Problem 1
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. Fit a model variogram of your choice to the sample variogram.

b. Use cross validation to choose between ordinary and universal kriging.

c. Make universal kriging predictions at a dense grid of your choice. Construct a raster map of the predicted values and their standard errors and add contours. On the raster map of the predicted values also add the observed data points as a bubble plot.

Problem 2
The following data give the location (x, y coordinates) and the calcium content at depth 0-20 cm (co20), for each data point. There are 178 data points. Please access the data at:

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

a. Create a grid for spatial predictions (by=10).

b. Create a gstat object assuming that there is a linear trend in the data (on the coordinates x, y).

c. Plot the semivariogram up to a maximum distance of 510 m.

d. Fit the spherical semivariogram to the sample semivariogram above using Cressie’s weights.

e. Perform universal kriging (linear trend on the coordinates).

f. Collapse the vector of the predicted values into a matrix and use the image function to create a raster map. Add contours to the raster map. Also add the observed data points as a bubble plot.

g. Collapse the vector of the variances of the predicted values into a matrix and use the image function to create a raster map. Add contours to the raster map.

h. Suppose that another possibility is to fit the exponential semivariogram. How would you choose between the spherical (used above) and the exponential semivariogram models?

Problem 3
Access the Jura data set:

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

Use Cd as the target variable and Co, Zn, Cu as the co-located variables to make cokriging predictions on a grid. (Use by=0.1 when you create the grid.)

Compare cokriging with ordinary kriging using cross validation.