บรรณานุกรม

ภาษาต่างประเทศ

Blair, R.C., Higgins, J.J. & Smitley, W.D.S. "On the relative power of the U and t-test." British Journal of Mathematical and Statistical Psychology 33(1 1980) : 114-120, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 312.

_____. "A Comparison of the power of Wilocoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 309-335.

Boneau, C.A. "The effects of violations of assumptions underlying the t-test." Psychological Bulletin 57 (1960) : 49-64, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 332.

_____. "A comparison of the power of the U and t-tests." Psychological Review 69 (1962) : 246-256, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 312.

Bradley, James V. Distribution-Free Statistical Tests. New Jersey : Prentice-Hall, Inc. 1968.

Cochran, W.G. "Some consequences when the assumptions for the analysis of variance are not satisfied." Biometics 3 (1947) : 22-38, cited by Ramsey, Philip H. "Exact Type I Error Rates for Robustness of Student's t Test with Unequal Variance." Journal of Educational Statistics 5 (Winter 1980) : 337-349.

Derek Srisukho. "Monte Carlo Study of the Power of H-Test Compared to F-Test when Population Distributions are Different in Form." Dissertation of Doctor Degree, University of California, Berkeley, 1974.

Dixon, W.J. "Power under normality of several nonparametics tests." Annals of Mathematical Statistics 25 (1954) : 610-614, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 311.

Gibbons, Jean Dickinson. Nonparametric Statistical Inference. New York : McGraw-Hill, 1971.

Guiford, J.P. & Benjamin, Fruchter. Fundamental Statistics in Psychology and Education. 5th ed. Tokyo : McGraw-Hill, 1973.

Hodges, J.L. & Lehmann, E.L. "The efficiency of some nonparametric competitors of the t-test." Annals of Mathematical Statistics 27 (1956) : 324-335, 336, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum

Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 311.

Kirk, Roger E. Experimental Design Procedures for the Behavioral Sciences. California : Brooke cole, 1969.

Lehmann, E.L. Nonparametrics. San Francisco : Holden-Day, 1975, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 311.

Marascuilo, Leonard A. & McSweeney, Maryellen. Nonparametric' and distribution-Free Methods for the Social Sciences. California : Brooks Cole, 1977.

Minium, Edward W. Statistical Reasoning in Psychology and Education. 2 rd ed. New York : John Wiley, 1978.

Mood, Aiexander M. & Graybill, Franklin. Introduction to the Theory of Statistic. 2d ed. New York : McGraw-Hill, 1968.

Neave, H.R. & Granger, C.W.J. "A Monte Carlo study comparing various two-sample tests for differences in mean." Technometrics 10 (1968) : 509-522, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 311-312.

Nie, Norman H., et al. Statistical Package for the Social Sciences. 2nd ed. New York : McGraw-Hill, 1975.

Neyman, J. First Course in Probability and Statistics. New York : Henry Holt, 1950, cited by Derek Srisukho "Monte Carlo Study of the Power of H-Test Compared to F-Test when Population Distributions are Different in Form." Dissertation of Doctor Degree, University of California, Berkeley, 1974.

Ramsey, Philip H. "Exact Type I Error Rates for Robustness of Student's t Test with Unequal Variances." Journal of Educational Statistics 5 (Winter 1980) : 337-349.

Sawat Pratoomraj. "The effect of unequal sample size and variance heterogeneity and non-normality on some two-sample test : an empirical investigation." Dissertation of Doctor Degree, University of Iowa, 1970.

Shannon, Robert E. System Simulation. New York : Prentice-Hall, 1975.

Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York : McGraw-Hill, 1956.

Toothaker, L.E. An empirical investigation of the permutation t-test as compared to Student's t-test and the Mann-Whitney U-test. Madison, Wis. : Wisconsin Research and Development Center for Cognitive Learning, 1972, cited by Blair, R.C. & Higgins, J.J. "A comparison of the power of Wilcoxon's Rank-Sum Statistic to that of Student's t Statistic under various nonnormal distributions." Journal of Educational Statistics 5 (Winter 1980) : 312.

ภาษาไทย

ชัยศิริ บัณฑิตานนท์. The Scientific Subroutine Package. กรุงเทพ : สถาบันบริการคอมพิวเตอร์ จุฬาลงกรณ์มหาวิทยาลัย, 1980.

ประคอง กรรณสูต. สถิติเพื่อการวิจัยทางพฤติกรรมศาสตร์. กรุงเทพ : บรรณกิจ, 2525.

วิเชียร เกตุสิงห์. สถิติวิเคราะห์สำหรับการวิจัย. กรุงเทพ : สำนักงานคณะกรรมการการศึกษาแห่งชาติ, 2524.

สุญาณี จิตตะยโศธร. "การศึกษาโดยวิธีมอนติคาร์โล : การเปรียบเทียบความคลาดเคลื่อนประเภทที่ ๑ จากข้อมูลที่ฝ่าฝืนข้อตกลงเบื้องต้นของการเปรียบเทียบพหุคูณ." วิทยานิพนธ์ปริญญามหาบัณฑิต ภาควิชาวิจัยการศึกษา บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย, 2525.

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ภาคผนวก

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ภาคผนวก ก.

การคำนวณช่วงความเชื่อมั่นของอัตราความคลาดเคลื่อนที่ระบุ (I)

วิธีคำนวณเกณฑ์ในการตัดสินอัตราความคลาดเคลื่อนที่ระบุ (nominated) ซึ่งสามารถคำนวณจากช่วงความเชื่อมั่นของ p เมื่อ p หมายถึงโอกาสที่เกิดจากความคลาดเคลื่อนประเภทที่ 1 ดังนี้

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

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

เพราะฉะนั้น

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

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

$$0.0364917 \leq p \leq 0.0635083$$

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

เพราะฉะนั้น

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

$$.0081051 \leq p \leq .0181051$$

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

$p = .01$ คือ $.008 \leq p \leq .018$

หมายเหตุ เกณฑ์ของโคแรนกำหนดช่วงของความเชื่อมั่นดังนี้

สำหรับ $p = .05$ คือ $.040 \leq p \leq .060$

$p = .01$ คือ $.007 \leq p \leq .015$

เพราะเหตุที่เกณฑ์ของโคแรนนั้นเป็นช่วงที่สั้นกว่าช่วงความเชื่อมั่นที่คำนวณได้ และ Ramsey ได้ใช้เกณฑ์ของโคแรนในการตัดสินอัตราความคลาดเคลื่อนประเภทที่ 1 ของการทดสอบที การวิจัยครั้งนี้จึงเลือกใช้เกณฑ์ของโคแรนตัดสินการเปรียบเทียบอัตราความคลาดเคลื่อนประเภทที่ 1 จากผลการทดลองกับอัตราความคลาดเคลื่อนที่ระบุ

<u>การทดสอบความแตกต่างกันของสัดส่วนของอำนาจของการทดสอบ</u>

ทำการทดสอบความแตกต่างอย่างมีนัยสำคัญทางสถิติของสัดส่วนของอำนาจของการทดสอบด้วยการทดสอบซี (Z-test) และเนื่องจากทดลองนี้ทำการซิมูเลทเพียง 1,000 ครั้ง เพื่อประหยัดการทำงานของเครื่องคอมพิวเตอร์จึงกำหนดอัตราความคลาดเคลื่อนที่ระบุสำหรับการทดสอบซีเท่ากับ .10

ทดสอบความแตกต่างอย่างมีนัยสำคัญของอำนาจของการทดสอบของ t-(NN,5) กับ W-(NN,5), T-(NN,5), V-(NN,5) เมื่อเดลต้ามีค่าเท่ากับ 0.25σ และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .05

จากสูตร
$$Z = \frac{\hat{p}1 - \hat{p}2}{\sqrt{\frac{\hat{p}1\hat{q}1}{n1} + \frac{\hat{p}2\hat{q}2}{n2}}}$$

เมื่อ $\hat{p}1$ คือสัดส่วนของอำนาจของการทดสอบของ t-(NN,5)

$\hat{p}2$ คือสัดส่วนของอำนาจของการทดสอบของ W-(NN,5)

$\hat{q}1$ คือ $(1-\hat{p}1)$

n1 คือจำนวนครั้งของการทดลองหาค่าของอำนาจของการทดสอบของ t-(NN,5)

n2 คือจำนวนครั้งของการทดลองหาค่าของอำนาจของการทดสอบของ W-(NN,5)

$$\therefore \quad Z = \frac{0.069 - 0.063}{\sqrt{\frac{(.069)(.931)}{1000} + \frac{(.063)(.937)}{1000}}}$$

$$= 0.5404089$$

ไม่มีเหตุผลเพียงพอที่จะสรุปว่า อำนาจของการทดสอบของ t-(NN,5), W-(NN,5), T-(NN,5), V-(NN,5) ณ จุดนี้แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .10 นั่นคือที่เดลต้ามีค่าเท่ากับ 0.25σ และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .05 การทดสอบของ t-(NN,5), W-(NN,5) และ T-(NN,5) มีอำนาจของการทดสอบใกล้เคียงกัน

ทดสอบความแตกต่างอย่างมีนัยสำคัญของอำนาจของการทดสอบของ t-(NN,10) กับ T-(NN,10) เมื่อเดลต้ามีค่าเท่ากับ 1.25σ และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .01

จากสูตร

$$Z = \frac{\hat{p}1 - \hat{p}2}{\sqrt{\frac{\hat{p}1\hat{q}1}{n1} + \frac{\hat{p}2\hat{q}2}{n1}}}$$

$$\therefore \quad Z = \frac{0.491 - 0.401}{\sqrt{\frac{(.491)(.509)}{1000} + \frac{(.401)(.599)}{1000}}}$$

$$= 4.0652961$$

สรุปได้ว่าอำนาจของการทดสอบของ t-(NN,10) และ T-(NN,10) ณ จุดนี้แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .05 นั่นคือที่เดลต้ามีค่าเท่ากับ 1.25σ และกำหนดอัตราความคลาดเคลื่อนที่ระบุ .01 t-(NN,10) มีอำนาจของการทดสอบเหนือกว่า T-(NN,10)

```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    12/03/83      TIME    02.03.53

          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *       THE COMPUTER PROGRAM, USED IN THIS STUDY IS       *
          C *   WRITTEN IN FORTRAN IV. IT IS DESIGNED TO COMPUTE      *
          C *   THE ACTUAL TYPE I ERROR WHEN DELTA IS 0.0 BESIDES     *
          C *   COMPUTING THE POWER OF TESTS WHEN DELTA'S ARE 0.25S.D., *
          C *   0.5S.D.,0.75S.D.,1.0S.D.,1.25S.D. AND 1.75S.D. AND THE *
          C *   POPULATION VARIANCES ARE 100.                         *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *                 NN : SAMPLE SIZE(N1) = 5                *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
          C
          C     DISCRIPTION OF PARAMETERS
          C          N1 = SAMPLE SIZE FORM POPULATION 1.
          C          N2 = SAMPLE SIZE FORM POPULATION 2.
          C          EX = MEAN OF POPULATION
          C          STD= STANDARD DEVIATION OF POPULATION
          C          EV = THE EXPECTED NORMAL SCORE
          C          ZI = THE INVERSE-NORMAL SCORE
          C
0001            DIMENSION NODAT(10),RR(10),R(10),EV(10),ZI(10),IEV(10),
               *IZI(10)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 5
0005            N2 = 5
0006            Y = 0.
          C/-----------------------------------------------------------------/
0007            DO 2000KKK = 1,8
0008            IA = 65539
0009            CTT05 = 0.
0010            CTT01 = 0.
0011            CWIN05 = 0.
0012            CWIN01 = 0.
0013            CTER05 = 0.
0014            CTER01 = 0.
0015            CVAN05 = 0.
0016            CVAN01 = 0.
          C/-----------------------------------------------------------------/
0017            DO 1001 = 1,1000
0018            STD = 10.
0019            SUM1  = 0.
0020            SUM2  = 0.
0021            SUMX1 = 0.
0022            SUMX2 = 0.
0023            SUMR1  = 0.
0024            SUMR2  = 0.
0025            ISUMT1= 0
0026            ISUMT2= 0
0027            ISUMV1= 0
0028            ISUMV2= 0
0029            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0030         19 EX = 500.
0031            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0032         12 EX = 502.5
0033            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0034         13 EX = 505.0
0035            GO TO 20
```

```
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 0.75S.D.
   14 EX = 507.5
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.0S.D.
   15 EX = 510.0
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.25S.D.
   16 EX = 512.5
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.50S.D.
   17 EX = 515.0
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.75S.D.
   18 EX = 517.5
   20 DO 10J = 1,5
      IF(Y.NE.0.)GO TO 21
      CALL NORMAL(EX,STD,X,Y)
      GO TO 10
   21 X = Y
      Y = 0.
   10 NODAT(J) = X
      EX = 500.
      DO 11IX = 6,10
      IF(Y.NE.0.)GO TO 22
      CALL NORMAL(EX,STD,X,Y)
      GO TO 11
   22 X = Y
      Y = 0.
   11 NODAT(IX) = X
C/-----------------------------T-TEST-----------------------------------------/
      DO 1IQ = 1,5
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,5
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 6,10
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 6,10
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.306) CTT05 = CTT05+1
      IF(TTEST.GE.3.355) CTT01 = CTT01+1
C/-----------------------------WILCOXON---------------------------------------/
      N = 10
      CALL RANK(NODAT,R,N)
      DO 3K = 1,10
    3 RR(K) = R(K)
      DO 4L = 1,5
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 6,10
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 IF(TR1.LE.18.0) CWIN05 = CWIN05+1
      IF(TR1.LE.15.0) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING--------------------------------/
      DO 30IJ = 1,10
      IF(RR(IJ).EQ.1.) IEV(IJ) = -154
      IF(RR(IJ).EQ.2.) IEV(IJ) = -100
      IF(RR(IJ).EQ.3.) IEV(IJ) = -66
      IF(RR(IJ).EQ.4.) IEV(IJ) = -38
      IF(RR(IJ).EQ.5.) IEV(IJ) = -12
      IF(RR(IJ).EQ.6.) IEV(IJ) =  12
      IF(RR(IJ).EQ.7.) IEV(IJ) =  38
      IF(RR(IJ).EQ.8.) IEV(IJ) =  66
      IF(RR(IJ).EQ.9.) IEV(IJ) = 100
      IF(RR(IJ).EQ.10.)IEV(IJ) = 154
   30 CONTINUE
```

```
0101          DO 311K = 1,5
0102       31 ISUMT1 = ISUMT1+IEV(IK)
0103          DO 321N = 6,10
0104       32 ISUMT2 = ISUMT2+IEV(IN)
0105          IF(ISUMT1.GT.ISUMT2) GO TO 33
0106          IT1 = ISUMT2
0107          GO TO 34
0108       33 IT1 = ISUMT1
0109       34 IF(IT1.GE.292) CTERO5 = CTERO5+1
0110          IF(IT1.EQ.370) CTERO1 = CTERO1+1
            C/-------------------------------VAN DER WAERDEN---------------------------------/
0111          DO 50JJ = 1,10
0112          IF(RR(JJ).EQ.1.) IZI(JJ) =-134
0113          IF(RR(JJ).EQ.2.) IZI(JJ) = -91
0114          IF(RR(JJ).EQ.3.) IZI(JJ) = -60
0115          IF(RR(JJ).EQ.4.) IZI(JJ) = -35
0116          IF(RR(JJ).EQ.5.) IZI(JJ) = -11
0117          IF(RR(JJ).EQ.6.) IZI(JJ) =  11
0118          IF(RR(JJ).EQ.7.) IZI(JJ) =  35
0119          IF(RR(JJ).EQ.8.) IZI(JJ) =  60
0120          IF(RR(JJ).EQ.9.) IZI(JJ) =  91
0121          IF(RR(JJ).EQ.10.)IZI(JJ) = 134
0122       50 CONTINUE
0123          DO 51LL = 1,5
0124       51 ISUMV1 = ISUMV1+IZI(LL)
0125          DO 52MM = 6,10
0126       52 ISUMV2 = ISUMV2+IZI(MM)
0127          IF(ISUMV1.GT.ISUMV2) GO TO 53
0128          ITV1 = ISUMV2
0129          GO TO 54
0130       53 ITV1 = ISUMV1
0131       54 IF(ITV1.GE.260) CVANO5 = CVANO5+1
0132          IF(ITV1.GE.331) CVANO1 = CVANO1+1
0133      100 CONTINUE
0134          WRITE(3,200)
0135      200 FORMAT(//5X,'CTTO5',5X,'CWINO5',5X,'CTERO5',5X,'CVANO5')
0136          WRITE(3,300)CTTO5,CWINO5,CTERO5,CVANO5
0137      300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0138          WRITE(3,400)
0139      400 FORMAT(/55X,'CTTO1',5X,'CWINO1',5X,'CTERO1',5X,'CVANO1')
0140          WRITE(3,500)CTTO1,CWINO1,CTERO1,CVANO1
0141      500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0142     2000 CONTINUE
0143          STOP
0144          END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME   02.04.13

          C/-----------------------------RANDOM-----------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

RANDOM(.)

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จุฬาลงกรณ์มหาวิทยาลัย

```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83     TIME    02.04.58

          C/-----------------------------NORMAL-----------------------------------------------/
0001            SUBROUTINE NORMAL(EX,STD,X,Y)
0002            COMMON IA
0003          1 CALL RANDOM(IA,IY,RN)
0004            V1 = 2.*RN-1.
0005            CALL RANDOM(IA,IY,RN)
0006            V2 = 2.*RN-1.
0007            S = V1*V1+V2*V2
0008            IF(S.GE.1)GO TO 1
0009            RNN1 = V1*SQRT((-2.* ALOG(S))/S)
0010            RNN2 = V2*SQRT((-2.* ALOG(S))/S)
0011            X = EX+RNN1*STD
0012            Y = EX+RNN2*STD
0013            RETURN
0014            END
```

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```
COS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME   02.05.36

C/-------------------------------RANK-------------------------------------------------/
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(10),R(10)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME    02.09.51

          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *                 NN : SAMPLE SIZE(N1) = 10               *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
0001            DIMENSION NODAT(20),RR(20),R(20),FV(20),ZI(20),IFV(20),
               *IZI(20)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 10
0005            N2 = 10
          C/-----------------------------------------------------------------------/
0006            DO 2000KKK = 1,8
0007            IA = 65539
0008            CTT05 = 0.
0009            CTT01 = 0.
0010            CWIN05 = 0.
0011            CWIN01 = 0.
0012            CTER05 = 0.
0013            CTER01 = 0.
0014            CVAN05 = 0.
0015            CVAN01 = 0.
          C/-----------------------------------------------------------------------/
0016            DO 1001 = 1,1000
0017            STD = 10.
0018            SUM1  = 0.
0019            SUM2  = 0.
0020            SUMX1 = 0.
0021            SUMX2 = 0.
0022            SUMR1 = 0.
0023            SUMR2 = 0.
0024            EXPP  = 0.
0025            ZII   = 0.
0026            ISUMT1= 0.
0027            ISUMT2= 0.
0028            ISUMV1= 0.
0029            ISUMV2= 0.
0030            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0031         19 EX = 500.
0032            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0033         12 EX = 502.5
0034            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0035         13 EX = 505.0
0036            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.75S.D.
0037         14 EX = 507.5
0038            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.0S.D.
0039         15 EX = 510.0
0040            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.25S.D.
0041         16 EX = 512.5
0042            GO TO 20
          C     THIS IS DESIONED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.50S.D.
0043         17 EX = 515.0
0044            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.75S.D.
0045         18 EX = 517.5
0046         20 DO 10J = 1,5
0047            CALL NORMAL(EX,STD,X,Y)
```

```
      NODAT(J) = X
   10 NODAT(J+5) = Y
      EX = 500.
      DO 11IX = 11,15
      CALL NORMAL(EX,STD,X,Y)
      NODAT(IX) = X
   11 NODAT(IX+5) = Y
C/-----------------------------T-TEST-----------------------------------------/
      DO 1IQ = 1,10
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,10
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 11,20
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 11,20
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.101) CTTO5 = CTTO5+1
      IF(TTEST.GE.2.878) CTTO1 = CTTO1+1
C/-----------------------------WILCOXON-----------------------------------------/
      N = 20
      CALL RANK(NODAT,R,N)
      DO 3K = 1,20
    3 RR(K) = R(K)
      DO 4L = 1,10
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 11,20
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
      ZWIN = ABS(WIN)
      IF(ZWIN.GE.1.96) CWINO5 = CWINO5+1
      IF(ZWIN.GE.2.58) CWINO1 = CWINO1+1
C/-----------------------------TERRY-HOEFFDING-----------------------------------/
      DO 30IJ = 1,20
      IF(RR(IJ).EQ.1.) IEV(IJ) =-137
      IF(RR(IJ).EQ.2.) IEV(IJ) =-141
      IF(RR(IJ).EQ.3.) IEV(IJ) =-113
      IF(RR(IJ).EQ.4.) IEV(IJ) = -92
      IF(RR(IJ).EQ.5.) IEV(IJ) = -75
      IF(RR(IJ).EQ.6.) IEV(IJ) = -59
      IF(RR(IJ).EQ.7.) IEV(IJ) = -45
      IF(RR(IJ).EQ.8.) IEV(IJ) = -31
      IF(RR(IJ).EQ.9.) IEV(IJ) = -19
      IF(RR(IJ).EQ.10.)IEV(IJ) =  -6
      IF(RR(IJ).EQ.11.)IEV(IJ) =   6
      IF(RR(IJ).EQ.12.)IEV(IJ) =  19
      IF(RR(IJ).EQ.13.)IEV(IJ) =  31
      IF(RR(IJ).EQ.14.)IEV(IJ) =  45
      IF(RR(IJ).EQ.15.)IEV(IJ) =  59
      IF(RR(IJ).EQ.16.)IEV(IJ) =  75
      IF(RR(IJ).EQ.17.)IEV(IJ) =  92
      IF(RR(IJ).EQ.18.)IEV(IJ) = 113
      IF(RR(IJ).EQ.19.)IEV(IJ) = 141
      IF(RR(IJ).EQ.20.)IEV(IJ) = 187
   30 CONTINUE
      DO 31IK = 1,10
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 11,20
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.LT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
   33 IT1 = ISUMT1
   34 T1 = IT1/100.
      DO 35KK = 1,20
      EV(KK) = IEV(KK)/100.
   35 EXPP = EXPP+EV(KK)**2
      VART = N1*N2/(N1+N2-1.)*(EXPP/(N1+N2))
```

```
      TER  = T1/SQRT(VART)
      ZTER = ABS(TER)
      IF(ZTER.GE.1.96) CTER05 = CTER05+1
      IF(ZTER.GE.2.58) CTER01 = CTER01+1
C/-----------------------------VAN DER WAERDEN-----------------------------------/
      DO 50JJ = 1,20
      IF(RR(JJ).EQ.1.) IZI(JJ) =-167
      IF(RR(JJ).EQ.2.) IZI(JJ) =-131
      IF(RR(JJ).EQ.3.) IZI(JJ) =-107
      IF(RR(JJ).EQ.4.) IZI(JJ) = -88
      IF(RR(JJ).EQ.5.) IZI(JJ) = -71
      IF(RR(JJ).EQ.6.) IZI(JJ) = -57
      IF(RR(JJ).EQ.7.) IZI(JJ) = -43
      IF(RR(JJ).EQ.8.) IZI(JJ) = -30
      IF(RR(JJ).EQ.9.) IZI(JJ) = -18
      IF(RR(JJ).EQ.10.)IZI(JJ) =  -6
      IF(RR(JJ).EQ.11.)IZI(JJ) =   6
      IF(RR(JJ).EQ.12.)IZI(JJ) =  18
      IF(RR(JJ).EQ.13.)IZI(JJ) =  30
      IF(RR(JJ).EQ.14.)IZI(JJ) =  43
      IF(RR(JJ).EQ.15.)IZI(JJ) =  57
      IF(RR(JJ).EQ.16.)IZI(JJ) =  71
      IF(RR(JJ).EQ.17.)IZI(JJ) =  88
      IF(RR(JJ).EQ.18.)IZI(JJ) = 107
      IF(RR(JJ).EQ.19.)IZI(JJ) = 131
      IF(RR(JJ).EQ.20.)IZI(JJ) = 167
   50 CONTINUE
      DO 51LL = 1,10
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 11,20
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.LT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
   54 TV1 = ITV1/100.
      DO 55NN = 1,20
      ZI(NN) = IZI(NN)/100.
   55 ZII = ZII+ZI(NN)**2/(N1+N2)
      VARV = N1*N2/(N1+N2-1.)*ZII
      VAN  = TV1/SQRT(VARV)
      ZVAN = ABS(VAN)
      IF(ZVAN.GE.1.96) CVAN05 = CVAN05+1
      IF(ZVAN.GE.2.58) CVAN01 = CVAN01+1
  100 CONTINUE
      WRITE(3,200)
  200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
      WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
  300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
      WRITE(3,400)
  400 FORMAT(/55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
      WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
  500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
 2000 CONTINUE
      STOP
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83     TIME   02.04.13

          C/-----------------------------RANDOM-----------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME   02.04.58

          C/-----------------------------NORMAL-----------------------------------------/
0001            SUBROUTINE NORMAL(EX,STD,X,Y)
0002            COMMON IA
0003          1 CALL RANDOM(IA,IY,RN)
0004            V1 = 2.*RN-1.
0005            CALL RANDOM(IA,IY,RN)
0006            V2 = 2.*RN-1.
0007            S = V1*V1+V2*V2
0008            IF(S.GE.1)GO TO 1
0009            RNN1 = V1*SQRT((-2.* ALOG(S))/S)
0010            RNN2 = V2*SQRT((-2.* ALOG(S))/S)
0011            X = EX+RNN1*STD
0012            Y = EX+RNN2*STD
0013            RETURN
0014            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/82      TIME   02.10.44
C/-----------------------------RANK-----------------------------------------------
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(20),R(20)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
OOS FORTRAN IV 360N-FO-479 3-8          MAINOCM              DATE    12/03/83      TIME     02.16.16
C ***************************************************************
C *                                                             *
C *                                                             *
C *                  NN : SAMPLE SIZE(N1) = 15                  *
C *                                                             *
C *                                                             *
C ***************************************************************
      DIMENSION NODAT(30),RR(30),R(30),EV(30),ZI(30),IEV(30),
     *IZI(30)
      COMMON IA
      REAL NODAT,N1,N2,MEAN1,MEAN2
      N1 = 15
      N2 = 15
      Y = 0.
C/---------------------------------------------------------------------------/
      DO 2000KKK = 1,8
      IA = 65539
      CTTO5 = 0.
      CTTO1 = 0.
      CWINO5 = 0.
      CWINO1 = 0.
      CTERO5 = 0.
      CTERO1 = 0.
      CVANO5 = 0.
      CVANO1 = 0.
C/---------------------------------------------------------------------------/
      DO 100I = 1,1000
      STD = 10.
      SUM1  = 0.
      SUM2  = 0.
      SUMX1 = 0.
      SUMX2 = 0.
      SUMR1 = 0.
      SUMR2 = 0.
      EXPP  = 0.
      ZII   = 0.
      ISUMT1= 0.
      ISUMT2= 0.
      ISUMV1= 0.
      ISUMV2= 0.
      GO TO (19,12,13,14,15,16,17,18),KKK
C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
C     WHEN DELTA IS 0.0S.D.
   19 EX = 500.
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 0.25S.D.
   12 EX = 502.5
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 0.5S.D.
   13 EX = 505.0
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 0.75S.D.
   14 EX = 507.5
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.0S.D.
   15 EX = 510.0
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.25S.D.
   16 EX = 512.5
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.50S.D.
   17 EX = 515.0
      GO TO 20
C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
C     WHEN DELTA IS 1.75S.D.
   18 EX = 517.5
   20 DO 10J = 1,15
      IF(Y.NE.0.)GO TO 21
```

```
      CALL NORMAL(EX,STD,X,Y)
      GO TO 10
   21 X = Y
      Y = 0.
   10 NODAT(J) = X
      EX = 500.
      DO 11IX = 16,30
      IF(Y.NE.0.)GO TO 22
      CALL NORMAL(EX,STD,X,Y)
      GO TO 11
   22 X = Y
      Y = 0.
   11 NODAT(IX) = X
C/-----------------------------T-TEST-----------------------------------------/
      DO 1IQ = 1,15
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,15
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 16,30
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 16,30
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N)+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.048) CTT05 = CTT05+1
      IF(TTEST.GE.2.763) CTT01 = CTT01+1
C/-----------------------------WILCOXON-----------------------------------------/
      N = 30
      CALL RANK(NODAT,R,N)
      DO 3K = 1,30
    3 RR(K) = R(K)
      DO 4L = 1,15
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 16,30
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
      ZWIN = ABS(WIN)
      IF(ZWIN.GE.1.96) CWIN05 = CWIN05+1
      IF(ZWIN.GE.2.58) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING-----------------------------------/
      DO 30IJ = 1,30
      IF(RR(IJ).EQ.1.) IEV(IJ) =-204
      IF(RR(IJ).EQ.2.) IEV(IJ) =-162
      IF(RR(IJ).EQ.3.) IEV(IJ) =-136
      IF(RR(IJ).EQ.4.) IEV(IJ) =-118
      IF(RR(IJ).EQ.5.) IEV(IJ) =-103
      IF(RR(IJ).EQ.6.) IEV(IJ) = -89
      IF(RR(IJ).EQ.7.) IEV(IJ) = -78
      IF(RR(IJ).EQ.8.) IEV(IJ) = -67
      IF(RR(IJ).EQ.9.) IEV(IJ) = -57
      IF(RR(IJ).EQ.10.)IEV(IJ) = -47
      IF(RR(IJ).EQ.11.)IEV(IJ) = -38
      IF(RR(IJ).EQ.12.)IEV(IJ) = -29
      IF(RR(IJ).EQ.13.)IEV(IJ) = -21
      IF(RR(IJ).EQ.14.)IEV(IJ) = -12
      IF(RR(IJ).EQ.15.)IEV(IJ) =  -4
      IF(RR(IJ).EQ.16.)IEV(IJ) =   4
      IF(RR(IJ).EQ.17.)IEV(IJ) =  12
      IF(RR(IJ).EQ.18.)IEV(IJ) =  21
      IF(RR(IJ).EQ.19.)IEV(IJ) =  29
      IF(RR(IJ).EQ.20.)IEV(IJ) =  38
      IF(RR(IJ).EQ.21.)IEV(IJ) =  47
      IF(RR(IJ).EQ.22.)IEV(IJ) =  57
      IF(RR(IJ).EQ.23.)IEV(IJ) =  67
      IF(RR(IJ).EQ.24.)IEV(IJ) =  78
      IF(RR(IJ).EQ.25.)IEV(IJ) =  89
      IF(RR(IJ).EQ.26.)IEV(IJ) = 103
      IF(RR(IJ).EQ.27.)IEV(IJ) = 118
      IF(RR(IJ).EQ.28.)IEV(IJ) = 136
      IF(RR(IJ).EQ.29.)IEV(IJ) = 162
      IF(RR(IJ).EQ.30.)IEV(IJ) = 204
   30 CONTINUE
```

```
0125              DO 31IK = 1,15
0126           31 ISUMT1 = ISUMT1+IEV(IK)
0127              DO 32IN = 16,30
0128           32 ISUMT2 = ISUMT2+IEV(IN)
0129              IF(ISUMT1.LT.ISUMT2) GO TO 33
0130              IT1 = ISUMT2
0131              GO TO 34
0132           33 IT1 = ISUMT1
0133           34 TL = IT1/100.
0134              DO 35KK = 1,30
0135              EV(KK) = IEV(KK)/100.
0136           35 EXPP = EXPP+EV(KK)**2
0137              VART = N1*N2/(N1+N2-1.)*(EXPP/(N1+N2))
0138              TER = TL/SQRT(VART)
0139              ZTER = ABS(TER)
0140              IF(ZTER.GE.1.96) CTER05 = CTER05+1
0141              IF(ZTER.GE.2.58) CTER01 = CTER01+1
                C/-----------------------------VAN DER WAERDEN-----------------------------/
0142              DO 50JJ = 1,30
0143              IF(RR(JJ).EQ.1.) IZI(JJ) =-185
0144              IF(RR(JJ).EQ.2.) IZI(JJ) =-152
0145              IF(RR(JJ).EQ.3.) IZI(JJ) =-130
0146              IF(RR(JJ).EQ.4.) IZI(JJ) =-113
0147              IF(RR(JJ).EQ.5.) IZI(JJ) = -99
0148              IF(RR(JJ).EQ.6.) IZI(JJ) = -86
0149              IF(RR(JJ).EQ.7.) IZI(JJ) = -75
0150              IF(RR(JJ).EQ.8.) IZI(JJ) = -65
0151              IF(RR(JJ).EQ.9.) IZI(JJ) = -55
0152              IF(RR(JJ).EQ.10.)IZI(JJ) = -46
0153              IF(RR(JJ).EQ.11.)IZI(JJ) = -37
0154              IF(RR(JJ).EQ.12.)IZI(JJ) = -29
0155              IF(RR(JJ).EQ.13.)IZI(JJ) = -20
0156              IF(RR(JJ).EQ.14.)IZI(JJ) = -12
0157              IF(RR(JJ).EQ.15.)IZI(JJ) =  -4
0158              IF(RR(JJ).EQ.16.)IZI(JJ) =   4
0159              IF(RR(JJ).EQ.17.)IZI(JJ) =  12
0160              IF(RR(JJ).EQ.18.)IZI(JJ) =  20
0161              IF(RR(JJ).EQ.19.)IZI(JJ) =  29
0162              IF(RR(JJ).EQ.20.)IZI(JJ) =  37
0163              IF(RR(JJ).EQ.21.)IZI(JJ) =  46
0164              IF(RR(JJ).EQ.22.)IZI(JJ) =  55
0165              IF(RR(JJ).EQ.23.)IZI(JJ) =  65
0166              IF(RR(JJ).EQ.24.)IZI(JJ) =  75
0167              IF(RR(JJ).EQ.25.)IZI(JJ) =  86
0168              IF(RR(JJ).EQ.26.)IZI(JJ) =  99
0169              IF(RR(JJ).EQ.27.)IZI(JJ) = 113
0170              IF(RR(JJ).EQ.28.)IZI(JJ) = 130
0171              IF(RR(JJ).EQ.29.)IZI(JJ) = 152
0172              IF(RR(JJ).EQ.30.)IZI(JJ) = 185
0173           50 CONTINUE
0174              DO 51LL = 1,15
0175           51 ISUMV1 = ISUMV1+IZI(LL)
0176              DO 52MM = 16,30
0177           52 ISUMV2 = ISUMV2+IZI(MM)
0178              IF(ISUMV1.LT.ISUMV2) GO TO 53
0179              ITV1 = ISUMV2
0180              GO TO 54
0181           53 ITV1 = ISUMV1
0182           54 TV1 = ITV1/100.
0183              DO 55NN = 1,30
0184              ZI(NN) = IZI(NN)/100.
0185           55 ZII = ZII+ZI(NN)**2/(N1+N2)
0186              VARV = N1*N2/(N1+N2-1.)*ZII
0187              VAN  = TV1/SQRT(VARV)
0188              ZVAN = ABS(VAN)
0189              IF(ZVAN.GE.1.96) CVAN05 = CVAN05+1
0190              IF(ZVAN.GE.2.58) CVAN01 = CVAN01+1
0191          100 CONTINUE
0192              WRITE(3,200)
0193          200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
0194              WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
0195          300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0196              WRITE(3,400)
0197          400 FORMAT(/55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
0198              WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
0199          500 FORMAT(51X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0200         2000 CONTINUE
0201              STOP
0202              END
```

```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    12/03/83      TIME     02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME    02.04.58
          C/-----------------------------NORMAL-----------------------------------------------/
0001            SUBROUTINE NORMAL(EX,STD,X,Y)
0002            COMMON IA
0003          1 CALL RANDOM(IA,IY,RN)
0004            V1 = 2.*RN-1.
0005            CALL RANDOM(IA,IY,RN)
0006            V2 = 2.*RN-1.
0007            S = V1*V1+V2*V2
0008            IF(S.GE.1)GO TO 1
0009            RNN1 = V1*SQRT((-2.* ALOG(S))/S)
0010            RNN2 = V2*SQRT((-2.* ALOG(S))/S)
0011            X = EX+RNN1*STD
0012            Y = EX+RNN2*STD
0013            RETURN
0014            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-9          MAINPGM          DATE  12/03/93      TIME    02.17.1
C/-----------------------------RANK-----------------------------------------------
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(30),R(30)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 10CI = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
DOS FORTRAN IV 360N FO-479 3 8          MAINPGM            DATE   15/03/83      TIME     22.53.26

          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *                 UU : SAMPLE SIZE(N1) = 5                *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
0001            DIMENSION NODAT(10),PR(10),R(10),EV(10),ZI(10),IEV(10),
               *IZI(10)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 5
0005            N2 = 5
          C/-----------------------------------------------------------------------/
0006            DO 2000KKK = 1,8
0007            IA = 65539
0008            CTT05 = 0.
0009            CTT01 = 0.
0010            CWIN05 = 0.
0011            CWIN01 = 0.
0012            CTER05 = 0.
0013            CTER01 = 0.
0014            CVAN05 = 0.
0015            CVAN01 = 0.
          C/-----------------------------------------------------------------------/
0016            DO 1001 = 1,1000
0017            STD = 10.
0018            SUM1  = 0.
0019            SUM2  = 0.
0020            SUMX1 = 0.
0021            SUMX2 = 0.
0022            SUMR1  = 0.
0023            SUMR2  = 0.
0024            ISUMT1= 0
0025            ISUMT2= 0
0026            ISUMV1= 0
0027            ISUMV2= 0
0028            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0029         19 EX = 500.
0030            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0031         12 EX = 502.5
0032            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0033         13 EX = 505.0
0034            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.75S.D.
0035         14 EX = 507.5
0036            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.0S.D.
0037         15 EX = 510.0
0038            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.25S.D.
0039         16 EX = 512.5
0040            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.50S.D.
0041         17 EX = 515.0
0042            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.75S.D.
0043         18 EX = 517.5
0044         20 B = EX+(STD*SQRT(3.))
0045            A = (2.*EX)-B
0046            DO 10J = 1,5
0047            CALL UNIFM(A,B,Z)
0048         10 NODAT(J) = Z
0049            EX = 500.
```

```
      B = EX+(STD*SQRT(3.))
      A = (2.*EX)-B
      DO 11IX = 6,10
      CALL UNIFM(A,B,Z)
   11 NODAT(IX) = Z
C/                                    T TEST                                  -----/
      DO 1IQ = 1,5
    1 SUM1 = SUM1+NODAT(IQ)          $\bar{X}^1$
      MEAN1 = SUM1/N1
      DO 8JQ = 1,5
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2   $\Sigma(x-\bar{x})^2$
      DO 2IB = 6,10
    2 SUMX1 = SUMX1+NODAT(IB)        $\bar{x}^2$
      MEAN2 = SUMX1/N2
      DO 9KQ = 6,10
    9 SUMX2 = SUMX2+(NODAT(KQ) MEAN2)**2   $\Sigma(\bar{x}^2-\bar{x})^2$
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.306) CTT05 = CTT05+1
      IF(TTEST.GE.3.355) CTT01 = CTT01+1
C/-------------------------------WILCOXON                                    ---/
      N = 10
      CALL RANK(NODAT,R,N)
      DO 3K = 1,10
    3 RR(K) = R(K)
      DO 4L = 1,5
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 6,10
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 IF(TR1.LE.18.0) CWIN05 = CWIN05+1
      IF(TR1.LE.15.0) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING-----------------------------------/
      DO 30IJ = 1,10
      IF(RR(IJ).EQ.1.) IEV(IJ) =-154
      IF(RR(IJ).EQ.2.) IEV(IJ) =-100
      IF(RR(IJ).EQ.3.) IEV(IJ) = -66
      IF(RR(IJ).EQ.4.) IEV(IJ) = -38
      IF(RR(IJ).EQ.5.) IEV(IJ) = -12
      IF(RR(IJ).EQ.6.) IEV(IJ) =  12
      IF(RR(IJ).EQ.7.) IEV(IJ) =  38
      IF(RR(IJ).EQ.8.) IEV(IJ) =  66
      IF(RR(IJ).EQ.9.) IEV(IJ) = 100
      IF(RR(IJ).EQ.10.)IEV(IJ) = 154
   30 CONTINUE
      DO 31IK = 1,5
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 6,10
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.GT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
   33 IT1 = ISUMT1
   34 IF(IT1.GE.292) CTER05 = CTER05+1
      IF(IT1.GE.370) CTER01 = CTER01+1
C/                                    VAN DER WAERDEN                         ---/
      DO 50JJ = 1,10
      IF(RR(JJ).EQ.1.) IZI(JJ) =-134
      IF(RR(JJ).EQ.2.) IZI(JJ) =  91
      IF(RR(JJ).EQ.3.) IZI(JJ) = -60
      IF(RR(JJ).EQ.4.) IZI(JJ) = -35
      IF(RR(JJ).EQ.5.) IZI(JJ) =  11
      IF(RR(JJ).EQ.6.) IZI(JJ) =  11
      IF(RR(JJ).EQ.7.) IZI(JJ) =  35
      IF(RR(JJ).EQ.8.) IZI(JJ) =  60
      IF(RR(JJ).EQ.9.) IZI(JJ) =  91
      IF(RR(JJ).EQ.10.)IZI(JJ) = 134
   50 CONTINUE
      DO 51LL = 1,5
   51 ISUMV1 = ISUMV1+IZI(LL)
```

```
0120            DO 52MM = 6,10
0121         52 ISUMV2 = ISUMV2+IZI(MM)
0122            IF(ISUMV1.GT.ISUMV2) GO TO 53
0123            ITV1 = ISUMV2
0124            GO TO 54
0125         53 ITV1 = ISUMV1
0126         54 IF(ITV1.GE.260) CVAN05 = CVAN05+1
0127            IF(ITV1.GE.331) CVAN01 = CVAN01+1
0128        100 CONTINUE
0129            WRITE(3,200)
0130        200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
0131            WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
0132        300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0133            WRITE(3,400)
0134        400 FORMAT(/55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
0135            WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
0136        500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0137       2000 CONTINUE
0138            STOP
0139            END
```

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```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME    02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    15/03/83      TIME     22.54.04
          C/-----------------------------UNIFORM-----------------------------------------------/
0001            SUBROUTINE UNIFM(A,B,Z)
0002            COMMON IA
0003            CALL RANDOM(IA,IY,RN)
0004            Z = A+(B-A)*RN
0005            RETURN
0006            END
```

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```
COS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME   02.05.36

C/-----------------------------RANK-----------------------------------------------/
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(10),R(10)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    15/03/83      TIME     22.59.30

          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *                 UU : SAMPLE SIZE(N1) = 10               *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
0001            DIMENSION NODAT(20),RR(20),R(20),EV(20),ZI(20),IEV(20),
               *IZI(20)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 10
0005            N2 = 10
          C/---                                                                  /
0006            DO 2000KKK = 1,8
0007            IA = 65539
0008            CTT05 = 0.
0009            CTT01 = 0.
0010            CWIN05 = 0.
0011            CWIN01 = 0.
0012            CTER05 = 0.
0013            CTER01 = 0.
0014            CVAN05 = 0.
0015            CVAN01 = 0.
          C/-------------------------------------------------------------------/
0016            DO 1001 = 1,1000
0017            STD = 10.
0018            SUM1  = 0.
0019            SUM2  = 0.
0020            SUMX1 = 0.
0021            SUMX2 = 0.
0022            SUMR1 = 0.
0023            SUMR2 = 0.
0024            EXPP  = 0.
0025            ZII   = 0.
0026            ISUMT1= 0.
0027            ISUMT2= 0.
0028            ISUMV1= 0.
0029            ISUMV2= 0.
0030            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0031         19 EX = 500.
0032            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0033         12 EX = 502.5
0034            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0035         13 EX = 505.0
0036            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.75S.D.
0037         14 EX = 507.5
0038            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.0S.D.
0039         15 EX = 510.0
0040            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.25S.D.
0041         16 EX = 512.5
0042            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.50S.D.
0043         17 EX = 515.0
0044            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.75S.D.
0045         18 EX = 517.5
0046         20 B = EX+(STD*SQRT(3.))
0047            A = (2.*EX) B
0048            DO 100 = 1,10
```

```
0049              CALL UNIFM(A,B,Z)
0050           10 NODAT(J) = Z
0051              EX = 500.
0052              B = EX+(STD*SQRT(3.))
0053              A = (2.*EX)-B
0054              DO 111X = 11,20
0055              CALL UNIFM(A,B,Z)
0056           11 NODAT(IX) = Z
                C/ ---------- T TEST ----------/
0057              DO 11Q = 1,10
0058            1 SUM1 = SUM1+NODAT(IQ)
0059              MEAN1 = SUM1/N1
0060              DO 8JQ = 1,10
0061            8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
0062              DO 21B = 11,20
0063            2 SUMX1 = SUMX1+NODAT(IB)
0064              MEAN2 = SUMX1/N2
0065              DO 9KQ = 11,20
0066            9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
0067              XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
0068              TEST = (MEAN1-MEAN2)/SQRT(XX)
0069              TTEST = ABS(TEST)
0070              IF(TTEST.GE.2.101) CTT05 = CTT05+1
0071              IF(TTEST.GE.2.878) CTT01 = CTT01+1
                C/ ----------WILCOXON----------
0072              N = 20
0073              CALL RANK(NODAT,R,N)
0074              DO 3K = 1,20
0075            3 RR(K) = R(K)
0076              DO 4L = 1,10
0077            4 SUMR1 = SUMR1+RR(L)
0078              DO 5M = 11,20
0079            5 SUMR2 = SUMR2+RR(M)
0080              IF(SUMR1.LT.SUMR2) GO TO 6
0081              TR1 = SUMR2
0082              GO TO 7
0083            6 TR1 = SUMR1
0084            7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
0085              ZWIN = ABS(WIN)
0086              IF(ZWIN.GE.1.96) CWIN05 = CWIN05+1
0087              IF(ZWIN.GE.2.58) CWIN01 = CWIN01+1
                C/----------TERRY-HOEFFDING----------
0088              DO 301J = 1,20
0089              IF(RR(IJ).EQ.1.) IEV(IJ) = 187
0090              IF(RR(IJ).EQ.2.) IEV(IJ) =-141
0091              IF(RR(IJ).EQ.3.) IEV(IJ) =-113
0092              IF(RR(IJ).EQ.4.) IEV(IJ) =  92
0093              IF(RR(IJ).EQ.5.) IEV(IJ) = -75
0094              IF(RR(IJ).EQ.6.) IEV(IJ) = -59
0095              IF(RR(IJ).EQ.7.) IEV(IJ) =  45
0096              IF(RR(IJ).EQ.8.) IEV(IJ) = -31
0097              IF(RR(IJ).EQ.9.) IEV(IJ) = -19
0098              IF(RR(IJ).EQ.10.)IEV(IJ) =   6
0099              IF(RR(IJ).EQ.11.)IEV(IJ) =   6
0100              IF(RR(IJ).EQ.12.)IEV(IJ) =  19
0101              IF(RR(IJ).EQ.13.)IEV(IJ) =  31
0102              IF(RR(IJ).EQ.14.)IEV(IJ) =  45
0103              IF(RR(IJ).EQ.15.)IEV(IJ) =  59
0104              IF(RR(IJ).EQ.16.)IEV(IJ) =  75
0105              IF(RR(IJ).EQ.17.)IEV(IJ) =  92
0106              IF(RR(IJ).EQ.18.)IEV(IJ) = 113
0107              IF(RR(IJ).EQ.19.)IEV(IJ) = 141
0108              IF(RR(IJ).EQ.20.)IEV(IJ) = 187
0109           30 CONTINUE
0110              DO 311K = 1,10
0111           31 ISUMT1 = ISUMT1+IEV(IK)
0112              DO 321N = 11,20
0113           32 ISUMT2 = ISUMT2+IEV(IN)
0114              IF(ISUMT1.LT.ISUMT2) GO TO 33
0115              IT1 = ISUMT2
0116              GO TO 34
0117           33 IT1 = ISUMT1
0118           34 T1 = IT1/100.
0119              DO 35KK = 1,20
0120              EV(KK) = IEV(KK)/100.
0121           35 EXPP = EXPP+EV(KK)**2
0122              VART = N1*N2/(N1+N2-1.)*(EXPP/(N1*N2))
0123              TER  = T1/SQRT(VART)
```

```
      ZTER = ABS(TER)
      IF(ZTER.GE.1.96) CTER05 = CTER05+1
      IF(ZTER.GE.2.58) CTER01 = CTER01+1
C/ ---------------------------VAN DER WAERDEN-----------------------------------/
      DO 50JJ = 1,20
      IF(RR(JJ).EQ.1.) IZI(JJ) =-167
      IF(RR(JJ).EQ.2.) IZI(JJ) =-131
      IF(RR(JJ).EQ.3.) IZI(JJ) =-107
      IF(RR(JJ).EQ.4.) IZI(JJ) = -88
      IF(RR(JJ).EQ.5.) IZI(JJ) = -71
      IF(RR(JJ).EQ.6.) IZI(JJ) = -57
      IF(RR(JJ).EQ.7.) IZI(JJ) = -43
      IF(RR(JJ).EQ.8.) IZI(JJ) =  30
      IF(RR(JJ).EQ.9.) IZI(JJ) = -18
      IF(RR(JJ).EQ.10.)IZI(JJ) =  -6
      IF(RR(JJ).EQ.11.)IZI(JJ) =   6
      IF(RR(JJ).EQ.12.)IZI(JJ) =  18
      IF(RR(JJ).EQ.13.)IZI(JJ) =  30
      IF(RR(JJ).EQ.14.)IZI(JJ) =  43
      IF(RR(JJ).EQ.15.)IZI(JJ) =  57
      IF(RR(JJ).EQ.16.)IZI(JJ) =  71
      IF(RR(JJ).EQ.17.)IZI(JJ) =  88
      IF(RR(JJ).EQ.18.)IZI(JJ) = 107
      IF(RR(JJ).EQ.19.)IZI(JJ) = 131
      IF(RR(JJ).EQ.20.)IZI(JJ) = 167
   50 CONTINUE
      DO 51LL = 1,10
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 11,20
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.LT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
   54 TV1 = ITV1/100.
      DO 55NN = 1,20
      ZI(NN) = IZI(NN)/100.
   55 ZII = ZII+ZI(NN)**2/(N1+N2)
      VARV = N1*N2/(N1+N2 1.)*ZII
      VAN  = TV1/SQRT(VARV)
      ZVAN = ABS(VAN)
      IF(ZVAN.GE.1.96) CVAN05 = CVAN05+1
      IF(ZVAN.GE.2.58) CVAN01 = CVAN01+1
  100 CONTINUE
      WRITE(3,200)
  200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
      WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
  300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
      WRITE(3,400)
  400 FORMAT(/55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
      WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
  500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
 2000 CONTINUE
      STOP
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    12/03/83      TIME     02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   15/03/83     TIME    22.54.04
          C/-----------------------------UNIFORM-----------------------------------------
0001            SUBROUTINE UNIFM(A,B,Z)
0002            COMMON IA
0003            CALL RANDOM(IA,IY,RN)
0004            Z = A+(B-A)*RN
0005            RETURN
0006            END
```

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```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/82      TIME   02.10.44

          C/-----------------------------RANK-----------------------------------------------/
                SUBROUTINE RANK(A,R,N)
                DIMENSION A(20),R(20)
                DO 10I = 1,N
             10 R(I) = 0.0
                DO 100I = 1,N
                IF(R(I))20,20,100
             20 SMALL = 0.0
                EQUAL = 0.0
                X = A(I)
                DO 50J = 1,N
                IF(A(J)-X)30,40,50
             30 SMALL = SMALL+1.0
                GO TO 50
             40 EQUAL = EQUAL+1.0
                R(J) = -1.0
             50 CONTINUE
                IF(EQUAL-1.0)60,60,70
             60 R(I) = SMALL+1.0
                GO TO 100
             70 P = SMALL+(EQUAL+1.0)*0.5
                DO 90J = 1,N
                IF(R(J)+1.0)90,80,90
             80 R(J) = P
             90 CONTINUE
            100 CONTINUE
                RETURN
                END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    15/03/83      TIME    23.07.39

          C ***************************************************************
          C *                                                             *
          C *                                                             *
          C *                  UU : SAMPLE SIZE(N1) = 15                  *
          C *                                                             *
          C *                                                             *
          C ***************************************************************
0001            DIMENSION NODAT(30),RR(30),R(30),EV(30),ZI(30),IEV(30),
               *IZI(30)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 15
0005            N2 = 15
          C/-------------------------------------------------------------------------/
0006            DO 2000KKK = 1,8
0007            IA = 65539
0008            CTT05 = 0.
0009            CTT01 = 0.
0010            CWIN05 = 0.
0011            CWIN01 = 0.
0012            CTER05 = 0.
0013            CTER01 = 0.
0014            CVAN05 = 0.
0015            CVAN01 = 0.
          C/                                  ------------------------------------------/
0016            DO 100I = 1,1000
0017            STD = 10.
0018            SUM1  = 0.
0019            SUM2  = 0.
0020            SUMX1 = 0.
0021            SUMX2 = 0.
0022            SUMR1 = 0.
0023            SUMR2 = 0.
0024            EXPP  = 0.
0025            ZII   = 0.
0026            ISUMT1= 0.
0027            ISUMT2= 0.
0028            ISUMV1= 0.
0029            ISUMV2= 0.
0030            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0031         19 EX = 500.
0032            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0033         12 EX = 502.5
0034            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0035         13 EX = 505.0
0036            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.75S.D.
0037         14 EX = 507.5
0038            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.0S.D.
0039         15 EX = 510.0
0040            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.25S.D.
0041         16 EX = 512.5
0042            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.50S.D.
0043         17 EX = 515.0
0044            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.75S.D.
0045         18 EX = 517.5
0046         20 B = EX+(STD*SQRT(3.))
0047            A = (2.*EX) B
```

```
      DO 10J = 1,15
      CALL UNIFM(A,B,Z)
   10 NODAT(J) = Z
      EX = 500.
      B = EX+(STD*SQRT(3.))
      A = (2.*EX)-B
      DO 11IX = 16,30
      CALL UNIFM(A,B,Z)
   11 NODAT(IX) = Z
C/                                T TEST                                  ------------------------/
      DO 1IQ = 1,15
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,15
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 16,30
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 16,30
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.048) CTT05 = CTT05+1
      IF(TTEST.GE.2.763) CTT01 = CTT01+1
C/                                WILCOXON------------------------------------------------/
      N = 30
      CALL RANK(NODAT,R,N)
      DO 3K = 1,30
    3 RR(K) = R(K)
      DO 4L = 1,15
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 16,30
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
      ZWIN = ABS(WIN)
      IF(ZWIN.GE.1.96) CWIN05 = CWIN05+1
      IF(ZWIN.GE.2.58) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING-----------------------------------------/
      DO 30IJ = 1,30
      IF(RR(IJ).EQ.1.) IEV(IJ) = 204
      IF(RR(IJ).EQ.2.) IEV(IJ) =-162
      IF(RR(IJ).EQ.3.) IEV(IJ) =-136
      IF(RR(IJ).EQ.4.) IEV(IJ) = 118
      IF(RR(IJ).EQ.5.) IEV(IJ) =-103
      IF(RR(IJ).EQ.6.) IEV(IJ) = -89
      IF(RR(IJ).EQ.7.) IEV(IJ) =  78
      IF(RR(IJ).EQ.8.) IEV(IJ) = -67
      IF(RR(IJ).EQ.9.) IEV(IJ) = -57
      IF(RR(IJ).EQ.10.)IEV(IJ) =  47
      IF(RR(IJ).EQ.11.)IEV(IJ) = -38
      IF(RR(IJ).EQ.12.)IEV(IJ) = -29
      IF(RR(IJ).EQ.13.)IEV(IJ) = -21
      IF(RR(IJ).EQ.14.)IEV(IJ) = -12
      IF(RR(IJ).EQ.15.)IEV(IJ) =  -4
      IF(RR(IJ).EQ.16.)IEV(IJ) =   4
      IF(RR(IJ).EQ.17.)IEV(IJ) =  12
      IF(RR(IJ).EQ.18.)IEV(IJ) =  21
      IF(RR(IJ).EQ.19.)IEV(IJ) =  29
      IF(RR(IJ).EQ.20.)IEV(IJ) =  38
      IF(RR(IJ).EQ.21.)IEV(IJ) =  47
      IF(RR(IJ).EQ.22.)IEV(IJ) =  57
      IF(RR(IJ).EQ.23.)IEV(IJ) =  67
      IF(RR(IJ).EQ.24.)IEV(IJ) =  78
      IF(RR(IJ).EQ.25.)IEV(IJ) =  89
      IF(RR(IJ).EQ.26.)IEV(IJ) = 103
      IF(RR(IJ).EQ.27.)IEV(IJ) = 118
      IF(RR(IJ).EQ.28.)IEV(IJ) = 136
      IF(RR(IJ).EQ.29.)IEV(IJ) = 162
      IF(RR(IJ).EQ.30.)IEV(IJ) = 204
   30 CONTINUE
      DO 31IK = 1,15
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 16,30
```

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```
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.LT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
   33 IT1 = ISUMT1
   34 T1 = IT1/100.
      DO 35KK = 1,30
      EV(KK) = IEV(KK)/100.
   35 EXPP = EXPP+EV(KK)**2
      VART = N1*N2/(N1+N2-1.)*(EXPP/(N1+N2))
      TER  = T1/SQRT(VART)
      ZTER = ABS(TER)
      IF(ZTER.GE.1.96) CTER05 = CTER05+1
      IF(ZTER.GE.2.58) CTER01 = CTER01+1
C/  ------------------------VAN DER WAERDEN-----------------------------------/
      DO 50JJ = 1,30
      IF(RR(JJ).EQ.1.) IZI(JJ) =-185
      IF(RR(JJ).EQ.2.) IZI(JJ) =-152
      IF(RR(JJ).EQ.3.) IZI(JJ) =-130
      IF(RR(JJ).EQ.4.) IZI(JJ) =-113
      IF(RR(JJ).EQ.5.) IZI(JJ) = -99
      IF(RR(JJ).EQ.6.) IZI(JJ) = -86
      IF(RR(JJ).EQ.7.) IZI(JJ) = -75
      IF(RR(JJ).EQ.8.) IZI(JJ) = -65
      IF(RR(JJ).EQ.9.) IZI(JJ) = -55
      IF(RR(JJ).EQ.10.)IZI(JJ) = -46
      IF(RR(JJ).EQ.11.)IZI(JJ) = -37
      IF(RR(JJ).EQ.12.)IZI(JJ) = -29
      IF(RR(JJ).EQ.13.)IZI(JJ) = -20
      IF(RR(JJ).EQ.14.)IZI(JJ) = -12
      IF(RR(JJ).EQ.15.)IZI(JJ) =  -4
      IF(RR(JJ).EQ.16.)IZI(JJ) =   4
      IF(RR(JJ).EQ.17.)IZI(JJ) =  12
      IF(RR(JJ).EQ.18.)IZI(JJ) =  20
      IF(RR(JJ).EQ.19.)IZI(JJ) =  29
      IF(RR(JJ).EQ.20.)IZI(JJ) =  37
      IF(RR(JJ).EQ.21.)IZI(JJ) =  46
      IF(RR(JJ).EQ.22.)IZI(JJ) =  55
      IF(RR(JJ).EQ.23.)IZI(JJ) =  65
      IF(RR(JJ).EQ.24.)IZI(JJ) =  75
      IF(RR(JJ).EQ.25.)IZI(JJ) =  86
      IF(RR(JJ).EQ.26.)IZI(JJ) =  99
      IF(RR(JJ).EQ.27.)IZI(JJ) = 113
      IF(RR(JJ).EQ.28.)IZI(JJ) = 130
      IF(RR(JJ).EQ.29.)IZI(JJ) = 152
      IF(RR(JJ).EQ.30.)IZI(JJ) = 185
   50 CONTINUE
      DO 51LL = 1,15
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 16,30
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.LT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
   54 TV1 = ITV1/100.
      DO 55NN = 1,30
      ZI(NN) = IZI(NN)/100.
   55 ZII = ZII+ZI(NN)**2/(N1+N2)
      VARV = N1*N2/(N1+N2-1.)*ZII
      VAN  = TV1/SQRT(VARV)
      ZVAN = ABS(VAN)
      IF(ZVAN.GE.1.96) CVAN05 = CVAN05+1
      IF(ZVAN.GE.2.58) CVAN01 = CVAN01+1
  100 CONTINUE
      WRITE(3,200)
  200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
      WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
  300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
      WRITE(3,400)
  400 FORMAT(/55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
      WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
  500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
 2000 CONTINUE
      STOP
      END
```

```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME    02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   15/03/83     TIME    22.54.04
          C/-----------------------------UNIFORM-----------------------------------------
0001            SUBROUTINE UNIFM(A,B,Z)
0002            COMMON IA
0003            CALL RANDOM(IA,IY,RN)
0004            Z = A+(B-A)*RN
0005            RETURN
0006            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE  12/03/85      TIME    02.17.12

          C/-----------------------------RANK-----------------------------------------------/
                SUBROUTINE RANK(A,R,N)
                DIMENSION A(30),R(30)
                DO 10I = 1,N
             10 R(I) = 0.0
                DO 100I = 1,N
                IF(R(I))20,20,100
             20 SMALL = 0.0
                EQUAL = 0.0
                X = A(I)
                DO 50J = 1,N
                IF(A(J)-X)30,40,50
             30 SMALL = SMALL+1.0
                GO TO 50
             40 EQUAL = EQUAL+1.0
                R(J) = -1.0
             50 CONTINUE
                IF(EQUAL-1.0)60,60,70
             60 R(I) = SMALL+1.0
                GO TO 100
             70 P = SMALL+(EQUAL+1.0)*0.5
                DO 90J = 1,N
                IF(R(J)+1.0)90,80,90
             80 R(J) = P
             90 CONTINUE
            100 CONTINUE
                RETURN
                END
```

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```
DOS FORTRAN IV 360N FO-479 3-8          MAINPGM          DATE    15/03/83      TIME     23.14.54

          C ***********************************************************
          C *                                                         *
          C *                                                         *
          C *                 LL : SAMPLE SIZE(N1) = 5                *
          C *                                                         *
          C *                                                         *
          C ***********************************************************
0001            DIMENSION NODAT(10),RR(10),R(10),EV(10),ZI(10),IEV(10),
               *IZI(10)
0002            COMMON IA
0003            REAL NODAT,N1,N2,MEAN1,MEAN2
0004            N1 = 5
0005            N2 = 5
          C/-------------------------------------------------------------------------------/
0006            DO 2000KKK = 1,8
0007            IA = 65539
0008            CTT05 = 0.
0009            CTT01 = 0.
0010            CWIN05 = 0.
0011            CWIN01 = 0.
0012            CTER05 = 0.
0013            CTER01 = 0.
0014            CVAN05 = 0.
0015            CVAN01 = 0.
          C/-------------------------------                                  ------/
0016            DO 1001 = 1,1000
0017            STD = 10.
0018            SUM1  = 0.
0019            SUM2  = 0.
0020            SUMX1 = 0.
0021            SUMX2 = 0.
0022            SUMR1 = 0.
0023            SUMR2 = 0.
0024            ISUMT1= 0.
0025            ISUMT2= 0.
0026            ISUMV1= 0.
0027            ISUMV2= 0.
0028            GO TO (19,12,13,14,15,16,17,18),KKK
          C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
          C     WHEN DELTA IS 0.0S.D.
0029         19 EX = 500.
0030            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.25S.D.
0031         12 EX = 502.5
0032            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.5S.D.
0033         13 EX = 505.0
0034            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 0.75S.D.
0035         14 EX = 507.5
0036            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.0S.D.
0037         15 EX = 510.0
0038            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.25S.D.
0039         16 EX = 512.5
0040            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.50S.D.
0041         17 EX = 515.0
0042            GO TO 20
          C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
          C     WHEN DELTA IS 1.75S.D.
0043         18 EX = 517.5
0044         20 DO 10J = 1,5
0045            CALL LOGIS(EX,STD,G)
0046         10 NODAT(J) = G
0047            EX = 500.
```

```
      DO 11IX = 6,10
      CALL LOGIS(EX,STD,G)
   11 NODAT(IX) = G
C/-------------------------T TEST-------------------------------------/
      DO 1IQ = 1,5
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,5
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 6,10
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 6,10
    9 SUMX2 = SUMX2+(NODAT(KQ) MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.306) CTT05 = CTT05+1
      IF(TTEST.GE.3.355) CTT01 = CTT01+1
C/-------------------------- WILCOXON------------------------------------/
      N = 10
      CALL RANK(NODAT,R,N)
      DO 3K = 1,10
    3 RR(K) = R(K)
      DO 4L = 1,5
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 6,10
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 IF(TR1.LE.18.0) CWIN05 = CWIN05+1
      IF(TR1.LE.15.0) CWIN01 = CWIN01+1
C/                                 TERRY HOEFFDING---------------------------------/
      DO 30IJ = 1,10
      IF(RR(IJ).EQ.1.) IEV(IJ) =-154
      IF(RR(IJ).EQ.2.) IEV(IJ) =-100
      IF(RR(IJ).EQ.3.) IEV(IJ) = -66
      IF(RR(IJ).EQ.4.) IEV(IJ) = -38
      IF(RR(IJ).EQ.5.) IEV(IJ) = -12
      IF(RR(IJ).EQ.6.) IEV(IJ) =  12
      IF(RR(IJ).EQ.7.) IEV(IJ) =  38
      IF(RR(IJ).EQ.8.) IEV(IJ) =  66
      IF(RR(IJ).EQ.9.) IEV(IJ) = 100
      IF(RR(IJ).EQ.10.)IEV(IJ) = 154
   30 CONTINUE
      DO 31IK = 1,5
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 6,10
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.GT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
   33 IT1 = ISUMT1
   34 IF(IT1.GE.292) CTER05 = CTER05+1
      IF(IT1.GE.370) CTER01 = CTER01+1
C/-------------------------VAN DER WAERDEN---------------------------------/
      DO 50JJ = 1,10
      IF(RR(JJ).EQ.1.) IZI(JJ) =-134
      IF(RR(JJ).EQ.2.) IZI(JJ) = -91
      IF(RR(JJ).EQ.3.) IZI(JJ) = -60
      IF(RR(JJ).EQ.4.) IZI(JJ) = -35
      IF(RR(JJ).EQ.5.) IZI(JJ) = -11
      IF(RR(JJ).EQ.6.) IZI(JJ) =  11
      IF(RR(JJ).EQ.7.) IZI(JJ) =  35
      IF(RR(JJ).EQ.8.) IZI(JJ) =  60
      IF(RR(JJ).EQ.9.) IZI(JJ) =  91
      IF(RR(JJ).EQ.10.)IZI(JJ) = 134
   50 CONTINUE
      DO 51LL = 1,5
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 6,10
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.GT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
```

```
0122            54 IF(ITV1.GE.260) CVANO5 = CVANO5+1
0123               IF(ITV1.GE.331) CVANO1 = CVANO1+1
0124           100 CONTINUE
0125               WRITE(3,200)
0126           200 FORMAT(//5X,'CTTO5',5X,'CWINO5',5X,'CTERO5',5X,'CVANO5')
0127               WRITE(3,300)CTTO5,CWINO5,CTERO5,CVANO5
0128           300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0129               WRITE(3,400)
0130           400 FORMAT(//5X,'CTTO1',5X,'CWINO1',5X,'CTERO1',5X,'CVANO1')
0131               WRITE(3,500)CTTO1,CWINO1,CTERO1,CVANO1
0132           500 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
0133          2000 CONTINUE
0134               STOP
0135               END
```

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```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME    02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   15/03/83     TIME    23.15.39
          C / ------------------- LOGISTIC ------------------------------------/
                SUBROUTINE LOGIS(EX,STD,G)
                COMMON IA
              1 CALL RANDOM(IA,IY,RN)
                IF(RN.LE.0.0)GO TO 1
                XL = ALOG(RN)-ALOG(1.0-RN)
                XL = XL*SQRT(3.0)/3.141593
                G = EX+STD*XL
                RETURN
                END
```

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```
COS FORTRAN IV 360N-FO-479 3-8          MAINRGM          DATE   12/03/83      TIME    02.05.36

C/-----------------------------RANK-------------------------------------------/
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(10),R(10)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-3          MAINPGM          DATE    12/03/83      TIME     12.35

              C ***********************************************************
              C *                                                         *
              C *                                                         *
              C *              LL : SAMPLE SIZE(N1) = 10                  *
              C *                                                         *
              C *                                                         *
              C ***********************************************************
0001                DIMENSION NODAT(20),FR(20),R(20),EV(20),ZI(20),ILV(20),
                   *IZI(20)
0002                COMMON IA
0003                REAL NODAT,N1,N2,MEAN1,MEAN2
0004                N1 = 10
0005                N2 = 10
              C/-----------------------------------------------------------------------
0006                DO 2000KKK = 1,8
0007                IA = 65539
0008                CTT05 = 0.
0009                CTT01 = 0.
0010                CWIN05 = 0.
0011                CWIN01 = 0.
0012                CTER05 = 0.
0013                CTER01 = 0.
0014                CVAN05 = 0.
0015                CVAN01 = 0.
              C/-----------------------------------------------------------------------
0016                DO 1001 = 1,1000
0017                STD = 10.
0018                SUM1  = 0.
0019                SUM2  = 0.
0020                SUMX1 = 0.
0021                SUMX2 = 0.
0022                SUMR1 = 0.
0023                SUMR2 = 0.
0024                EXPP  = 0.
0025                ZII   = 0.
0026                ISUMT1= 0.
0027                ISUMT2= 0.
0028                ISUMV1= 0.
0029                ISUMV2= 0.
0030                GO TO (19,12,13,14,15,16,17,18),KKK
              C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
              C     WHEN DELTA IS 0.0S.D.
0031             19 EX = 500.
0032                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 0.25S.D.
0033             12 EX = 502.5
0034                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 0.5S.D.
0035             13 EX = 505.0
0036                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 0.75S.D.
0037             14 EX = 507.5
0038                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 1.0S.D.
0039             15 EX = 510.0
0040                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 1.25S.D.
0041             16 EX = 512.5
0042                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 1.50S.D.
0043             17 EX = 515.0
0044                GO TO 20
              C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
              C     WHEN DELTA IS 1.75S.D.
0045             18 EX = 517.5
0046             20 DO 10J = 1,10
0047                CALL LOGIS(EX,STD,G)
```

```
   10 NODAT(J) = G
      EX = 500.
      DO 11IX = 11,20
      CALL LOGIS(EX,STD,G)
   11 NODAT(IX) = G
C/-----------------------------T-TEST-------------------------------------------/
      DO 1IQ = 1,10
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,10
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 11,20
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 11,20
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.101) CTT05 = CTT05+1
      IF(TTEST.GE.2.878) CTT01 = CTT01+1
C/-----------------------------WILCOXON-------------------------------------------/
      N = 20
      CALL RANK(NODAT,R,N)
      DO 3K = 1,20
    3 RR(K) = R(K)
      DO 4L = 1,10
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 11,20
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
      ZWIN = ABS(WIN)
      IF(ZWIN.GE.1.96) CWIN05 = CWIN05+1
      IF(ZWIN.GE.2.58) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING-------------------------------------/
      DO 30IJ = 1,20
      IF(RR(IJ).EQ.1.) IEV(IJ) =-187
      IF(RR(IJ).EQ.2.) IEV(IJ) =-141
      IF(RR(IJ).EQ.3.) IEV(IJ) =-113
      IF(RR(IJ).EQ.4.) IEV(IJ) = -92
      IF(RR(IJ).EQ.5.) IEV(IJ) = -75
      IF(RR(IJ).EQ.6.) IEV(IJ) = -59
      IF(RR(IJ).EQ.7.) IEV(IJ) = -45
      IF(RR(IJ).EQ.8.) IEV(IJ) = -31
      IF(RR(IJ).EQ.9.) IEV(IJ) = -19
      IF(RR(IJ).EQ.10.)IEV(IJ) =  -6
      IF(RR(IJ).EQ.11.)IEV(IJ) =   6
      IF(RR(IJ).EQ.12.)IEV(IJ) =  19
      IF(RR(IJ).EQ.13.)IEV(IJ) =  31
      IF(RR(IJ).EQ.14.)IEV(IJ) =  45
      IF(RR(IJ).EQ.15.)IEV(IJ) =  59
      IF(RR(IJ).EQ.16.)IEV(IJ) =  75
      IF(RR(IJ).EQ.17.)IEV(IJ) =  92
      IF(RR(IJ).EQ.18.)IEV(IJ) = 113
      IF(RR(IJ).EQ.19.)IEV(IJ) = 141
      IF(RR(IJ).EQ.20.)IEV(IJ) = 187
   30 CONTINUE
      DO 31IK = 1,10
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 11,20
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.LT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
   33 IT1 = ISUMT1
   34 T1 = IT1/100.
      DO 35KK = 1,20
      EV(KK) = IEV(KK)/100.
   35 EXPP = EXPP+EV(KK)**2
      VART = N1*N2/(N1+N2-1.)*(EXPP/(N1+N2))
      TER  = T1/SQRT(VART)
      ZTER = ABS(TER)
      IF(ZTER.GE.1.96) CTER05 = CTER05+1
      IF(ZTER.GE.2.58) CTER01 = CTER01+1
```

```
C/----------VAN DER WAERDEN----------/
      DO 5000 J = 1,20
      IF(RR(JJ).EQ.1.) IZI(JJ) =-167
      IF(RR(JJ).EQ.2.) IZI(JJ) =-131
      IF(RR(JJ).EQ.3.) IZI(JJ) =-107
      IF(RR(JJ).EQ.4.) IZI(JJ) = -83
      IF(RR(JJ).EQ.5.) IZI(JJ) = -71
      IF(RR(JJ).EQ.6.) IZI(JJ) = -57
      IF(RR(JJ).EQ.7.) IZI(JJ) = -43
      IF(RR(JJ).EQ.8.) IZI(JJ) = -30
      IF(RR(JJ).EQ.9.) IZI(JJ) = -18
      IF(RR(JJ).EQ.10.)IZI(JJ) =  -6
      IF(RR(JJ).EQ.11.)IZI(JJ) =   6
      IF(RR(JJ).EQ.12.)IZI(JJ) =  18
      IF(RR(JJ).EQ.13.)IZI(JJ) =  30
      IF(RR(JJ).EQ.14.)IZI(JJ) =  43
      IF(RR(JJ).EQ.15.)IZI(JJ) =  57
      IF(RR(JJ).EQ.16.)IZI(JJ) =  71
      IF(RR(JJ).EQ.17.)IZI(JJ) =  83
      IF(RR(JJ).EQ.18.)IZI(JJ) = 107
      IF(RR(JJ).EQ.19.)IZI(JJ) = 131
      IF(RR(JJ).EQ.20.)IZI(JJ) = 167
   50 CONTINUE
      DO 51LL = 1,10
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 11,20
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.LT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
   54 TV1 = ITV1/100.
      DO 55NN = 1,20
      ZI(NN) = IZI(NN)/100.
   55 ZII = ZII+ZI(NN)**2/(N1+N2)
      VARV = N1*N2/(N1+N2-1.)*ZII
      VAN  = TV1/SQRT(VARV)
      ZVAN = ABS(VAN)
      IF(ZVAN.GE.1.96) CVAN05 = CVAN05+1
      IF(ZVAN.GE.2.58) CVAN01 = CVAN01+1
  100 CONTINUE
      WRITE(3,200)
  200 FORMAT(//5X,'CTT05',5X,'CWIN05',5X,'CTER05',5X,'CVAN05')
      WRITE(3,300)CTT05,CWIN05,CTER05,CVAN05
  300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
      WRITE(3,400)
  400 FORMAT(//55X,'CTT01',5X,'CWIN01',5X,'CTER01',5X,'CVAN01')
      WRITE(3,500)CTT01,CWIN01,CTER01,CVAN01
  500 FORMAT(53X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
 2000 CONTINUE
      STOP
      END
```

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```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83     TIME    02.04.13

          C/-----------------------------RANDOM-----------------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   15/03/83     TIME    23.15.39
          C / ------------------------ LOGISTIC ------------------------------------------/
0001            SUBROUTINE LOGIS(EX,STD,G)
0002            COMMON IA
0003          1 CALL RANDOM(IA,IY,RN)
0004            IF(RN.LE.0.0)GO TO 1
0005            XL = ALOG(RN)-ALOG(1.0-RN)
0006            XL = XL*SQRT(3.0)/3.141593
0007            G = EX+STD*XL
0008            RETURN
0009            END
```

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```
DCS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE   12/03/83      TIME   02.10.44
C/-----------------------------RANK-----------------------------------------------/
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(20),R(20)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAIN.COB              DATE    14/03/82      TIME      10:49:35

      C ***************************************************************
      C *                                                             *
      C *                                                             *
      C *                  LL : SAMPLE SIZE(N1) = 15                  *
      C *                                                             *
      C *                                                             *
      C ***************************************************************
0001        DIMENSION NODAT(30),RR(30),R(30),CV(30),ZI(30),IEV(30),
           *IZI(30)
0002        COMMON IA
0003        REAL NODAT,N1,N2,MEAN1,MEAN2
0004        N1 = 15
0005        N2 = 15
      C/-------------------------------------------------------------------------/
0006        DO 2000KKK = 1,8
0007        IA = 65539
0008        CTTO5 = 0.
0009        CTTO1 = 0.
0010        CWIN05 = 0.
0011        CWING1 = 0.
0012        CTERO5 = 0.
0013        CTERO1 = 0.
0014        CVANO5 = 0.
0015        CVANO1 = 0.
      C/-------------------------------------------------------------------------/
0016        DO 1001 = 1,1000
0017        STD = 10.
0018        SUM1  = 0.
0019        SUM2  = 0.
0020        SUMX1 = 0.
0021        SUMX2 = 0.
0022        SUMR1 = 0.
0023        SUMR2 = 0.
0024        EXPP  = 0.
0025        ZII   = 0.
0026        ISUMT1= 0.
0027        ISUMT2= 0.
0028        ISUMV1= 0.
0029        ISUMV2= 0.
0030        GO TO (19,12,13,14,15,16,17,18),KKK
      C     THIS IS DESIGNED TO COMPUTE THE ACTUAL TYPE I ERROR
      C     WHEN DELTA IS 0.0S.D.
0031     19 EX = 500.
0032        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 0.25S.D.
0033     12 EX = 502.5
0034        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 0.5S.D.
0035     13 EX = 505.0
0036        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 0.75S.D.
0037     14 EX = 507.5
0038        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 1.0S.D.
0039     15 EX = 510.0
0040        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 1.25S.D.
0041     16 EX = 512.5
0042        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 1.5OS.D.
0043     17 EX = 515.0
0044        GO TO 20
      C     THIS IS DESIGNED TO COMPUTE THE POWER OF TESTS
      C     WHEN DELTA IS 1.75S.D.
0045     18 EX = 517.5
0046     20 DO 10J = 1,15
0047        CALL LOGIS(EX,STD,G)
```

```
   10 NODAT(J) = G
      EX = 500.
      DO 11IX = 16,30
      CALL LOGIS(EX,STD,G)
   11 NODAT(IX) = G
C/-----------------------------T-TEST-------------------------------------------/
      DO 1IQ = 1,15
    1 SUM1 = SUM1+NODAT(IQ)
      MEAN1 = SUM1/N1
      DO 8JQ = 1,15
    8 SUM2 = SUM2+(NODAT(JQ)-MEAN1)**2
      DO 2IB = 16,30
    2 SUMX1 = SUMX1+NODAT(IB)
      MEAN2 = SUMX1/N2
      DO 9KQ = 16,30
    9 SUMX2 = SUMX2+(NODAT(KQ)-MEAN2)**2
      XX = (SUM2+SUMX2)/(N1+N2-2.)*(1./N1+1./N2)
      TEST = (MEAN1-MEAN2)/SQRT(XX)
      TTEST = ABS(TEST)
      IF(TTEST.GE.2.048) CTT05 = CTT05+1
      IF(TTEST.GE.2.763) CTT01 = CTT01+1
C/-----------------------------WILCOXON-----------------------------------------/
      N = 30
      CALL RANK(NODAT,R,N)
      DO 3K = 1,30
    3 RR(K) = R(K)
      DO 4L = 1,15
    4 SUMR1 = SUMR1+RR(L)
      DO 5M = 16,30
    5 SUMR2 = SUMR2+RR(M)
      IF(SUMR1.LT.SUMR2) GO TO 6
      TR1 = SUMR2
      GO TO 7
    6 TR1 = SUMR1
    7 WIN = (TR1-N1*(N1+N2+1.)/2.)/SQRT(N1*N2*(N1+N2+1.)/12.)
      ZWIN = ABS(WIN)
      IF(ZWIN.GE.1.96) CWIN05 = CWIN05+1
      IF(ZWIN.GE.2.58) CWIN01 = CWIN01+1
C/-----------------------------TERRY-HOEFFDING----------------------------------/
      DO 30IJ = 1,30
      IF(RR(IJ).EQ.1.) IEV(IJ) =-204
      IF(RR(IJ).EQ.2.) IEV(IJ) =-162
      IF(RR(IJ).EQ.3.) IEV(IJ) =-136
      IF(RR(IJ).EQ.4.) IEV(IJ) =-118
      IF(RR(IJ).EQ.5.) IEV(IJ) =-103
      IF(RR(IJ).EQ.6.) IEV(IJ) = -89
      IF(RR(IJ).EQ.7.) IEV(IJ) = -78
      IF(RR(IJ).EQ.8.) IEV(IJ) = -67
      IF(RR(IJ).EQ.9.) IEV(IJ) = -57
      IF(RR(IJ).EQ.10.)IEV(IJ) = -47
      IF(RR(IJ).EQ.11.)IEV(IJ) = -38
      IF(RR(IJ).EQ.12.)IEV(IJ) = -29
      IF(RR(IJ).EQ.13.)IEV(IJ) = -21
      IF(RR(IJ).EQ.14.)IEV(IJ) = -12
      IF(RR(IJ).EQ.15.)IEV(IJ) =  -4
      IF(RR(IJ).EQ.16.)IEV(IJ) =   4
      IF(RR(IJ).EQ.17.)IEV(IJ) =  12
      IF(RR(IJ).EQ.18.)IEV(IJ) =  21
      IF(RR(IJ).EQ.19.)IEV(IJ) =  29
      IF(RR(IJ).EQ.20.)IEV(IJ) =  38
      IF(RR(IJ).EQ.21.)IEV(IJ) =  47
      IF(RR(IJ).EQ.22.)IEV(IJ) =  57
      IF(RR(IJ).EQ.23.)IEV(IJ) =  67
      IF(RR(IJ).EQ.24.)IEV(IJ) =  78
      IF(RR(IJ).EQ.25.)IEV(IJ) =  89
      IF(RR(IJ).EQ.26.)IEV(IJ) = 103
      IF(RR(IJ).EQ.27.)IEV(IJ) = 118
      IF(RR(IJ).EQ.28.)IEV(IJ) = 136
      IF(RR(IJ).EQ.29.)IEV(IJ) = 162
      IF(RR(IJ).EQ.30.)IEV(IJ) = 204
   30 CONTINUE
      DO 31IK = 1,15
   31 ISUMT1 = ISUMT1+IEV(IK)
      DO 32IN = 16,30
   32 ISUMT2 = ISUMT2+IEV(IN)
      IF(ISUMT1.LT.ISUMT2) GO TO 33
      IT1 = ISUMT2
      GO TO 34
```

```
   33 IT1 = ISUMT1
   34 T1 = IT1/100.
      DO 35KK = 1,30
      EV(KK) = IEV(KK)/100.
   35 EXPP = EXPP+EV(KK)**2
      VART = N1*N2/(N1+N2-1.)*(EXPP/(N1+N2))
      TER  = T1/SQRT(VART)
      ZTER = ABS(TER)
      IF(ZTER.GE.1.96) CTERO5 = CTERO5+1
      IF(ZTER.GE.2.58) CTERO1 = CTERO1+1
C/-----------------------------VAN DER WAERDEN-----------------------------------/
      DO 50JJ = 1,30
      IF(RR(JJ).EQ.1.) IZI(JJ) =-185
      IF(RR(JJ).EQ.2.) IZI(JJ) =-152
      IF(RR(JJ).EQ.3.) IZI(JJ) =-130
      IF(RR(JJ).EQ.4.) IZI(JJ) =-113
      IF(RR(JJ).EQ.5.) IZI(JJ) = -99
      IF(RR(JJ).EQ.6.) IZI(JJ) = -86
      IF(RR(JJ).EQ.7.) IZI(JJ) = -75
      IF(RR(JJ).EQ.8.) IZI(JJ) = -65
      IF(RR(JJ).EQ.9.) IZI(JJ) = -55
      IF(RR(JJ).EQ.10.)IZI(JJ) = -46
      IF(RR(JJ).EQ.11.)IZI(JJ) = -37
      IF(RR(JJ).EQ.12.)IZI(JJ) = -29
      IF(RR(JJ).EQ.13.)IZI(JJ) = -20
      IF(RR(JJ).EQ.14.)IZI(JJ) = -12
      IF(RR(JJ).EQ.15.)IZI(JJ) =  -4
      IF(RR(JJ).EQ.16.)IZI(JJ) =   4
      IF(RR(JJ).EQ.17.)IZI(JJ) =  12
      IF(RR(JJ).EQ.18.)IZI(JJ) =  20
      IF(RR(JJ).EQ.19.)IZI(JJ) =  29
      IF(RR(JJ).EQ.20.)IZI(JJ) =  37
      IF(RR(JJ).EQ.21.)IZI(JJ) =  46
      IF(RR(JJ).EQ.22.)IZI(JJ) =  55
      IF(RR(JJ).EQ.23.)IZI(JJ) =  65
      IF(RR(JJ).EQ.24.)IZI(JJ) =  75
      IF(RR(JJ).EQ.25.)IZI(JJ) =  86
      IF(RR(JJ).EQ.26.)IZI(JJ) =  99
      IF(RR(JJ).EQ.27.)IZI(JJ) = 113
      IF(RR(JJ).EQ.28.)IZI(JJ) = 130
      IF(RR(JJ).EQ.29.)IZI(JJ) = 152
      IF(RR(JJ).EQ.30.)IZI(JJ) = 185
   50 CONTINUE
      DO 51LL = 1,15
   51 ISUMV1 = ISUMV1+IZI(LL)
      DO 52MM = 16,30
   52 ISUMV2 = ISUMV2+IZI(MM)
      IF(ISUMV1.LT.ISUMV2) GO TO 53
      ITV1 = ISUMV2
      GO TO 54
   53 ITV1 = ISUMV1
   54 TV1 = ITV1/100.
      DO 55NN = 1,30
      ZI(NN) = IZI(NN)/100.
   55 ZII = ZII+ZI(NN)**2/(N1+N2)
      VARV = N1*N2/(N1+N2-1.)*ZII
      VAN  = TV1/SQRT(VARV)
      ZVAN = ABS(VAN)
      IF(ZVAN.GE.1.96) CVANO5 = CVANO5+1
      IF(ZVAN.GE.2.58) CVANO1 = CVANO1+1
  100 CONTINUE
      WRITE(3,200)
  200 FORMAT(//5X,'CTTO5',5X,'CWINO5',5X,'CTERO5',5X,'CVANO5')
      WRITE(3,300)CTTO5,CWINO5,CTERO5,CVANO5
  300 FORMAT(3X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
      WRITE(3,400)
  400 FORMAT(/55X,'CTTO1',5X,'CWINO1',5X,'CTERO1',5X,'CVANO1')
      WRITE(3,500)CTTO1,CWINO1,CTERO1,CVANO1
  500 FORMAT(55X,F6.1,4X,F6.1,5X,F6.1,5X,F6.1)
 2000 CONTINUE
      STOP
      END
```

```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    12/03/83      TIME    02.04.13

          C/-----------------------------RANDOM-----------------------------------------/
0001            SUBROUTINE RANDOM(IX,IY,RN)
0002            COMMON IA
0003            IY = IX*65539
0004            IF(IY)5,6,6
0005          5 IY = IY+2147483647+1
0006          6 RN = IY
0007            RN = RN*.4656613E-9
0008            IX = IY
0009            IA = IX
0010            RETURN
0011            END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE    15/03/83      TIME     23.15.39

          C / ------------------------ LOGISTIC ------------------------------------------/
                SUBROUTINE LOGIS(EX,STD,G)
                COMMON IA
              1 CALL RANDOM(IA,IY,RN)
                IF(RN.LE.0.0)GO TO 1
                XL = ALOG(RN)-ALOG(1.0-RN)
                XL = XL*SQRT(3.0)/3.141593
                G = EX+STD*XL
                RETURN
                END
```

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```
DOS FORTRAN IV 360N-FO-479 3-8          MAINPGM          DATE  12/03/83      TIME    02.17.12
C/-----------------------------RANK-----------------------------------------------------
      SUBROUTINE RANK(A,R,N)
      DIMENSION A(30),R(30)
      DO 10I = 1,N
   10 R(I) = 0.0
      DO 100I = 1,N
      IF(R(I))20,20,100
   20 SMALL = 0.0
      EQUAL = 0.0
      X = A(I)
      DO 50J = 1,N
      IF(A(J)-X)30,40,50
   30 SMALL = SMALL+1.0
      GO TO 50
   40 EQUAL = EQUAL+1.0
      R(J) = -1.0
   50 CONTINUE
      IF(EQUAL-1.0)60,60,70
   60 R(I) = SMALL+1.0
      GO TO 100
   70 P = SMALL+(EQUAL+1.0)*0.5
      DO 90J = 1,N
      IF(R(J)+1.0)90,80,90
   80 R(J) = P
   90 CONTINUE
  100 CONTINUE
      RETURN
      END
```

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ประวัติผู้เขียน

นางสาวไปรมา พจนพิมล เกิดวันที่ 18 กรกฎาคม พ.ศ. 2498 ที่จังหวัดชุมพร สำเร็จการศึกษาปริญญาการศึกษาบัณฑิต (เกียรตินิยมอันดับ 2) วิชาเอกคณิตศาสตร์ จากมหาวิทยาลัยศรีนครินทรวิโรฒ วิทยาเขตบางแสน เมื่อปีการศึกษา 2520 เข้าศึกษาต่อในสาขาวิชา สถิติการศึกษา ภาควิชาวิจัยการศึกษา บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย ปีการศึกษา 2524 ปัจจุบันรับราชการตำแหน่งอาจารย์ 1 ระดับ 3 โรงเรียนสวนศรีวิทยา อ.หลังสวน จ.ชุมพร

หอสมุดกลาง สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

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