Exercise 1:
Access the Maas river data at:

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

For this exercise use `geoR` to answer the questions below.

a. Create a data frame with `x`, `y`, `log(zinc)`.

b. Compute the sample semivariogram and fit a model to it. Use the robust estimator with `dir = π/4` and fit the spherical semivariogram. What are the estimates of the parameters of the spherical semivariogram?

c. Plot the semivariogram and the fitted model on the same graph.

d. Create a grid for ordinary kriging predictions (use `by=50`). Plot the grid and the data points.

e. Perform ordinary kriging predictions on the grid.

f. Collapse the predicted values into a matrix to construct a raster map of the predicted values and add contours to the plot. Add the points using `cex` to create a bubble plot. Note: For adding contours you can use the following:

```r
contour(seq(from=x.range[1], to=x.range[2], by=50),
seq(from=y.range[1], to=y.range[2], by=50), qqq, add=TRUE, col="black", labcex=1)
```

Exercise 2:
Access the Walker lake data:

```r
```

Use `gstat` for this exercise.

a. Construct the grid for ordinary kriging predictions (use `by=2`).

b. Create a `gstat` object and compute the sample semivariogram using the robust estimator and cutoff=100. Fit the spherical semivariogram. What are the estimates of the parameters? Plot the semivariogram and the fitted model on the same graph.

c. Perform ordinary kriging predictions using the `krige` function.

d. Collapse the predicted values into a matrix to construct a raster map of the predicted values and add contours to the plot. Add the points using `cex` to create a bubble plot.

Exercise 3:
Access the Kruger Park rainfall data:

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

Use `gstat` for this exercise.

a. Create a data frame with the variables (long, lat, rain). Rename the variables using the names `x`, `y`, `rain`.

b. Compute the sample semivariogram and fit a model to it.

c. Construct a grid for ordinary kriging predictions (use `by=0.01`).

d. Perform ordinary kriging predictions using the `krige` function. Collapse the predicted values into a matrix to construct a raster map of the predicted values and add contours to the plot. Add the points using `cex` to create a bubble plot.

e. Collapse the vector of the variances of the ordinary kriging predictions into a matrix and use the `image` function to create a raster map. Add contours to the raster map.
Exercise 4:
The following data give the location \((x, y)\) coordinates and the calcium content at depth 0-20 cm \((ca20)\), for each data point. There are 178 data points. Please access the data at:

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

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

b. Create a \texttt{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 ordinary kriging (linear trend on the coordinates).

f. Collapse the vector of the predicted values into a matrix and use the \texttt{image} function to create a raster map. Add contours to the raster map.

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