

ACM Pacific NW Region Programming Contest

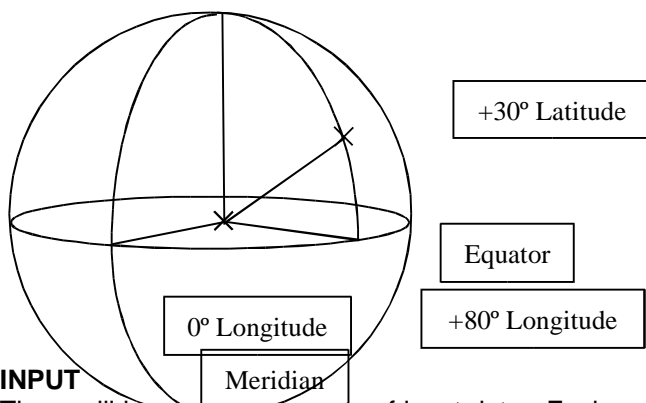
9 November 2002

PROBLEM F

Communication Planning for Phobos

Life has been found on Phobos, one of the satellites of Mars! Unfortunately, the life forms there aren't quite as advanced as those on Earth, and they don't have modern communications (at least by Earth standards). The Advanced Communication Management Company (ACM) has decided to build a central office and connect the Phobosians' homes for communication (telephone, television, Internet, and so forth). They naturally want to minimize their capital outlay in this effort, and they need to decide how to lay fiber optic cable (essentially on the surface) so the smallest amount is used. Since ACM uses digital broadband technology, it is only necessary that there be a cable path that connects every subscriber and the central office. That is, there does not necessarily need to be a separate cable from the central office to each subscriber's home.

We know the precise location of each Phobosian's home and the planned ACM central office on the surface. These are given using longitude and latitude. Longitude is measured from an arbitrary meridian on the surface of Phobos, and has values in the range -180 degrees to $+180$ degrees. Latitude is measured from the equator, and has values in the range -90 degrees to $+90$ degrees. For planning purposes we assume Phobos is perfectly spherical, exactly 16.7 miles in diameter. The figure below illustrates one possible location ($+80^\circ$ longitude, $+30^\circ$ latitude).



INPUT

There will be one or more sets of input data. Each set will contain, in order, an integer N no larger than 100, but at least 2, followed by N pairs of real numbers, each pair giving the unique longitude and latitude, in degrees, of a Phobosian's home or the central office. A single integer zero will follow the last data set.

OUTPUT

For each input data set print a single line containing the data set number (1, 2, ...) and the number of miles of cable required to connect all the Phobosian's homes and the central office; show two fractional digits in the distance.

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SAMPLE INPUT

```
3
0 0    0 90    0 -90

3
0 0    0 90    90 0

3
0 0    90 0    45 0

6
-10 10   -10 -10   0 0   90 0   80 20   100 -10

0
```

EXPECTED OUTPUT

```
Case 1: 26.23 miles
Case 2: 26.23 miles
Case 3: 13.12 miles
Case 4: 21.16 miles
```