University of California, Los Angeles
Department of Statistics

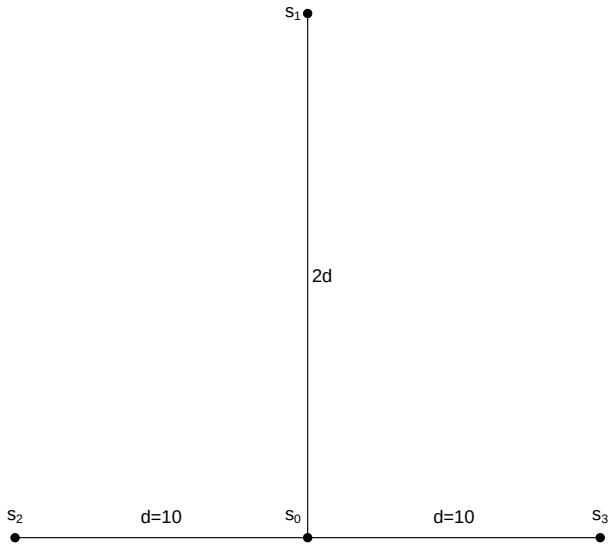
Statistics C173/C273 **Instructor: Nicolas Christou**

Homework 8

Exercise 1
Consider the points in the figure below. Locations s_1, s_2, s_3 are the data points and location s_0 is the location of the point to be predicted. Assume the spherical variogram with $c_0 = 0, c_1 = 1, \alpha = 50$. If $d = 10$ set up the ordinary kriging system and compute:

a. The weights w_1, w_2, w_3.

b. The ordinary kriging variance.



Exercise 2
Load the `data(parana)` data (you need to load `geoR` first) and check the details of the data set using `help(parana)`. Answer the following questions:

a. Perform an explanatory analysis.

b. Would you include a trend in the model?

c. Is there evidence of spatial correlation? Construct h-scatterplots and empirical variogram(s). Fit a theoretical variogram to the empirical variogram(s).

d. Make predictions using kriging at a dense grid of your choice. Construct a raster map of the predicted values and their standard errors (kriging predictions and variances).

e. Use the inverse distance interpolation method (`idw`) to make predictions on the same grid as in (d).

Exercise 3
Consider the elevation data:

```
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c173_c273/
elevation.txt", header=TRUE)
```

Use a simple regression model with elevation as the response variable and north-south direction (y) as the predictor. Fit the model using ordinary least squares and by examining the residuals decide what other predictors and/or transformations need to be included in the analysis of elevation.

Exercise 4
Consider the coal-ash data:

```
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c173_c273/coal_ash.txt", header=TRUE)
```

There are 208 measurements on coal-ash. The first six rows of the data set and the spatial locations of the data points are given below:

```
> head(a)
  x  y coalash
1 1 14   10.21
2 1 15    9.92
3 1 16   11.17
4 2  8   10.01
5 2 10   11.15
6 2 11   11.31
```

For this problem use `gstat` to answer the following questions:

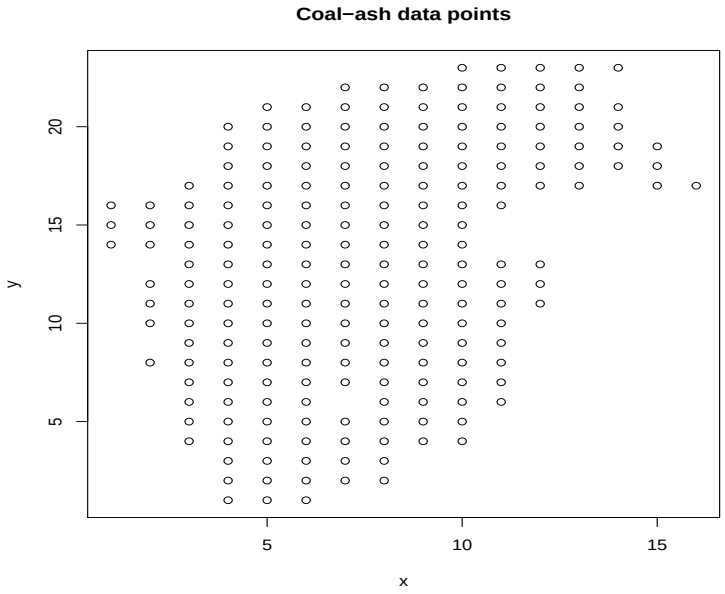
a. Compute the sample variogram.

b. Fit a model to the sample variogram.

c. Create a grid (use `by=0.1`).

d. Perform ordinary kriging predictions.

e. Construct the raster map using the predicted values from (d).



Exercise 5
Use your own data that you chose for the final project. Perform kriging predictions on a dense grid of your choice and then construct a rsaster msp of the krigin predictions and their variances. If you use lognormal kriging construct a raster map using back transformations, i.e., the $\check{Z}(s_0)$ values.