Homework 7 - Spatial Point Process

Due November 7 at 9:00am

Name___Lindsay Platt & Ian Hart___

Worksheet: Spatial point process

Please turn in the assignment as a link to a GitHub repo containing this worksheet as a PDF file and your code.

Background
We're going to simulate and analyze data from a clustered spatial point process. The file generate_clustered_pt_proc.R will be used to generate the data. We will use the Kest() and envelope() functions from the spatstat package to analyze the data.

Q1: Simulate some data using generate_clustered_pt_proc.R.

Q1.1: Which parameter(s) control the spatial extent of clusters

Xmin, Xmax, Ymin, and Ymax

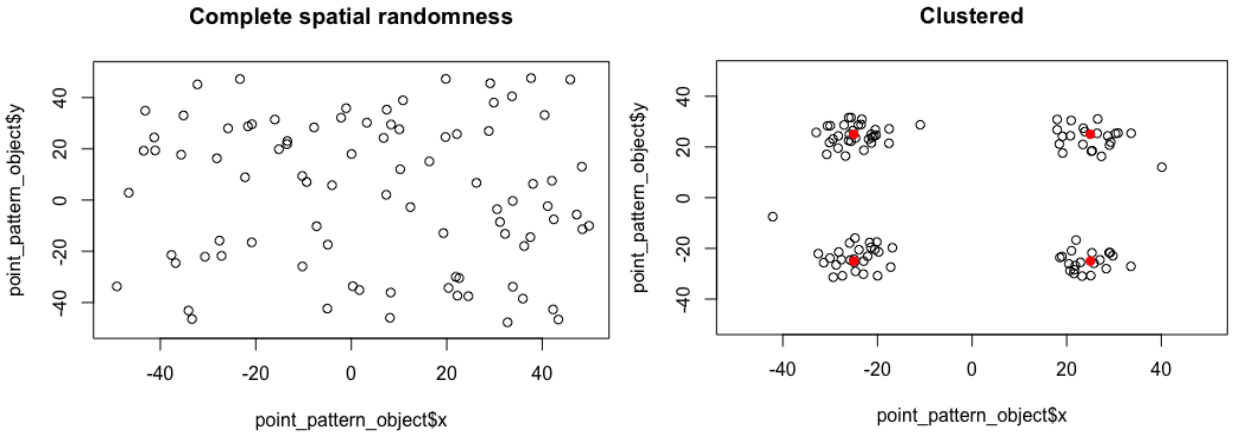
Q1.2: Which parameter(s) control the strength of clustering (i.e., density within clusters relative to outside of clusters)

val.at.center appears to control how tightly the points are within a cluster. `effect.range` also appears to do this, but has a nonlinear relationship because 1 is more spread than 10 and 100 is also more spread than 10.

It's hard to see but when set to 1, there is a really tight cluster underneath the quadrant markers as well. Effect range = 1 sets a very strict threshold for accepting points which causes those tight clusters, but also means many more iterations will occur and through chance, distant points will be accepted. Effect range = 100 means every point has a good chance of being accepted, since all generated points are between -50 & 50.

At background = 1, every point would be accepted. Actually, points whose minimum distance < effect range would have lower probability of being accepted although still high.

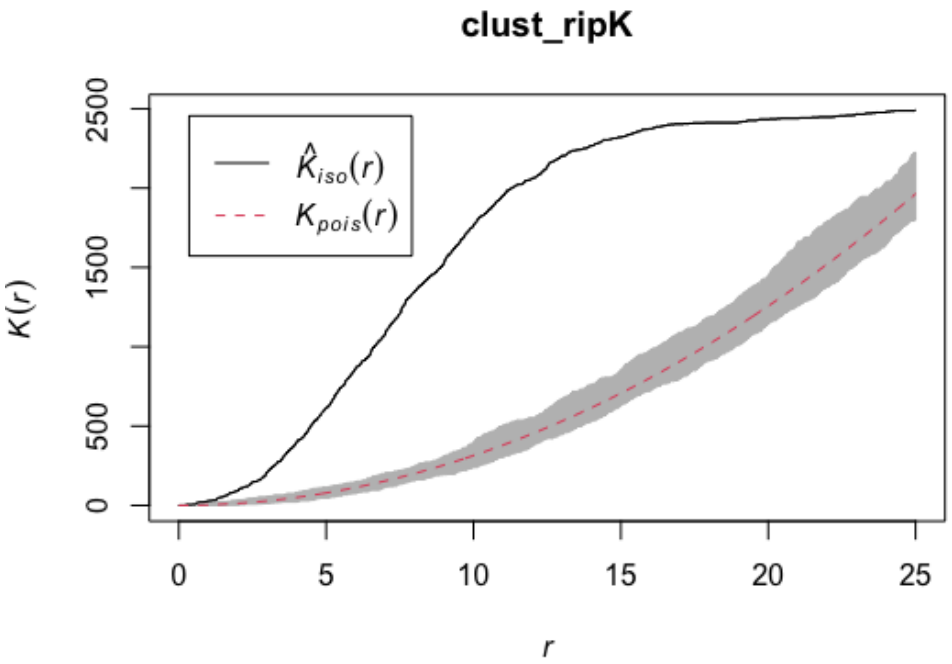
Q1.3 Generate point pattern data from a complete spatial randomness (CSR) process and a clustered process and paste the two plots below.



Q2: Use the quadrat test to determine whether each of these plots differs significantly from CSR. You can either code this yourself or, if that seems daunting, use the quadrat.test() function in the spatstat library. Report the Chi-square statistic and p value for each plot above.

	X^2	p-val
CSR	23.9	0.93
Clustered	283	<0.0001

Q3: Describe the degree of clustering at different spatial scales using a Ripley's K plot. Either code it yourself using eq. 2.8 from Fortin and Dale or use the Kest() function in the spatstat library and the envelope() function to generate an envelope for the null expectation for K for CSR data. Paste the plot below.



Q4: Can you generate spatial point process data that are clustered at smaller spatial scales but random at larger scales? Paste a plot of the spatial point pattern and a plot of Ripley's K below.