Spatial

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Task 1: Preprocessing data

```
city <- city %>%
  mutate(length_stay = `Q28 Approximately how many years have yo`,
         own_rent = factor(`Q31 Do you own or rent your current resi`),
         lat = `Block Lat`,
         lon = `Block Lon`) %>%
  filter(!is.na(lon), !is.na(lat)) %>%
  mutate(lon = lon/1000000,
         lat = lat/1000000) %>%
  select(length_stay, lon, lat)
```

Task 2: St as Sf

```
city <- st_as_sf(city, coords = c("lon", "lat"),
                 crs = 4269,
                 remove = F,
                 agr = "constant")
```

Task 3: Shapefile

```
nc <- nc %>%
  filter(STCOFIPS == 37063) %>%
  select(TRACT, NAME, POP2010)
```

Task 4: Moran's I on areal data

```
sp_wts <- poly2nb(nc, row.names=nc$name, queen = T)
sp_mat_std <- nb2mat(sp_wts, style='W')
sp_mat_std[1:10,1:10] # standardized spatial weight matrix
```

```
##    [,1]       [,2]       [,3] [,4]      [,5] [,6] [,7] [,8] [,9] [,10]
## 1  0.00 0.20000000 0.20000000  0.2 0.0000000    0  0.0    0 0.00     0
```

```
## 2  0.25 0.00000000 0.25000000  0.0 0.0000000    0  0.0    0 0.25     0
## 3  0.20 0.20000000 0.00000000  0.2 0.0000000    0  0.0    0 0.20     0
## 4  0.20 0.00000000 0.20000000  0.0 0.0000000    0  0.0    0 0.00     0
## 5  0.00 0.00000000 0.00000000  0.0 0.0000000    0  0.5    0 0.00     0
## 6  0.00 0.00000000 0.00000000  0.0 0.0000000    0  0.0    0 0.00     0
## 7  0.00 0.00000000 0.00000000  0.0 0.3333333    0  0.0    0 0.00     0
## 8  0.00 0.00000000 0.00000000  0.0 0.0000000    0  0.0    0 0.00     0
## 9  0.00 0.09090909 0.09090909  0.0 0.0000000    0  0.0    0 0.00     0
## 10 0.00 0.00000000 0.00000000  0.0 0.0000000    0  0.0    0 0.00     0
```

```
sp_mat_list <-  nb2listw(sp_wts, style='W')
sp_mat_list
```

```
## Characteristics of weights list object:
## Neighbour list object:
## Number of regions: 60
## Number of nonzero links: 340
## Percentage nonzero weights: 9.444444
## Average number of links: 5.666667
##
## Weights style: W
## Weights constants summary:
##    n   nn S0      S1       S2
## W 60 3600 60 22.5871 250.7958
```

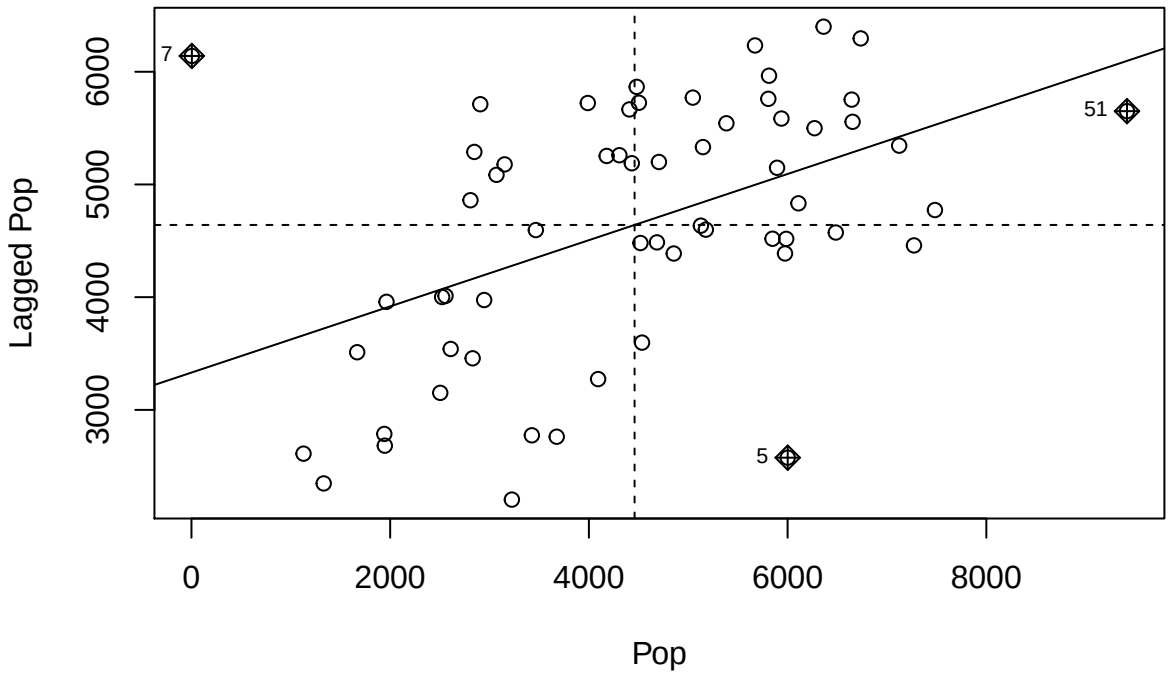
```
# 0.2936976 # some correlation
moran(nc$POP2010, sp_mat_list, nrow(nc), sum(sp_mat_std))
```

```
## $I
## [1] 0.2936976
##
## $K
## [1] 2.736547
```

```
set.seed(123)
moran.mc(nc$POP2010, sp_mat_list, nsim = 999)
```

```
##
##  Monte-Carlo simulation of Moran I
##
## data:  nc$POP2010
## weights: sp_mat_list
## number of simulations + 1: 1000
##
## statistic = 0.2937, observed rank = 1000, p-value = 0.001
## alternative hypothesis: greater
```

```
moran.plot(nc$POP2010, sp_mat_list,
           xlab = "Pop",
           ylab = "Lagged Pop")
```



Task 5: Spatial weight matrix point-valued data

```
dists <- as.matrix(dist(cbind(city$lon, city$lat))) + 0.01
dists <- 1/dists
diag(dists) <- 0
```

Task 6: Moran's I for point-valued data

```
Moran.I(city$length_stay, dists, na.rm = TRUE)
```

```
## $observed
## [1] 0.01889734
##
## $expected
## [1] -0.001222494
##
## $sd
## [1] 0.001325884
##
## $p.value
## [1] 0
```

Task 7: REPRODUCE the map

```
ggplot(nc) +
  geom_sf(aes(fill = POP2010), alpha = 1) +
  geom_sf(data = city,
          aes(color = length_stay),
          alpha = 0.4,
          size  = 1) +
  scale_color_gradient(low = "#fee8c8", high = "#7f0000") +
  labs(x = "Long.", y = "Lat.") +
  theme_bw(base_size = 10)
```