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DECUS NO.	FOCAL8-131
TITLE	ZAREA
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ZAREA

DECUS Program Library Write-up

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Purpose: This program is designed to calculate the area under the Guassian (normal) curve, given two Z scores. The proportion of cases falling between any two specified values of Z is a useful statistical tool. By converting the raw scores into Z scores, the percent cumulative frequency (or the number per hundred individuals) falling between the interval range can often be found. It is important to note that areas under the Guassian curve can also be interpreted as probabilities and as approximations of other measures.

Procedure: The program execution starts by asking for two Z scores. To transform a raw score into a "standard score" (Z) subtract the mean of the distribution from that score and divide the result by the standard deviation of the distribution. Generally, the Gaussian distribution may be used under at least two conditions: The population distribution from which the sample is drawn is Gaussian; or secondly, the sample is "large" (approximately 30 or more).

The routine will next ask for a tolerance,i.e.,the user's specifications of the segment width used to incrementally compute areas. Areas are computed by summing small area segments (tolerance times curve height) over the interval specified.

Recommendations: Table 1 below lists typical results from runs on a TSS-8 computer for various intervals and tolerances. In general, as the tolerance increases, error increases but execution time decreases. Unless a very high speed computer is used (e.g.,PDP-10),

tolerances of .001 and .0001 are unrealistic because of the drastic increase in execution time. It is recommended that .01 be used with short and intermediate ranges. This tolerance produces reasonable accuracy without the large execution time of the finer tolerances. This program, or portions of it, can easily be modified for use as a subroutine.

TABLE 1

EXECUTION TIME AND PERCENT ERROR OF PAIRS OF Z SCORES BY TOLERANCE

Z LIMITS	TOL	RESULT	TABLE VALUE*	APPROXIMATE EXECUTION TIME	PERCENT ERROR
[.9,1.9]	0.001	15.52	15.54	3Min.	-0.1
[.9,1.9]	0.01	15.43	15.54	15Sec.	-0.7
[.9,1.9]	0.1	14.54	15.54	3Sec.	-6.1
[+0.03,-0.6]	0.001	23.77	23.77	1Min. 35Sec.	0.0
[+0.03,-0.6]	0.01	22.94	23.77	10Sec.	-3.6
[-3.2,1.3]	0.001	90.21	90.19	9Min. 15Sec.	+0.02
[-3.2,1.3]	0.01	89.93	90.19	1Min.	-0.3
[-3.2,1.3]	0.1	87.11	90.19	4Sec.	-3.3
[-0.03,-.05]	0.0001	.7972	0.79	30Sec.	+0.9
[-0.03,-.05]	0.001	.7972	0.79	5Sec.	+0.9
[-0.03,-.05]	0.01	.7970	0.79	5Sec.	+0.88

* Table from Neyman, J. First Course in Probability and Statistics, New York, Holt: 1954

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02.10 S X=0;S A=0;S L=0
02.20 ASK Z
02.30 S D(X)=Z;S X=X+1;IF (X-2)2.2,2.4,2.4
02.40 IF (FABS(D(0))-FABS(D(1)))2.5,3.1,3.1
02.50 S TM=D(0);S D(0)=D(1);S D(1)=TM

03.10 S Z=0;S X=0;S NC=0;S PC=0
03.20 ASK T
03.30 IF (D(X))3.31,3.32,3.33
03.31 S D(X)=FABS(D(X));IF (NC-1)3.32,3.4,3.4
03.32 S NC=NC+1;GOTO 3.35
03.33 IF (PC-1)3.34,3.4,3.4
03.34 S PC=PC+1
03.35 S X=X+1;IF (X-1)3.3,3.3,3.8
03.40 S Z=D(1)
03.41 S Z=Z+T;IF (Z-D(0))3.6,3.6,3.91
03.50 IF (X-1)3.41,3.41,3.8
03.60 S Y=(1/FSQT(6.284))*FEXP(-.5*(Z*Z))
03.70 S A=A+(Y*T);GOTO 3.5
03.80 S Z=Z+T;IF (Z-D(1))3.6,3.6,3.9
03.90 S L=A;S A=0;S X=0;GOTO 3.4
03.91 S CF=(2*L)+A
03.92 T "% CUMULATIVE FREQ",100*CF
03.93 QUIT
*
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```
*?00.00
*LIBRARY CALL ZSAREA
*G
:-1.37 :-2.67
:.01
% CUMULATIVE FREQ=     8.0823*
*
*G
:-1.96
:1.96
:.01
% CUMULATIVE FREQ=    94.6528*
*G
:.59 :.94 :.001 % CUMULATIVE FREQ=    10.3940*
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