

Coordinate Conversions

Both geographic coordinates (longitude and latitude) are angular measurements that can be expressed in various units. Ability to make proper unit conversions is needed for an effective data analysis.

Explorer's Guide

Before You Start

How much time (in minutes) elapsed between the following timed events:

Pair	Event 1	Event 2	Time elapsed (min)
1	1:20 pm	1:40 pm	
2	1:50 pm	2:10 am	
3	11:50 pm	0:10 am	

Compare your answers. Are they different? Did you have to use a different formula each time and why? Would you think of a way to find the time interval by simple subtraction of time corresponding to Event 2 from time corresponding to Event 1?

Learning by Doing

- Using a GPS receiver, obtain geographic coordinates for three points in three different formats (use setup option to change the format) and complete the table below:
 - Point 1: Decimal degrees (hddd.dddd°)
 - Point 2: Degrees and decimal minutes (hddd°mm.mmm')
 - Point 3: Degrees, minutes and seconds (hddd°mm'ss.s")

Point	Longitude			Latitude		
	Degrees(°)	Minutes(')	Seconds(")	Degrees(°)	Minutes(')	Seconds(")
1						
2						
3						

- To convert latitude and longitude into decimal degrees (DD) for a specific location, the following general equation should be used:

$$Latitude / Longitude_{DD} = Degrees + \frac{Minutes}{60} + \frac{Seconds}{3600}$$

Point 1: $Longitude_{DD} =$

$Latitude_{DD} =$

Point 2: $Longitude_{DD} =$

$Latitude_{DD} =$

Point 3: $Longitude_{DD} =$

$Latitude_{DD} =$

3. Using sign convention where Western longitude is negative and Northern latitude is positive (most of United States), complete the table below:

Point	Latitude	Longitude
1	_____°	_____°
2	_____°	_____°
3	_____°	_____°

How Does It Work

Since geographic coordinates are actually angles, they are measured in degrees (360° form a complete circle). In Nebraska, 1° of latitude means almost 70 miles while 1° of longitude is about 53 miles. Therefore, we need to have 5-6 decimal points (decimal degree format) to deal with relatively small distances (around 1 foot) or use minutes (') and, in some cases, seconds (") to represent fractions of an angle. Similarly to the measurement of time, 1° = 60' and 1' = 60". For practical applications, it is always better to record geographic coordinates in decimal degrees with "-" sign (negative) to indicate Western longitude or Southern latitude. Following are couple of examples to show how geographic coordinates are converted from fractional units to decimal degrees:

1. For Northern Latitude of 40° 51.0642':

$$Latitude_{DD} = 40 + \frac{51.0642}{60} = 40.85107^{\circ}$$

2. For Western Longitude of 96° 28' 9.8"

$$Longitude_{DD} = -\left(96 + \frac{28}{60} + \frac{9.8}{3600}\right) = -96.46939^{\circ}$$

Additional Challenge

How would you convert latitude and longitude from decimal degrees format to degrees, minutes and seconds? Provide an example.

Vocabulary

Unit Conversion: Converting quantities of something from one measurement to the other.

Interesting to Know

In mathematics, angles are typically measured in radians. A complete circle (360°) equals 2π radians, where π (pi) is approximately 3.1416. A 1 radian angle cuts an arc of a circle of the same length as its radius when placed in the center. Calculators capable of dealing with angles need to be switched to appropriate units (degrees or radians) when calculations are done.

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