**Homework-09**

**The questions:**

1. Local estimates of Moran’s I and Geary’s C are often used to identify spatial clustering/hotspots) and outliers in attribute values. Please point out which conditions indicate hotspots and which ones indicate outliers.

**Answer：**

1）Moran’s I的取值范围为[-1，1]。当其取值大于0时，表明所研究区域存在空间正相关，且取值越接近1且显著性检验*p*<0.05，表明空间正自相关性越强，研究对象的值呈聚集分布，形成hotspots；当其取值小于0时，表明所研究区域存在空间负相关，,取值越接近-1，表明空间负自相关性越强，研究对象的值呈离散互斥(高值周围排斥高值、低值周围排斥低值)分布，形成outliers；当其取值接近于0，研究对象的值呈随机分布，不存在自相关性。

2）而Geary’s C取值范围为[0，2]。当其取值大于1时，表明所研究区域存在空间正相关，且取值越接近2且显著性检验*p*<0.05，表明空间正自相关性越强，研究对象的值呈聚集分布，形成hotspots；当其取值小于1时，表明所研究区域存在空间负相关，,取值越接近0，表明空间负自相关性越强，研究对象的值呈离散互斥分布，形成outliers；当其取值接近于1，研究对象的值呈随机分布，不存在自相关性。

1. When working with lattice data, there are typically two forms of filters used for the weight matrix. Please points the following filters, and give their spatial weights matrices, respectively. Also, please write a line code for create the weighting matrix according to any one of the weight filters.

**Answer：**

1）下面分别是Rook和Queen定义多边形邻域的方法，源于国际象棋。

Rook方法：需要多个共享点来满足连续性条件；

Queen方法：单个共享边界点满足连续性条件。

2）空间权重矩阵：

Rook:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |

Queen:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |

3）创建Rook权重矩阵的代码：

library(spdep)

nbRook <- poly2nb(columbus, queen = FALSE) ##Rook

## columbus是spdep包的教学数据：columbus <- st\_read(system.file("shapes/columbus.shp", package="spData")[1], quiet=TRUE)；正常分析时用需要的空间数据代替

