A computer program to estimate a raw score frequency distribution from percentile ranks

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The purpose of this paper is to describe a computer program written in FORTRAN IV (Appendix A), by which a raw score frequency distribution can be estimated by using percentile ranks and the size of the normative sample.

Description. Estimated frequencies (EF) associated with raw score points can be found, beginning with the lowest percentile rank (PR), using the following formula: $EF = (PR/100.0 - ECP) * 2.0 * N$. ECP represents the estimated cumulative percentage below a given raw score point, and N indicates the number of subjects in the normative sample.

When percentile ranks are exact, the resulting frequencies will be exact. However, since percentile ranks are usually reported sans decimals, estimated frequencies often vary depending upon whether the estimation begins with the highest or lowest percentile rank. To

compensate for this likelihood, estimated frequencies are also calculated, beginning with the highest percentile rank, using the following formula: $EF = (1.0 - PR/100.0 - ECP) * 2.0 * N$. Estimated frequencies are then determined using the average of estimated frequencies beginning with the highest percentile rank, and those beginning with the lowest percentile rank.

Input. The control card contains the number of raw score and percentile rank points, the size of the normative sample, and an alphanumeric job description. This is followed by a variable format card. Raw score points, followed by corresponding percentile rank points, are then read.

Output. Input specifications are printed, followed by a listing of raw score points, corresponding percentile rank points, estimated frequencies, means and standard deviations, and indices of skewness and kurtosis (see McNemar, 1949).

Availability. A listing of the FORTRAN IV program, and sample input and output (Appendix B) are available at no cost from Edward Burns, Programs in Professional Education, State University of New York, Binghamton, New York 13901.

Appendix A

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C      1. PROBLEM CARD:
C      COLS. 1 - 5 = NUMBER OF RAW SCORE AND PERCENTILE RANK POINTS
C      COLS. 6 - 10 = SAMPLE NUMBER
C      2. FORMAT CARD FOR RAW SCORE AND PERCENTILE RANK POINTS
C      3. RAW SCORE POINTS FOLLOWED BY PERCENTILE RANK POINTS
C      4. REPEAT STEPS 1 - 3 AS DESIRED
C
      DIMENSION FORMAT(20), PR(100), EN(3,100), SCORE(100), SX(3),
      ISXS(3), XMEAN(3), TEN(3), SD(3), SKEW(3), XKUR(3), LABEL(18)
5      CONTINUE
      READ(5,10,END=70) NPR, NS, (LABEL(I), I=1,18)
10     FORMAT(2I5, 17A4, A2)
      XNS=NS
      READ(5,15) (FORMAT(I), I=1,20)
15     FORMAT(20A4)
      READ(5,FORMAT) (SCORE(I), I=1,NPR), (PR(J), J=1,NPR)
      WRITE(6,20) (LABEL(I), I=1,18), NPR, NS, (FORMAT(J), J=1,20)
20     FORMAT ('1'////10X,17A4,A2/10X,'PR POINTS = ',I5/10X,'NUMBER = ',
      I15/10X,20A4//10X,45('-')//14X,'SCORE',2X,'PR RANK',3X,'N DOWN',5X,
      2'N UP',3X,'N MEAN'//10X,45('-')//)
      DO 25 J=1,3
      SX(J)=0.0
      SXS(J)=0.0
      TEN(J)=0.0
      SKEW(J)=0.0
25     XKUR(J)=0.0
C
      C=0.0
      DO 30 I=1,NPR
      PER=(1.0 - PR(I) / 100.0 - C) * 2.0
      IF(PER .LT. 0.0) PER=0.0
      EN(1,I)=PER * XNS
30     C=C + PER
      C=0.0
      DO 35 I=1,NPR
      PER=(PR(NPR+1-I) / 100.0 - C) * 2.0

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IF(PER .LT. 0.0) PER=0.0
EN(2,NPR+1-I)=PER * XNS
C=C + PER
EN(3,NPR+1-I)=(EN(1,NPR+1-I) + EN(2,NPR+1-I) / 2.0
DO 35 J=1,3
SX(J)=SX(J) + SCORE(NPR+1-I) * EN(J,NPR+1-I)
SXS(J)=SXS(J) + SCORE(NPR+1-I)**2 * EN(J, NPR+1-I)
35 TEN(J)=TEN(J) + EN(J, NPR+1-I)
C
DO 45 I=1,NPR
WRITE(6,40) SCORE(I), PR(I), (EN(J,I), J=1,3)
40 FORMAT(10X, 5F9.3)
45 CONTINUE
DO 50 J=1,3
XMEAN(J)=SX(J) / TEN(J)
50 SD(J)=SQRT(SXS(J) / TEN(J) - XMEAN(J)**2)
DO 55 J=1,3
DO 55 I=1,NPR
SKEW(J)=SKEW(J) + (SCORE(I) - XMEAN(J))**3 * EN(J,I)
55 XKUR(J)=XKUR(J) + (SCORE(I) - XMEAN(J))**4 * EN(J,I)
DO 60 J=1,3
SKEW(J)=SKEW(J) / TEN(J) / SD(J)**3 / SQRT(6.0 / TEN(J))
60 XKUR(J)=(XKUR(J) / TEN(J) / SD(J)**4 - 3.0) / SQRT(24.0 / TEN(J))
C
WRITE(6,65) (TEN(J),J=1,3), (XMEAN(J),J=1,3), (SD(J),J=1,3)
1, (SKEW(J),J=1,3), (XKUR(J),J=1,3)
65 FORMAT(/10X,45(' ')/17X,'NUMBER = ',2X3F9.3/17X,'MEAN = ',4X,
13F9.3/17X,'STAND D = ',1X,3F9.3/17X,'SKEWNESS = ',3F9.3/17X,
2'KURTOSIS = ',3F9.3)
GO TO 5
70 STOP
END

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Appendix B Sample Data

Input

18 50 SAMPLE DATA FROM BLOMMERS AND LINDQUIST (1960, P.73.)
(18F3.0/18F3.0)

27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10
99	98	96	93	89	82	71	52	31	17	11	9	8	8	7	6	4	1

Output

SAMPLE DATA FROM BLOMMERS AND LINDQUIST (1960, P.73.)
PR POINTS = 18
NUMBER = 50
(18F3.0/18F3.0)

SCORE	PR RANK	N DOWN	N UP	N MEAN
27.000	99.000	1.000	1.000	1.000
26.000	98.000	0.0	0.0	0.0
25.000	96.000	2.000	2.000	2.000
24.000	93.000	1.000	1.000	1.000
23.000	89.000	3.000	3.000	3.000
22.000	82.000	4.000	4.000	4.000
21.000	71.000	7.000	7.000	7.000
20.000	52.000	12.000	12.000	12.000
19.000	31.000	9.000	9.000	9.000
18.000	17.000	5.000	5.000	5.000
17.000	11.000	1.000	1.000	1.000
16.000	9.000	1.000	1.000	1.000
15.000	8.000	0.0	0.0	0.0
14.000	8.000	0.0	0.0	0.0
13.000	7.000	1.000	1.000	1.000
12.000	6.000	0.0	0.0	0.0
11.000	4.000	2.000	2.000	2.000
10.000	1.000	1.000	1.000	1.000

APPENDIX B (Continued)

	N DOWN	N UP	N MEAN
NUMBER =	50.000	50.000	50.000
MEAN =	19.680	19.680	19.680
STAND D =	3.240	3.240	3.240
SKEWNESS =	-2.815	-2.815	-2.815
KURTOSIS =	2.932	2.932	2.932

REFERENCES

- BLOMMERS, P., & LINDQUIST, E. *Elementary statistical methods*. Boston: Houghton Mifflin, 1960.
 MCNEMAR, Q. *Psychological statistics*. New York: John Wiley, 1949.

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