



A SUBROUTINE SUBPROGRAM TO COMPUTE GEODETIC DISTANCE

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A SUBROUTINE SUBPROGRAM TO COMPUTE
GEODETTIC DISTANCES

GEØ is a subroutine subprogram, written in Fortran IVG, that computes geodetic distances¹ between two points on the earth's surface given the longitude and latitude of each point.

Accuracy

The subroutine has been tested on distances for which accurate measurements were available. The following results have been obtained:

Point A		Point B		Previously Established Distance	Subprogram GEØ Computed Distance	Differences in Miles
Long.	Lat.	Long.	Lat.			
94°04'	58°45'	97°14'	49°54'	625.18 mi.	625.42 mi.	0.24 mi.
101°04'	56°52'	108°29'	59°34'	328.79 mi.	328.77 mi.	-0.02 mi.
98°06'	59°55'	102°00'	60°00'	135.50 mi.	135.46 mi.	-0.04 mi.
101°57'	60°02'	103°25'	59°58'	51.06 mi.	51.05 mi.	-0.01 mi.
101°57'	60°02'	102°00'	60°00'	2.89 mi.	2.89 mi.	0.00 mi.

Note: All distances were measured in statute miles and rounded to the nearest 0.01 mi.
Longitude and latitude were taken to the nearest minute.

Storage*

The subroutine requires a storage area of 2,124 bytes.

¹Formula for computing geodetic distances was obtained from the Geodetic Section of the Dept. of Energy, Mines and Resources, as were the five sets of points and corresponding distances used in testing the accuracy of the formula.

Time*

Its execution time has been roughly estimated to be 0.001 sec. for each distance computation.

Use

A Fortran program may use this subroutine by means of the following statement:

```
CALL GEØ (Argument 1, Argument 2, Argument 3, Argument 4,  
          Argument 5, Argument 6)
```

Argument 1 - is the longitude of the first point

Argument 2 - is the latitude of the first point

Argument 3 - is the longitude of the second point

Argument 4 - is the latitude of the second point

Argument 5 - is the number of distances to be calculated, assuming one distance calculation for every two points and a longitude and latitude measurement for each point. Argument 5 must never be zero. If it is desired to perform only one distance computation this argument must be set equal to 1, if on the other hand, it is desired to calculate 100 distances, argument 5 would then be set equal to 100.

Argument 6 - is the resulting distance or distances calculated in statute miles.

* Based on IBM/360-65.

With the exception of argument 5 which is integer, all other arguments used by the subroutine are real and in single precision.

All longitudes and latitudes (Arguments 1 to 4 inclusively) must be in degrees. Minutes and seconds must be converted to decimals of degrees.

The following is an example of a short program written to use subroutine GEO.

```
C
C   EXAMPLE OF MAIN PROGRAM USING SUBROUTINE GEO.
C
C   DIMENSION ALONG(5),ALAT(5),BLONG(5),BLAT(5),DIST(5)
C   NO=5
C   ALONG,ALAT,BLONG,BLAT ARE THE LONGTITUDES AND LATITUDES OF POINTS
C   A AND B RESPECTIVELY.
C   NO IS THE NUMBER OF SETS OF POINTS TO BE PROCESSED.
C   DIST IS THE DISTANCE BETWEEN EACH SET OF POINTS.
C   READ(5,1) (ALONG(J),ALAT(J),BLONG(J),BLAT(J),J=1,NO)
1  FORMAT (4F6.2)
   CALL GEO (ALONG,ALAT,BLONG,BLAT,NO,DIST)
   WRITE(6,2)
2  FORMAT(/25X,'LONGTITUDE-A  LATITUDE-A  LONGTITUDE-B  LATITUDE-B',
15X,'DISTANCE'//)
   DO 5 J=1,NO
C   DISTANCES ROUNDED TO NEAREST .01 MI.
   DIST(J)=DIST(J)+0.005
   WRITE(6,3) ALONG(J),ALAT(J),BLONG(J),BLAT(J),DIST(J)
3  FORMAT      (20X,4(5X,F8.2),6X,F10.2,' STAT. MILES'//)
5  CONTINUE
   STOP
   END
```

Five distances are to be computed, thus Argument 5 is set equal to 5.

NOTE: Arguments 1 to 5 inclusively are not altered in any way after usage by the subroutine.

The input data used by the sample program is the same data used to test the accuracy of the formula. To keep the sample program simple these longtitudes and latitudes were converted to degrees and decimals of degrees, rounded to the nearest .01 degree, prior to being read by the sample program. This then accounts for the differences in accuracy in the resulting distances. (see page 1)

The following is the output of the sample program.

LONGTITUDE-A	LATITUDE-A	LONGTITUDE-B	LATITUDE-B	DISTANCE
94.07	58.75	97.23	49.90	625.37 STAT. MILES
101.07	56.87	108.48	59.57	328.55 STAT. MILES
98.10	59.92	102.00	60.00	135.45 STAT. MILES
101.95	60.03	103.42	59.97	51.13 STAT. MILES
101.95	60.03	102.00	60.00	2.71 STAT. MILES

All longitudes and latitudes are measured in degrees.

Program deck, source or binary, or further information may be obtained by contacting the author of this report.