Hand-in exercise: Murchison data

```
library(spatstat)
```

In this exercise we work with the `spatstat` dataset `murchison` rescaled to km (applying `rescale` to a spatial object list (`solist`)):

```
mur <- solapply(murchison, rescale, s = 1000, unitname = "km")
```

Exercise 1

Read the help file for `murchison` (in `spatstat.data`) and reproduce the plot given in the *Examples* section of the help file.

Exercise 2

Add the distance to the neareast fault line to the spatial object list `mur`:

```
mur$dfault <- distfun(mur$faults)
```

Now, consider the Poisson model:

```
model_d <- ppm(gold ~ dfault, data = mur)
model_d
```

```
## Nonstationary Poisson process
##
## Log intensity:  ~dfault
##
## Fitted trend coefficients:
## (Intercept)      dfault
##  -4.3412775  -0.2607664
##
##               Estimate       S.E.    CI95.lo    CI95.hi Ztest      Zval
## (Intercept) -4.3412775 0.08556260 -4.5089771 -4.1735779   *** -50.73802
## dfault      -0.2607664 0.02018789 -0.3003339 -0.2211988   *** -12.91697
```

Write the estimated intensity function $\hat{\lambda}(u)$ as a function of the distance to the nearest fault, $D(u)$, with the parameter values inserted.

Exercise 3

Consider the model

```
model_g <- ppm(gold ~ greenstone, data = mur)
model_g
```

```
## Nonstationary Poisson process
##
## Log intensity:  ~greenstone
##
## Fitted trend coefficients:
##    (Intercept) greenstoneTRUE
```

```
##      -8.103178       3.980409
##
##                  Estimate      S.E.   CI95.lo   CI95.hi Ztest      Zval
## (Intercept)    -8.103178 0.1666667 -8.429839 -7.776517   *** -48.61907
## greenstoneTRUE  3.980409 0.1798443  3.627920  4.332897   ***  22.13252
```

- What does this model state about the intensity function? (*Hint:* the plot you produce below may be helpful.)
- Use `predict.ppm()` to calculate the estimated intensity function and plot it.

Exercise 4

Consider the model

```
model_dg <- ppm(gold ~ dfault + greenstone, data = mur)
model_dg
```

```
## Nonstationary Poisson process
##
## Log intensity:  ~dfault + greenstone
##
## Fitted trend coefficients:
##    (Intercept)         dfault greenstoneTRUE
##     -6.6171116     -0.1037835      2.7539637
##
##                   Estimate       S.E.    CI95.lo     CI95.hi Ztest       Zval
## (Intercept)    -6.6171116 0.21707953 -7.0425796 -6.19164351   *** -30.482430
## dfault         -0.1037835 0.01794981 -0.1389645 -0.06860255   ***  -5.781874
## greenstoneTRUE  2.7539637 0.20655423  2.3491248  3.15880250   ***  13.332885
```

and write down $\hat{\lambda}(u)$ as a function of the distance to the nearest fault, $D(u)$, and the greenstone indicator function

$$G(u) = 1\{u \text{ in greenstone area}\}$$

with the parameter values inserted.

Exercise 5

Fit a cluster model of your choice to the `mur` data with the same intensity model using `kppm(gold ~ dfault + greenstone, ..., data = mur)`.

Compare the standard errors obtained for this cluster model with the standard errors for the Poisson model `model_dg`.