Lab 10: Gibbs processes

This session is concerned with Gibbs models for point patterns with interpoint interaction.
The lecturer's R script is available here (right click and save).

Exercise 1

In this question we fit a Strauss point process model to the `swedishpines` data.

1. We need a guess at the interaction distance R. Compute and plot the L-function of the dataset and choose the value r which maximises the discrepancy $|L(r) - r|$.
2. Fit the stationary Strauss model with the chosen interaction distance using

```
ppm(swedishpines ~ 1, Strauss(R))
```

   where `R` is your chosen value.

3. Interpret the printout: how strong is the interaction?
4. Plot the fitted pairwise interaction function using `plot(fitin(fit))`.

Exercise 2

In Question 1 we guesstimated the Strauss interaction distance parameter. Alternatively this parameter could be estimated by profile pseudolikelihood.

1. Look again at the plot of the L-function of `swedishpines` and determine a plausible range of possible values for the interaction distance.
2. Generate a sequence of values equally spaced across this range, for example, if your range of plausible values was $[5, 12]$, then type

```
rvals <- seq(5, 12, by=0.5)
```

3. Construct a data frame, with one column named `r` (matching the argument name of `Strauss`), containing these values. For example

```
D <- data.frame(r = rvals)
```

4. Execute

```
fitp <- profilepl(D, Strauss, swedishpines ~ 1)
```

   to find the maximum profile pseudolikelihood fit.

5. Print and plot the object `fitp`.
6. Compare the computed estimate of interaction distance r with your guesstimate. Compare the corresponding estimates of the Strauss interaction parameter γ.
7. Extract the fitted Gibbs point process model from the object `fitp` as

```
bestfit <- as.ppm(fitp)
```

Exercise 3

For the Strauss model fitted in Question 1,

1. Generate and plot a simulated realisation of the fitted model using `simulate`.
2. Plot the L-function of the data along with the global simulation envelopes from 19 realisations of the fitted model.

Exercise 4

1. Read the help file for `Geyer`.
2. Fit a stationary Geyer saturation process to `swedishpines`, with the same interaction distance as for the Strauss model computed in Question 2, and trying different values of the saturation parameter `sat = 1, 2, 3` say.
3. Fit the same model with the addition of a log-quadratic trend.
4. Plot the fitted trend and conditional intensity.

Exercise 5

Modify question 1 by using the Huang-Ogata approximate maximum likelihood algorithm (`method="ho"`) instead of maximum pseudolikelihood (the default, `method="mpl"`).

Exercise 6

Repeat Question 2 for the inhomogeneous Strauss process with log-quadratic trend. The corresponding call to `profilepl` is

```
fitp <- profilepl(D, Strauss, swedishpines ~ polynom(x,y,2))
```

Exercise 7

Repeat Question 3 for the inhomogeneous Strauss process with log-quadratic trend, using the inhomogeneous L-function `Linhom` in place of the usual L-function.