# Lab 9: Cluster and Cox processes

This session is concerned with summary statistics for interpoint spacing and distances.
The lecturer's R script is available here (right click and save).

**Exercise 1**

The command `rThomas` generates simulated realisations of the Thomas model ('modified Thomas cluster process').

1. Read the help file.
2. Type `plot(rThomas(10, 0.05, 8))` a few times, and interpret the results.
3. Experiment with the arguments of `rThomas` to obtain point patterns that
    1. consist of a few, well-separated, very tight clusters of points;
    2. look similar to realisations of a uniform Poisson process.

**Exercise 2**

1. Read the help file for `kppm`.
2. Fit the Thomas model to the `redwood` data by the method of minimum contrast:

```
fit <- kppm(redwood ~ 1, clusters="Thomas")
fit
plot(fit)
```

3. Read off the parameters of the fitted model, and generate a simulated realisation of the fitted model using `rThomas`.
4. Type `plot(simulate(fit))` to generate a simulated realisation of the fitted model automatically.
5. Try the command

```
fit2 <- kppm(redwood ~ 1, clusters="Thomas", startpar=c(kappa=10, scale=0.1))
```

   and briefly explore the fitting algorithm's sensitivity to the initial guesses at the parameter values `kappa` and `scale`.
6. Generate and plot several simulated realisations of the fitted model, to assess whether it is plausible.
7. Extract and plot the fitted pair correlation function by

```
pcffit <- pcfmodel(fit)
plot(pcffit, xlim = c(0, 0.3))
```

8. Type `plot(envelope(fit, Lest, nsim=39))` to generate simulation envelopes of the $L$ function from this fitted model. Do they suggest the model is plausible?

**Exercise 3**

1. Fit a Matern cluster process to the `redwood` data.
2. Use `vcov` to estimate the covariance matrix of the parameter estimates.
3. Compare with the covariance matrix obtained when fitting a homogeneous Poisson model.