

# Assignment Project Exam Help

Lecture 7: Spatial Autocorrelation (Local)

Quantitative Methods II

<https://powcoder.com>

Dr. Adams

Add WeChat powcoder

# Assignment Project Exam Help

Global measure of spatial autocorrelation

- ▶ Single value calculated across all spatial units

- ▶ Points

- ▶ Polygons

- ▶ Measure of the overall clustering of the data.

- ▶ Assumes homogeneity

<https://powcoder.com>

Add WeChat powcoder

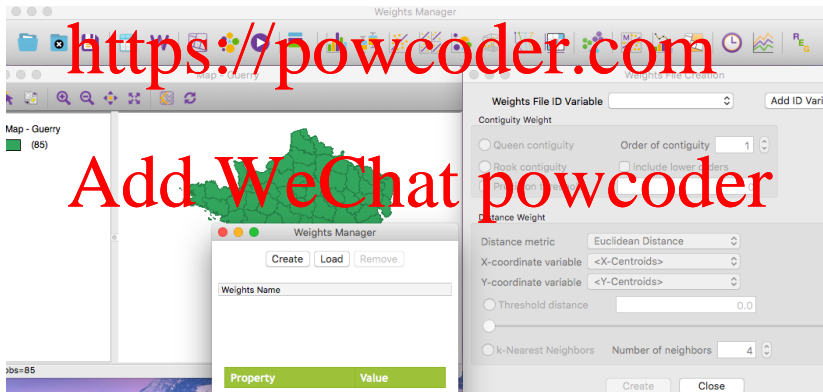
# Options for Moran's I

- ▶ R, `spdep::moran.mc()`
- ▶ ArcGIS, Spatial Statistics toolbox -> Analyzing Patterns toolset
- ▶ GeoDa

Assignment Project Exam Help

<https://powcoder.com>

Add WeChat powcoder



# Assignment Project Exam Help

What if you wanted to know if crime hot spots were occurring?

<https://powcoder.com>

Moran's I, indicates clustering

Add WeChat powcoder

The G statistic distinguishes between hot spots and cold spots.

# Assignment Project Exam Help

- ▶ Identifies spatial concentrations

- ▶ When G is relatively large

<https://powcoder.com>

- ▶ high values clusters

- ▶ When G is relatively low

- ▶ low values clusters

Add WeChat powcoder

Further reading: Getis, A. and Ord, J.K. (1992) The analysis of spatial association by use of distance statistics *Geographical Analysis*, 24(3) 189-206

# Assignment Project Exam Help

- ▶ Contiguity
  - ▶ Binary (0/1)
  - ▶ Zones that share boundaries = 1

- ▶ Distance

- ▶ Continuous
  - ▶ Measure distance between points

- ▶ Historically, distance between polygon centroids

<https://powcoder.com>

Add WeChat powcoder

# Assignment Project Exam Help

- ▶ Raw Matrix (0/1)
- ▶ Row standardized

<https://powcoder.com>

- ▶ Divide each value by the row sum

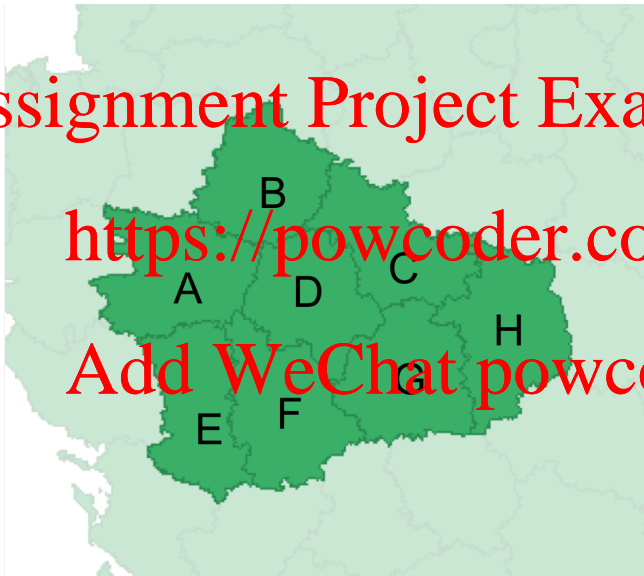
- ▶ Adjusts for varying number of borders

Add WeChat powcoder

Assignment Project Exam Help

<https://powcoder.com>

Add WeChat powcoder





Fill in a binary contiguity matrix

## Assignment Project Exam Help

```
##   A  B  C  D  E  F  G  H  row.sum
```

```
## A 0
```

```
## B 0
```

```
## C   0
```

```
## D     0
```

```
## E       0
```

```
## F        0
```

```
## G           0
```

```
## H            0
```

<https://powcoder.com>

Add WeChat powcoder

# Assignment Project Exam Help

- ▶ Polygons that are close but do not share a border?
- ▶ Non border connections, e.g. bridges & tunnels
- ▶ Length of border?

- ▶ Calculate using the length of shared border

- ▶ More computation required

Add WeChat powcoder

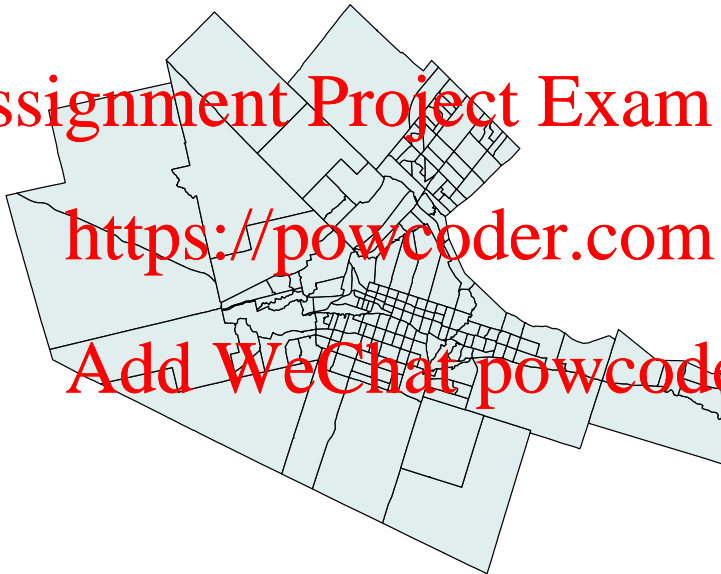
<https://powcoder.com>

House Value, Moran's  $I = 0.64333$

Assignment Project Exam Help

<https://powcoder.com>

Add WeChat powcoder



# Assignment Project Exam Help

Calculate a value for each observation

### Motivation

- ▶ Different spatial patterns may occur across space
  - ▶ Spatial Processes

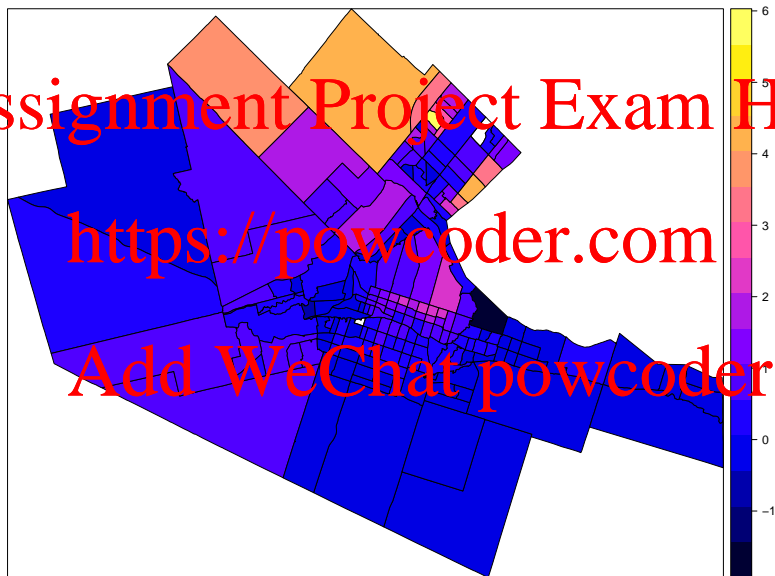
<https://powcoder.com>

See: Luc Anselin 1995 Local Indicators of Spatial Association-LISA  
*Geographical Analysis* 27: 93-115

Add WeChat powcoder

Often global measures have an associated local measure

## House Value, Local Moran's I



# Assignment Project Exam Help

LISA: Local Indicator of Spatial Association

- ▶ We can map the LISA value for each polygon.
  - ▶ How does spatial autocorrelation occur across space.

- ▶ Also, we can map out statistically significant polygons

Each observation has a local  $I_i$  value and a test statistic

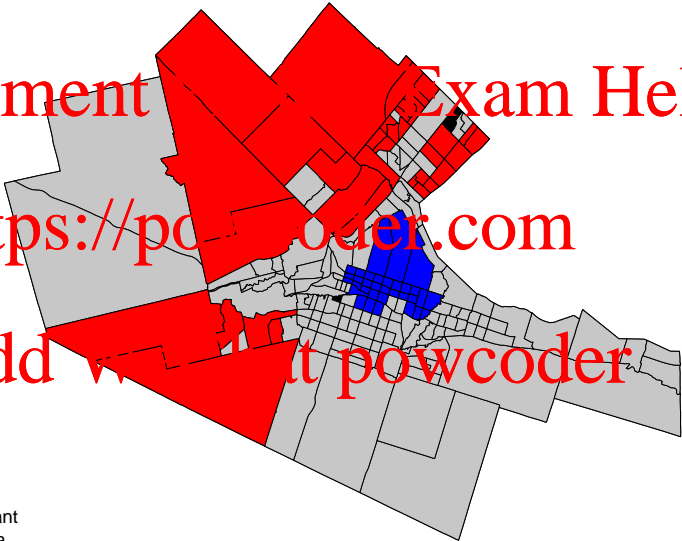
Add WeChat powcoder

## Hot Spot Map - LISA

Assignment Exam Help

<https://powcoder.com>

Add website to powcoder

- 
- A map showing a city area with various colored regions. The map is overlaid with large red text. The legend indicates the following categories:
- High-High
  - High-Low
  - Low-High
  - Low-Low
  - Not Significant
  - Missing Data

# Assignment Project Exam Help

where  $z_i$  is the standardized values of  $x_i$

<https://powcoder.com>

$$z_i = \frac{x_i - \bar{x}}{\sigma_x}$$

$w_{ij}$  is the spatial weight for  $i$  and  $j$

Add WeChat powcoder

$$\sigma_x = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$



Assignment Project Exam Help

<https://powcoder.com>

Add WeChat powcoder

Poly_ID	x	z	i
A	—	—	—
B	—	—	—
C	—	—	—
D	—	—	—
E	—	—	—
F	—	—	—
G	—	—	—
H	—	—	—

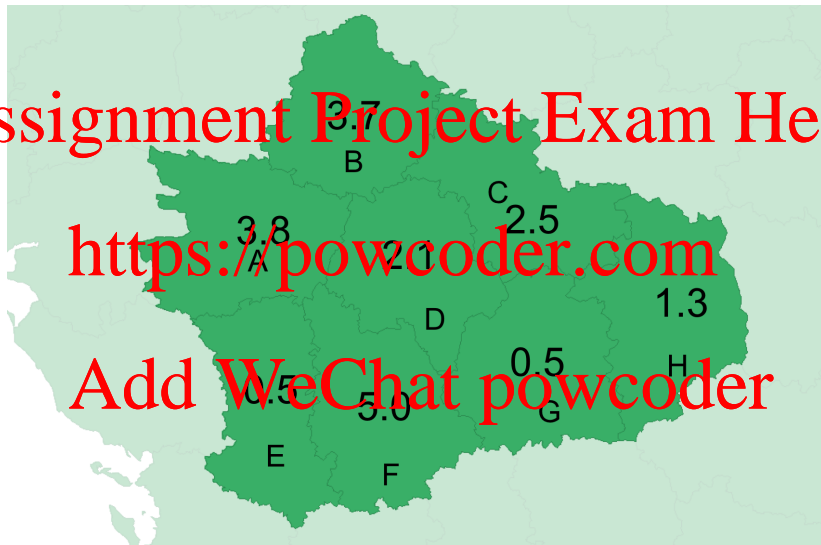
$$\bar{x} = ?$$

Local Moran's I for D, E and C -  $\sigma_x = 1.65$

Assignment Project Exam Help

<https://powcoder.com>

Add WeChat powcoder



$$I_i = z_i \sum_j w_{ij} z_j \mid z_i = \frac{x_i - \bar{x}}{\sigma_x}$$

# Assignment Project Exam Help

- ▶ Statistical significance is calculated through simulations.
- ▶ It may differ slightly each time it is calculated
- ▶ Available in ArcGIS

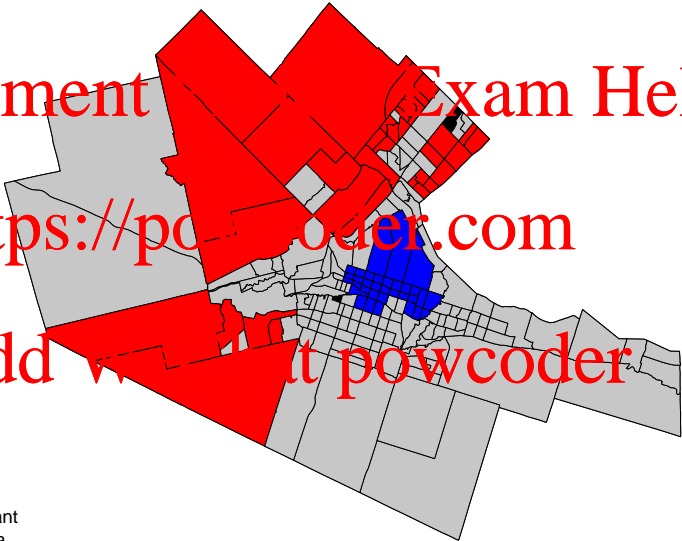
<https://powcoder.com>

## Add WeChat powcoder

Assignment Exam Help

<https://powcoder.com>

Add website to powcoder

- 
- High-High
  - High-Low
  - Low-High
  - Low-Low
  - Not Significant
  - Missing Data

```
## Load plot.local.moran function  
source("https://raw.githubusercontent.com/rgis07TM/  
spatialplots/master/plotlocalmoran.R")
```

```
polyNB <- poly2nb(polys)  
weights <- nb2listw(polyNB)
```

```
LISA <- localmoran(polys@data$houseValue, weights,  
na.action = na.exclude)
```

```
plot.local.moran(polys, "houseValue", LISA,  
weights = weights)
```