

GNSS/GPS Homework 3

- **Converting 3-D Cartesian coordinate to Latitude, Longitude**
- **Converting Latitude, Longitude to 3-D Cartesian coordinate**

(I) Program

I allocated WGS84's constants to code, give in course material.

Ellipsoid Name (year computed)	Semi-Major Axis, a, [m]	Inverse Flattening, 1/f
Bessel (1841)	6377397.155	299.152813
Geodetic Reference System (1967), GRS67	6378160.0	298.2471674273
World Geodetic System (1972), WGS72	6378160.0	298.26
Geodetic Reference System (1980), GRS80	6378137.0	298.257222101
World Geodetic System (1984), WGS84	6378137.0	298.257223563

```
# Constants for WGS84
a = 6378137.0 # Semi-major axis
f = 1 / 298.257223563 # Flattening
e2 = f * (2 - f) # Square of eccentricity
```

Then I just write the code down converting latitude/longitude to xyz coordinates, as course material given.

$$X = OH = (v + h) \cos \varphi \cos \lambda$$

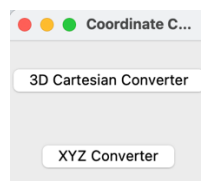
$$Y = HK = (v + h) \cos \varphi \sin \lambda$$

$$Z = KA = (v (1 - e^2) + h) \sin \varphi$$

```
lat_rad = math.radians(lat)
lon_rad = math.radians(lon)
N = a / math.sqrt(1 - e2 * math.sin(lat_rad)**2)
X = (N + h) * math.cos(lat_rad) * math.cos(lon_rad)
Y = (N + h) * math.cos(lat_rad) * math.sin(lon_rad)
Z = ((1 - e2) * N + h) * math.sin(lat_rad)
return X, Y, Z
```

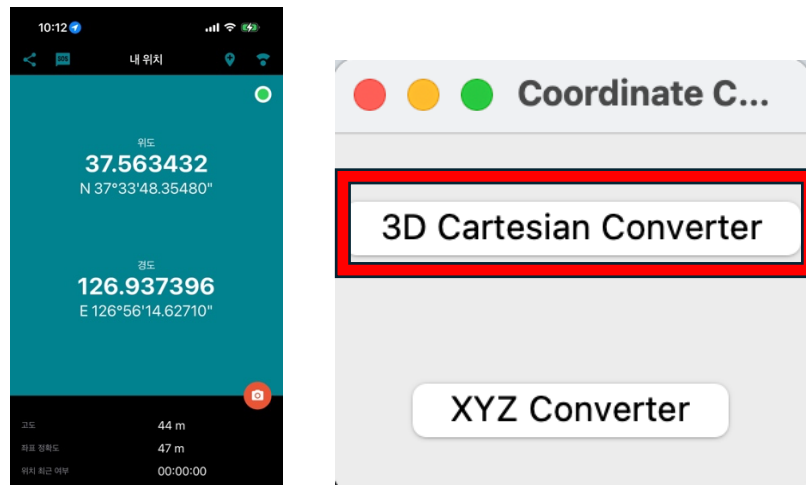
And to made program based on GUI, and OOP.

Once click each button, the conversion starts and the result comesout as pop-up box.



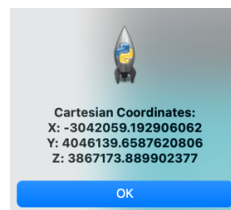
(II) Verification.

I downloaded GPS tracker from appstore, and got a data from yonsei central library, where I was doing homework.



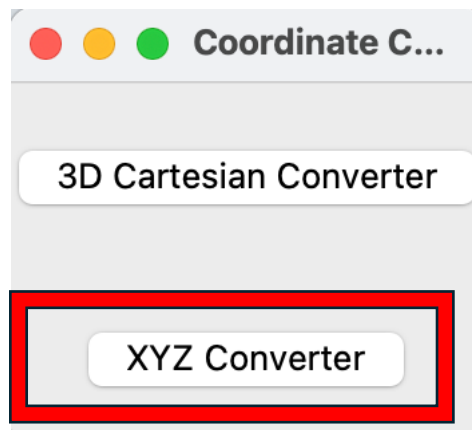
Then click on 3D Cartesian Converter, I write down there coordinates.

The dialog box is titled 'Enter Geographic Coordinates'. It contains three input fields:
Latitude: 37.563432
Longitude: 126.937396
Ellipsoidal Height: 44
At the bottom, there are 'OK' and 'Cancel' buttons. The 'OK' button is highlighted with a red rectangle.



X: -3042059.192906062
Y: 4046139.6587620806
Z: 3867173.889902377

This is the result I get.




Then Click on XYZ converter, I straightly write down does results.

Enter Cartesian Coordinates

X:

Y:


Z:



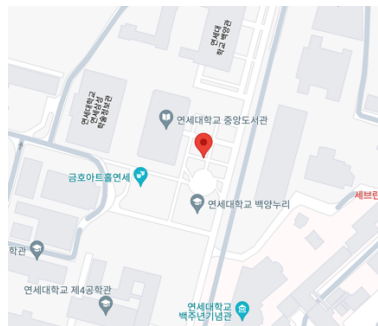
Geographic Coordinates:
Latitude: 37.563432
Longitude: 126.937396
Ellipsoidal Height: 44.0

Latitude: 37.563432
Longitude: 126.937396
Ellipsoidal Height: 44.0

And ellipsoidal height was exactly the same as I inserted before.

 **37.563432 126.937396**

Then I searched latitude/longitude coordinates on Google Map.



This is searched result. Since I was doing homework at library, the result seems quite exact.