A FORTRAN IV function to compute the probability of a standard normal deviate

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The function yields an estimate of the probability that a standard normal deviate (z) has a value more extreme than the one evaluated. The algorithm used relies upon Simpson's Rule to approximate the definite integral. The function is presently set up to partition the interval between zero (the mean of the standard normal distribution) and the evaluated z into 1,000 equal intervals. The density function is computed at the successive ordinates created by the partitioning. These densities are then combined according to Simpson's Rule to yield an approximation of the area under the curve. It should be noted that increasing the number of

intervals beyond 1,000 will not change the first 10 digits of the estimate, so good convergence is reached with this number. The area exceeding z is easily computed by adding .5 (the other half of the curve) to the obtained area and subtracting this value from 1. A two-tailed estimate of the probability of z is obtained by multiplying this value by two.

Input. The function is called by a FORTRAN program. One argument, the z to be evaluated, is required.

Output. A value corresponding to a two-tailed probability of the argument is returned to the calling program.

Computer. The function was tested on an IBM 370/168 using FORTRAN IV. The arithmetic is performed in double precision and requires approximately 1K bytes of core. The function takes .23 sec to compile and an additional .06 sec to run.

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FUNCTION ZPROB (Z)
DOUBLE PRECISION X,F,SUM1,SUM2,SUMF,RINC,RINC2,Z,E,ZPROB,FLAST,CONST,RN
N=1000
RN=FLOAT(N)
E=2.718281828
CONST=.3989422804
RINC=DABS(Z)/RN
RINC2=RINC * 2.0
SUM1 = 0.0
X=-1.0 * RINC
DO 10 J=2,N,2
X=X+RINC2
F=CONST * (1.0/E** ((X*X)/2.0)) * 4.0
10 SUM1=SUM1+F
SUM2=0.0
X=0.0
DO 15 J=3,N,2
X=X+RINC2
F=CONST * (1.0/ E ** ((X*X)/2.0)) * 2.0
15 SUM2=SUM2+F
FLAST=CONST * (1.0/ E ** ((Z*Z)/2.0))
SUMF=FLAST+SUM1+SUM2+CONST
ZPROB=(1.0 - (((DABS(Z))/(3.0*RN)) * SUMF)+ .5)) * 2.0
RETURN
END

```

Figure 1.