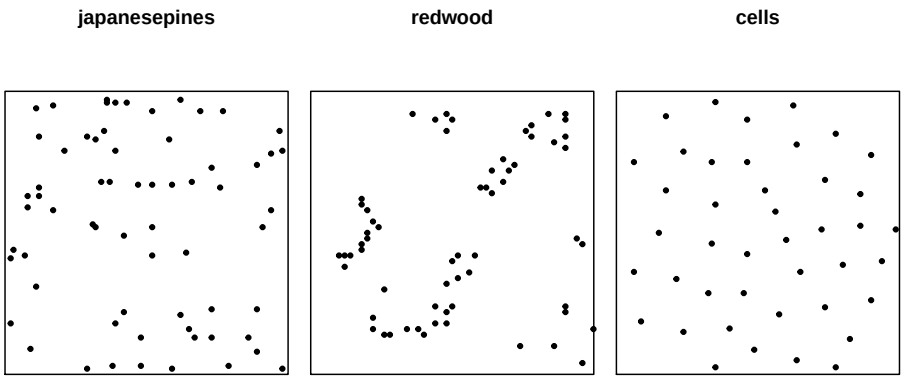
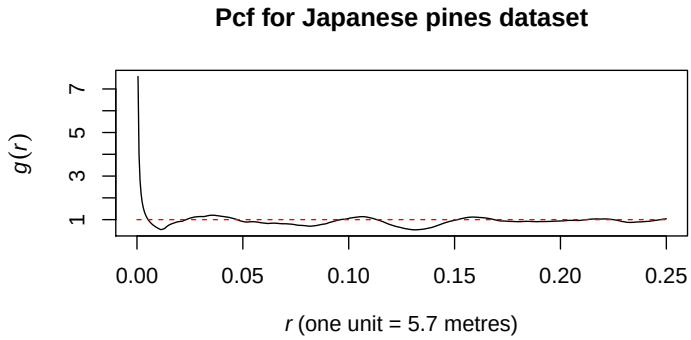
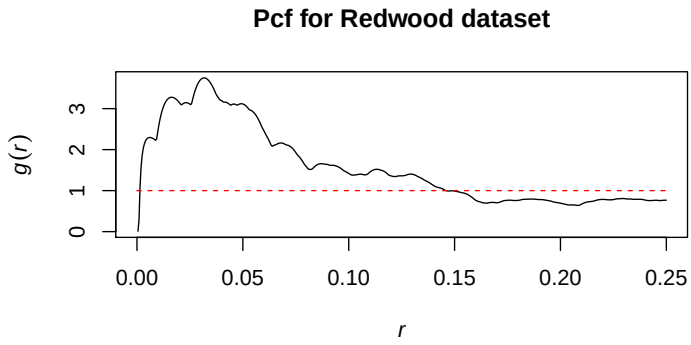
Planar point processes

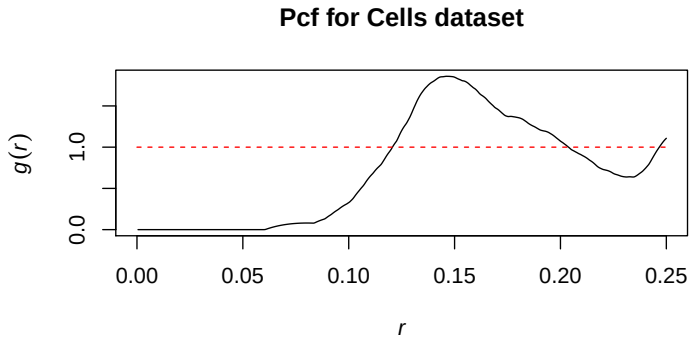
We look at three examples of real data: `japanesepines` (Poisson-like, locations of Japanese black pine saplings in a square sampling region in a natural forest), `redwood` (clustered, locations of seedlings and saplings of California redwood trees in a square sampling region) and `cells` (regular, centers of biological cells observed under optical microscopy in a histological section). The datasets are plotted below.

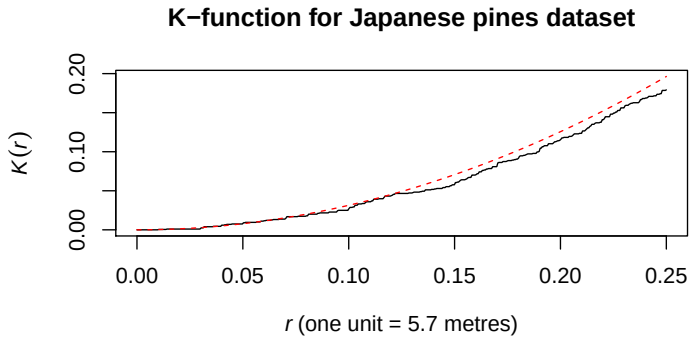


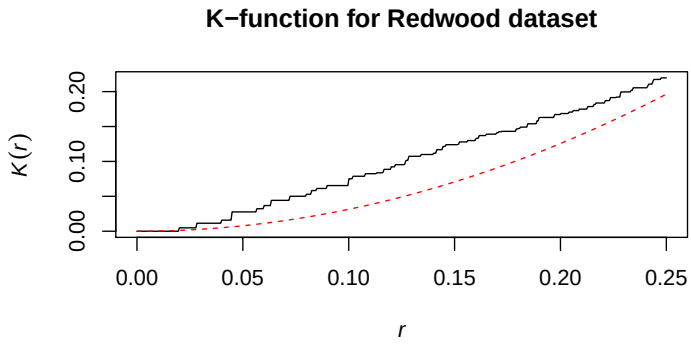
Our main interest is now in estimating the summary characteristics of the three datasets (pair-correlation function, K-function, nearest-neighbour distance distribution function G, empty-space distribution function (i.e. spherical contact distribution function) F). The precise formulae for estimation are omitted here and will be discussed in detail in the course on Spatial Statistics. We note, however, that we assume stationarity of the process that generated the data. The figures below show the estimated characteristics for the different datasets (black curve – estimated from the data; red curve – theoretical value for the Poisson process). Think about why the estimated curve is above or below the theoretical curve for the clustered or regular dataset.

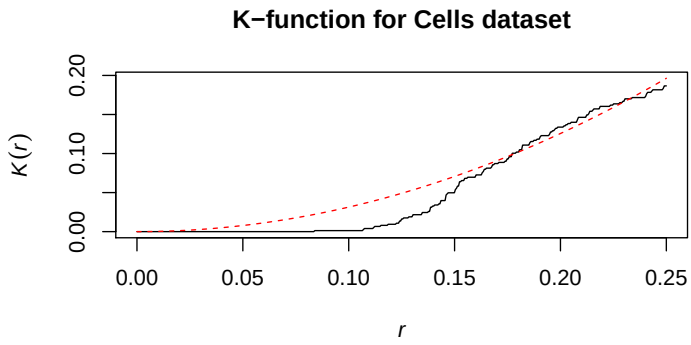

Pcf for Japanese pines dataset
g(r)
1
3
5
7
0.00
0.05
0.10
0.15
0.20
0.25
r (one unit = 5.7 metres)

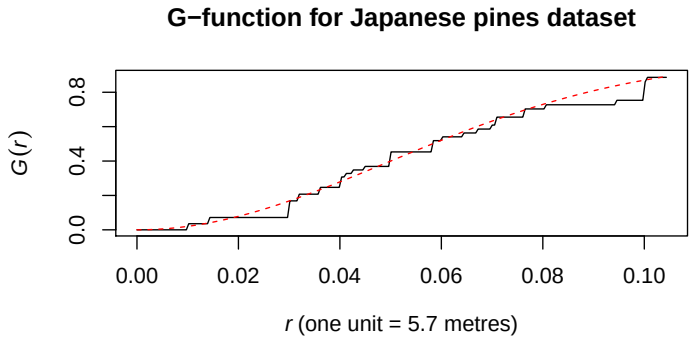

Pcf for Redwood dataset
g(r)
0
1
2
3
0.00
0.05
0.10
0.15
0.20
0.25
r

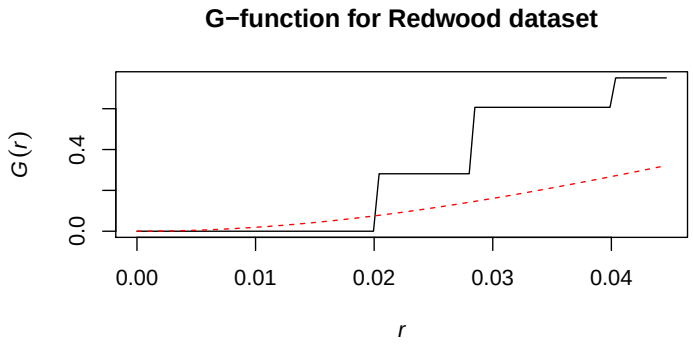

Pcf for Cells dataset
g(r)
0.0
1.0
0.00
0.05
0.10
0.15
0.20
0.25
r

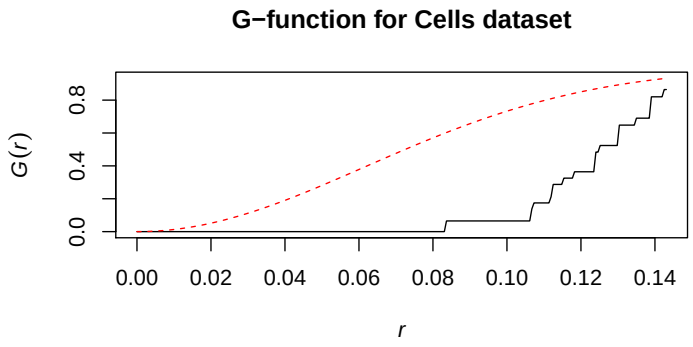

K−function for Japanese pines dataset
K(r)
0.00
0.10
0.20
0.00
0.05
0.10
0.15
0.20
0.25
r (one unit = 5.7 metres)

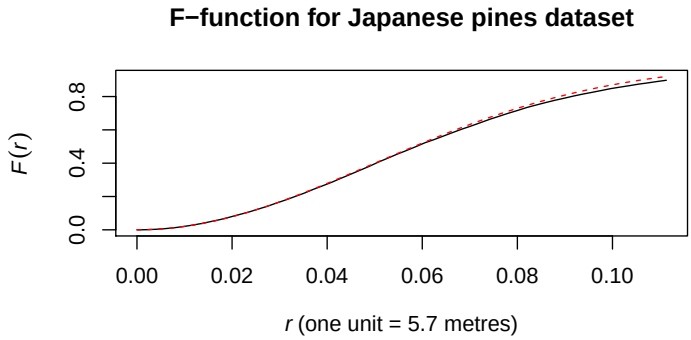

K−function for Redwood dataset
K(r)
0.00
0.10
0.20
0.00
0.05
0.10
0.15
0.20
0.25
r

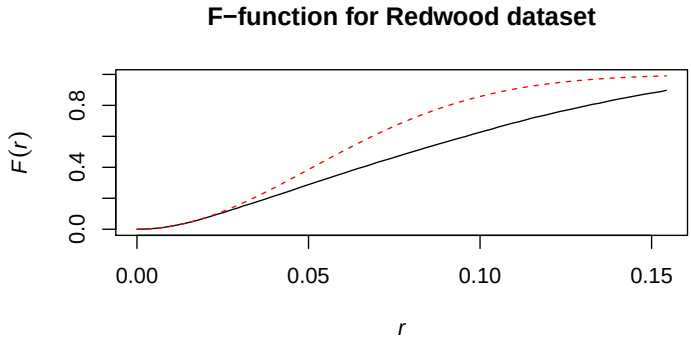

K−function for Cells dataset
K(r)
0.00
0.10
0.20
0.00
0.05
0.10
0.15
0.20
0.25
r

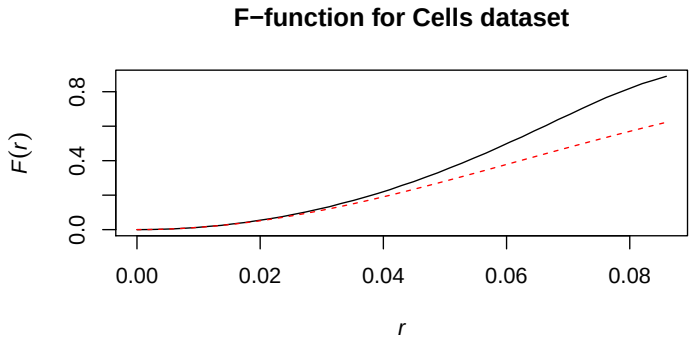

G−function for Japanese pines dataset
G(r)
0.0
0.4
0.8
0.00
0.02
0.04
0.06
0.08
0.10
r (one unit = 5.7 metres)


G−function for Redwood dataset
G(r)
0.0
0.4
0.00
0.01
0.02
0.03
0.04
r


G−function for Cells dataset
G(r)
0.0
0.4
0.8
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
r


F−function for Japanese pines dataset
F(r)
0.0
0.4
0.8
0.00
0.02
0.04
0.06
0.08
0.10
r (one unit = 5.7 metres)


F−function for Redwood dataset
F(r)
0.0
0.4
0.8
0.00
0.05
0.10
0.15
r


F−function for Cells dataset
F(r)
0.0
0.4
0.8
0.00
0.02
0.04
0.06
0.08
r