM1 = 0.
22 SUM2 = 0.
23 SUMX1 = 0.
24 SUMX2 = 0.
C THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C WHEN DELTA IS 0.0 S.D.
25 EX = 500.
26 DO 11 I = 1, 6
27 NODAT(I) = 0.
28 IF (Y.NE.0) IJ TO 2
29 CALL NORMAL(14, STD, X, Y)
30 GO TO 3
31 2 X = Y
32 Y = 0.
33 NODAT(I) = X
34 10 CONTINUE
C STD = 10.
C EX = 500.
35 DO 11 J = 7, 15
36 NODAT(J) = 0.
37 IF (Y.NE.0) IJ TO 4
38 CALL SNORML(14, SD, X), Y1)
39 X = ((D2*X1+C2)+X1+B2)*X1+A2)
40 Y = ((D2*Y1+C2)+Y1+B2)*Y1+A2)
41 GO TO 5
42 4 X = Y
43 Y = 0.
44 NODAT(J) = X
45 11 CONTINUE
-----T TEST-----
46 DO 1 IO = 1, 6
47 1 SUM1 = SUM1+N1)DAT(1Q)
48 MEAN1 = SUM1/N1
49 DO 8 JQ = 1, 5
50 SUM2 = SUM2+(1)DAT(IJQ)-MEAN1)**2
51 DO 27 IB = 7, 15
52 22 SUMX1 = SUMX1+NDAT(1B)
53 MEAN2 = SUMX1/I2
54 DO 21 KQ = 7, 15
55 2. SUMX2 = SUMX2+(NDAT(IKQ)-MEAN2)**2
56 XX = (SUM2+SJ1K2)/(N1+N2-2.)*(1./N1+1./N2)
57 TEST = (MEAN1-MEAN2)/SQRT(XX)
58 TTEST = ABS(TEST)
59 IF (TTEST.GE.2.150) C1C5 = C1C5+1
60 IF (TTEST.GE.3.0) C1C10 = C1C1+1
-----KS TEST-----
61 DO 100 NI = 1, 15
62 100 H(NI) = NODAT(NI)
63 CALL RANK(H, NI)
64 D=0.
65 DO 51 KJ = 1, 15
66 51 G(KJ) = 0.0
67 DO 31 IJ = 1, 15
68 DO 32 KI = 1, 5
69 IF (H(IJ).EQ.0) DAT(KI) GO TO 33
70 D = D+0.
71 GO TO 34
72 35 D = D+(1./N1)
73 34 G(IJ) = D
74 32 CONTINUE
75 31 CONTINUE
76 F=0.
77 DO 52 NJ = 1, 15
78 52 C(NJ) = 0.0

```

```

79      DO 43 JJ = 1, 15
80      DO 42 JT = 7, 13
81      IF (H(JJ).EQ.1) DAT(JJ) ISG TO 41
82      F = F + .2
83      GO TO 44
84      43 F = F + (.7/N2)
85      44 C(JJ) = F
86      42 CONTINUE
87      41 CONTINUE
88      DO 101 MJ = 1, 15
89      101 SKS(MJ) = .4351(G(MJ)-C(MJ))
90      DMAX = SKS(1)
91      DO 24 LJ = 1, 15
92      IF (DMAX-SKS(LJ)) 23, 24, 24
93      13 DMAX = SKS(LJ)
94      24 CONTINUE
95      IF (DMAX.GE.0.655) CKS(5) = CKS(5)+1
96      IF (DMAX.GE.0.777) CKS(1) = CKS(1)+1
97      IF (DMAX.GE.0.859) ACKS(1) = ACKS(1)+1
98      55 CONTINUE
99      WRITE(6,60)
100     60  FORMAT(2X,'CTT(5)',5X,'CKS(5)',5X,'CTT(1)',5X,'CKS(1)',5X,'ACKS(1)')
101     WRITE(6,40) CTT(5),CKS(5),CTT(1),CKS(1),ACKS(1)
102     40  FORMAT(2X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1,5X,F5.1)
103     STOP
104     END

```

-----F ANDUM-----

```

105     SUBROUTINE R4JJM(IY,RN)
106     COMMON IA
107     IY = IY + 65539
108     IF (IY) 5, 6, 7
109     5 IY = IY + 2147 + 83647 + 1
110     6 RN = IY
111     RN = RN * .4056611E-9
112     IX = IY
113     IY = IX
114     RETURN
115     END

```

-----NORMAL-----

```

115     SUBROUTINE NORMAL(IX,STD,X,Y)
116     COMMON IA
117     CALL FANDUM(IA,IY,RN)
118     V1 = 2.*RN-1.
119     CALL FANDUM(IA,IY,RN)
120     V2 = 2.*RN-1.
121     S = V1*V1+V2*V2
122     IF (S.GE.1) GO TO 1
123     FNN1 = V1*SQRT((-2.*ALOG(S))/S)
124     FNN2 = V2*SQRT((-2.*ALOG(S))/S)
125     X = IX+FNN1*STD
126     Y = (X+FNN2*STD)
127     RETURN
128     END

```

-----STANDARD NORMAL-----

```

131     SUBROUTINE SJR4L(AM,SD,X1,Y1)
132     COMMON IA
133     1 CALL FANDUM(IA,IY,RN)
134     V1 = 2.*RN-1.
135     CALL FANDUM(IA,IY,RN)
136     V2 = 2.*RN-1.
137     S = V1*V1+V2*V2
138     IF (S.GE.1) GO TO 1
139     FNN1 = V1*SQRT((-2.*ALOG(S))/S)
140     FNN2 = V2*SQRT((-2.*ALOG(S))/S)
141     X1 = AM+RN(1)*SD
142     Y1 = (X1+FNN2*SD)
143     RETURN
144     END

```

-----RANK-----

```

144     SUBROUTINE RANK(H,K)
145     DIMENSION H(15)
146     N = 15
147     L1 = K-1
148     DO 23 I = 1, L1
149     N = N-1
150     DO 22 J = 1, I
151     IF (H(J)-H(J+1)) 22, 22, 21
152     21 SAVE = H(J)
153     H(J) = H(J+1)
154     H(J+1) = SAVE
155     22 CONTINUE
156     23 CONTINUE
157     RETURN
158     END

```

```

C *****
C *
C *          LIST: SAMPLE SIZE (5,5)
C *
C *****
1  DIMENSION NDATA(10),H(10),G(10),C(10),SKS(10)
2  COMMON JA
3  REAL NDATA,N1,N2,MEAN1,MEAN2
4  N1 = 5
5  N2 = 5
6  Y = 1.
7  AM = 0.
8  SD = 1.
9  A1=459.293743671
10 P1=10.165225253
11 C1=1.716253325
12 D1=-1.0572239
13 A2 = 497.431751038
14 E2 = 22.66552335
15 C2 = 2.515243912
16 D2=-7.920133941
17 IA = 65539
18 CTT(5) = 0.
19 CTT(1) = 0.
20 CKS(5) = 0.
21 CKS(1) = 1.
22 DO 50 IK=1,100
23 STD = 10.
24 SUM1 = 0.
25 SUM2 = 0.
26 SUMX1 = 0.
27 SUMX2 = 0.
C THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C WHEN DELTA IS 1.0 S.D.
C FX = 500.
27 DO 10 I = 1,5
28 NDATA(I)=J.
29 IF (Y.NE.0) GO TO 2
30 CALL SNGRML(A1,SD,X1,Y1)
31 X = (((D1*X1+C1)*X1)+P1)*X1+A1)
32 Y = (((D1*Y1+C1)*Y1)+P1)*Y1+A1)
33 GO TO 2
34 2 X = Y
35 Y = 0.
36 NDATA(I)=X
37 10 CONTINUE
C STD = 10.
C FX = 500.
38 DO 11 J = 6,10
39 NDATA(J)=0.
40 IF (Y.NE.0) GO TO 4
41 CALL SNGRML(A1,SD,X1,Y1)
42 X = (((D2*X1+C2)*X1)+B2)*X1+A2)
43 Y = (((D2*Y1+C2)*Y1)+B2)*Y1+A2)
44 GO TO 5
45 4 X = Y
46 Y = 0.
47 5 NDATA(J)=X
48 11 CONTINUE
C ----- T TEST -----
49 DO 1 IO = 1,5
50 SUM1 = SUM1+NDAT(IO)
51 MEAN1 = SUM1/N1
52 DO 8 JO = 1,5
53 SUM2 = SUM2+(NDAT(JO)-MEAN1)**2
54 DO 22 IB = 6,10
55 SUMX1 = SUMX1+NDAT(IB)
56 MEAN2 = SUMX1/42
57 DO 21 KQ = 6,10
58 SUMX2 = SUMX2+(NDAT(KQ)-MEAN2)**2
59 XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
60 TTEST = (MEAN1-MEAN2)/SQRT(XX)
61 TTEST = ABS(TTEST)
62 IF (TTEST.GE.2.316) CTT(5) = CTT(5)+1
63 IF (TTEST.GE.3.355) CTT(1) = CTT(1)+1
C ----- S TEST -----
64 DO 100 NI = 1,10
65 H(NI) = NDATA(NI)
66 CALL FAKK(H,N)
67 D=1.
68 DO 53 KJ = 1,10
69 G(KJ) = 0.
70 DO 33 IJ = 1,10
71 DO 32 KI = 1,5
72 IF (H(IJ).EQ.0) NDATA(KI) GO TO 25

```



```

74      D = D+J.
75      GO TO 34
76      D = D+(1./N1)
77      C(I,J) = -D
78      CONTINUE
79      I = I+1
80      DO 57 MJ = 1, 10
81      C(MJ) = 0.0
82      DO 47 JJ = 1, 10
83      DO 42 JJ = 1, 10
84      IF (H(JJ).EQ.10) T(JJ) GO TO 43
85      F = F+D.
86      GO TO 44
87      F = F+(1./N2)
88      C(JJ) = F
89      CONTINUE
90      CONTINUE
91      DO 10 MJ = 1, 10
92      SKS(MJ) = ABS((S(MJ)-C(MJ)))
93      DMAX = SKS(1)
94      DO 14 LJ = 1, 10
95      IF (DMAX-SKS(LJ)) 13, 24, 24
96      DMAX = SKS(LJ)
97      CONTINUE
C      THE CALCULATION OF MULTIPLE AND QUOTIENT WILL BE DIFFERENT FROM
C      EXACT VALUE (J,J) WHEN IT CALCULATES 3 FLOATING POINTS.
98      DDMAX = DMAX+.001
99      IF (DDMAX.GE.0.100) CKS(5) = CKS(5)+1
100      IF (DDMAX.GE.0.100) CKS(3) = CKS(3)+2
101      CONTINUE
102      WRITE(6,80)
103      FORMAT(12X,'C(1,5)',12X,'CKS(5)')
104      WRITE(6,80)
105      FORMAT(12X,F6.1,12X,F6.1)
106      WRITE(6,80)
107      FORMAT(48X,'C(10,1)',12X,'CKS(1)')
108      WRITE(6,80)
109      FORMAT(48X,F6.1,12X,F6.1)
110      STOP
111      END

```

-----F ALDUM-----

```

112      SUBROUTINE RAJUM(IX,IY,RN)
113      COMMON 14
114      IY = IX * .55559
115      IF (IY) 5, 5, 5
116      IY = IY+2147483547+1
117      RN = IY
118      RN = RN * .+0566125-9
119      IX = IY
120      IA = IX
121      RETURN
122      END

```

-----STANDARD NUMAL-----

```

123      SUBROUTINE SNUMAL(AM,SD,X1,Y1)
124      COMMON 14
125      CALL FANDU4(IA,IY,RN)
126      V1 = 2.*RN-1.
127      CALL FANDU4(IA,IY,RN)
128      V2 = 2.*RN-1.
129      S = V1*V1+V2*V2
130      IF (S.GE.1) GO TO 1
131      FNN1 = V1*SQRT((-2.*ALOG(S))/S)
132      FNN2 = V2*SQRT((-2.*ALOG(S))/S)
133      X1 = AM+RN11*SD
134      Y1 = AM+FNN2*SD
135      RETURN
136      END

```

-----FANK-----

```

137      SUBROUTINE RANK(H,F)
138      DIMENSION H(10)
139      N = 10
140      LL = N-1
141      DO 23 J = 1, LL
142      N = N-1
143      DO 22 J = 1, 1
144      IF (H(J)-H(J+1)) 23, 22, 23
145      SAVE = H(J)
146      H(J) = H(J+1)
147      H(J+1) = SAVE
148      CONTINUE
149      CONTINUE
150      RETURN
151      END

```

```

C *****
C *
C *          JS2: SAMPLE SIZE (6,9)
C *
C *****
1  DIMENSION NDDAT(15),H(15),S(15),C(5),SKS(5)
2  COMMON TA
3  REAL NDDAT,ME,N2,MEAN1,MEAN2
4      N1 = 6
5      N2 = 9
6      Y = 0.
7      AM = 0.
8      SD = 1.
9      B2 = 497.434751088
10     B2 = 11.565552335
11     C2 = 2.515243912
12     D2 = -0.921133941
13     TA = 65539
14     CTT05 = 0.
15     CTT1 = 0.
16     CKS05 = 0.
17     CKS1 = 0.
18     CKS11 = 0.
19     DO 55 IK = 1,15
20     SUM1 = 0.
21     SUM2 = 0.
22     SUMX1 = 0.
23     SUMX2 = 0.
C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C     WHEN DELTA IS 0.1 S.D.
24     FX = 500.
25     STD = 10.
26     R = FX+(STD*SQRT(3.))
27     A = 12.*FX)-3
28     DO 11 I = 1,6
29     CALL UNIFM(A,B,Z)
30     NDDAT(I) = Z
C     STD = 10.
C     FX = 500.
31     DO 11 J = 7,15
32     NDDAT(J) = 0.
33     IF(Y.NE.0) GO TO 4
34     CALL SNORML(A4,SD,X1,Y1)
35     K = (((D2*X1+22)*X1)+B2)*X1+B2)
36     Y = (((D2*Y1+C2)*Y1)+B2)*Y1+B2)
37     GO TO 5
38     4 X = Y
39     Y = 0.
40     5 NDDAT(J) = X
41     11 CONTINUE
C ----- T TEST -----
42     DO 10 IQ = 1,6
43     1 SUM1 = SJM1+NDDAT(IQ)
44     MEAN1 = SJM1/41
45     DO 8 JQ = 1,6
46     8 SUM2 = SJM2+(NDDAT(JQ)-MEAN1)**2
47     DO 22 IB = 7,15
48     22 SUMX1 = SJM1+NDDAT(IB)
49     MEAN2 = SJM1/N2
50     DO 21 KQ = 7,15
51     21 SUMX2 = SJM2+(NDDAT(KQ)-MEAN2)**2
52     XX = (SUM2+SJM2)/(N1+N2-2.)*(1./N1+1./N2)
53     TTEST = (MEAN1-MEAN2)/SQRT(XX)
54     TTEST = ABS(TTEST)
55     IF(TTEST.GE.2.16) CTT05 = CTT05+1
56     IF(TTEST.GE.3.112) CTT01 = CTT01+1
C ----- S TEST -----
57     DO 100 NI = 1,15
58     100 H(NI) = NDDAT(NI)
59     CALL RANK(-,N)
60     D = 0.
61     DO 51 KJ = 1,15
62     51 S(KJ) = 0.
63     DO 31 IJ = 1,15
64     DO 32 KI = 1,6
65     IF(-H(IJ).EQ.NDDAT(KI))GO TO 33
66     D = D+1.
67     GO TO 34
68     33 J = D+(1./6.)
69     34 S(IJ) = D
70     32 CONTINUE
71     31 CONTINUE

```

```

72      E = F.
73      DO 52 NJ = 1, 15
74  52   C(NJ) = F.
75      DO 41 JJ = 1, 15
76      DO 42 JI = 7, 15
77      IF (H(JJ), FJ, NJ) AT (JI) GO TO 43
78      E = F + C.
79      GO TO 44
80      F = F + (1./9.)
81  44   C(JJ) = F
82  42   CONTINUE
83  41   CONTINUE
84      DO 101 MJ = 1, 15
85  101  SKS(MJ) = ABS((B(MJ) - C(MJ)))
86      DMAX = SKS(1)
87      DO 24 LJ = 1, 15
88      IF (DMAX - SKS(LJ)) 13, 24, 24
89  13   DMAX = SKS(LJ)
90  24   CONTINUE
91      IF (DMAX .GE. 0.655) CKS05 = CKS05 + 1
92      IF (DMAX .GE. 0.777) CKS01 = CKS01 + 1
93      IF (DMAX .SF. 0.359) ACKS01 = ACKS01 + 1
94  55   CONTINUE
95      WRITE (6, 6)
96  53   FORMAT (12X, 'CTT', 5, '5X, 'CKS05', 5X, 'CTT01', 5X, 'CKS01', 5X, 'ACKS01' /)
97      WRITE (6, 40) CTT, 5, CKS05, CTT01, CKS01, ACKS01
98  41   FORMAT (12X, F5.1, 5X, F5.1, 5X, F5.1, 5X, F5.1, 5X, F5.1)
99      STOP
100     END

```

-----RANDOM-----

```

101     SUBROUTINE RANDOM(IX, IY, RN)
102     COMMON IA
103     IY = IX + 65539
104     IF (IY) 5, 6, 5
105     5   IY = IY + 2147483647 + 1
106     6   RN = IY
107     RN = RN * .4656613E-9
108     IX = IY
109     IA = IX
110     RETURN
111     END

```

-----STANDARD NORMAL-----

```

112     SUBROUTINE SNORML(A, SD, X, Y)
113     COMMON IA
114     1   CALL RANDOM(IA, IY, RN)
115     V1 = 2.*RN - 1.
116     CALL RANDJ4(IA, IY, RN)
117     V2 = 2.*RN - 1.
118     S = V1*V1 + V2*V2
119     IF (S .GT. 1) GO TO 121
120     RNV1 = V1*SQR((-2.*ALOG(S))/S)
121     RNV2 = V2*SQR((-2.*ALOG(S))/S)
122     X = A + RNV1*SD
123     Y = A + RNV2*SD
124     RETURN
125     END

```

-----UNIFORM-----

```

126     SUBROUTINE UNIF(A, B, Z)
127     COMMON IA
128     CALL RANDJ4(IA, IY, RN)
129     Z = A + (B - A)*RN
130     RETURN
131     END

```

-----RANK-----

```

132     SUBROUTINE RANK(H, N)
133     DIMENSION H(15)
134     N = 15
135     LL = N - 1
136     DO 23 I = 1, LL
137     N = N - 1
138     DO 22 J = 1, N
139     IF (H(J) - H(J+1)) 22, 22, 23
140     21  SAVE = H(J)
141     H(J) = H(J+1)
142     H(J+1) = SAVE
143     22  CONTINUE
144     23  CONTINUE
145     RETURN
146     END

```

ประวัติผู้เขียน

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