Exercise 1:
Access the following data sets:

```r
a1 <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c173_c273/o3.txt", header=T)
a2 <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c173_c273/soil.txt", header=TRUE)
a3 <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c173_c273/swiss_rainfall_data_all.txt", header=TRUE)
```

Description of data sets:
1. California ozone data: Ozone levels were measured at 175 location in California on 08 August 2005. Variables: date, site, lat, lon, o3.
2. Maas river data: Concentration of lead and zinc were measured at 155 locations on the flooded banks of the Maas river in the Netherlands. Variables x, y, lead, zinc.
3. Swiss rainfall data: Rainfall measures at 467 location in Switzerland were taken on 08 May 1986. Variables: x, y, data.

For each data set above:
- a. Perform a non-spatial exploratory analysis (summary statistics, histograms, etc.).
- b. Create a geodata object using `geoR`.
- c. Use the command `plot` and `points` to construct and print the appropriate graphs.
- d. Compute and plot the sample variograms (classical and robust). You can compute omnidirectional variograms and variograms by choosing different values for the arguments `dir` and `tol`.
- e. Try to fit a model variogram (exponential, spherical, etc.) by eye to any of the sample variograms you constructed in (d) using the command `lines.variomodel`. Print the graphs that show the fitted model variograms.

Exercise 2:
Let \( X \sim \chi^2_1 \). Find the probability density function of \( Y = X^{\frac{1}{4}} \). Draw this density in R and verify that it is approximately symmetrical (see figure on page 2 of handout 3).

Exercise 3:
Suppose that \( Z \) is a second order stationary process with \( E[Z(s)] = 0 \) and with spherical semivariogram:

\[
\gamma(h; \theta) = \begin{cases} 
0, & h = 0 \\
0.5 + 4 \left( \frac{3}{2} \left( \frac{h}{50} \right) - \frac{1}{2} \left( \frac{h}{50} \right)^3 \right), & 0 < h \leq \alpha \\
4.5, & h > \alpha
\end{cases}
\]

- a. What is the sill of \( Z \)?
- b. What is the nugget effect of \( Z \)?
- c. Draw this variogram (approximately). Make sure you place some important number on the graph.
- d. Compute \( \gamma(5) \).
- e. Write the covariance function \( C(h; \theta) \) that corresponds to the spherical semivariogram above.