

CF 597 Adj. Geospa. Obs. HW5  
Due Thurs 21 Nov.

1. Find the file `sphere-m.xyz` which contains point cloud data ( $X, Y, Z$  coordinates) from a terrestrial laser scanner for a spherical object. Use GLS to fit a sphere to the data. Use  $\sigma_{x,y,z} = 5\text{mm}$ , make 2-sided global test @  $\alpha = .05$ , show 90% conf. ellipse for  $X_c, Z_c$  and  $Y_c, Z_c$ . There are 340 points in the file, use graphical display to estimate sphere parameters. Units are meters

```
load sphere-m.xyz
X = sphere-m(:, 1);
Y = sphere-m(:, 2);
Z = sphere-m(:, 3);
plot3(X, Y, Z, 'r'); % spin around to view *
```

2. Use GLS to fit 7-parameter transformation to given data:

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \lambda M \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \\ t_z \end{bmatrix}$$

	X	Y	Z	x	y	z (m)
1.	1.000	1.000	0.000	1.275	0.930	0.013
2.	3.000	1.000	0.000	3.493	0.561	0.282
3.	3.000	5.000	0.000	4.203	4.866	0.017
4.	1.000	5.000	0.000	2.147	5.202	-0.213
5.	2.000	3.000	3.000	2.502	3.071	3.341

all coordinates observed,  $\sigma_{x,y,z}, \sigma_{X,Y,Z} = 3\text{cm}$ . Make 2-sided global test @  $\alpha = .05$ , construct 90% confidence interval for scale. For initial approximations try  $\lambda = 1.0$ , others = 0.0.

\* If matrix sizes are an obstacle, try every 2nd point, every 3rd, ... until it fits.