INFSCI 2809: Spatial Data Analytics
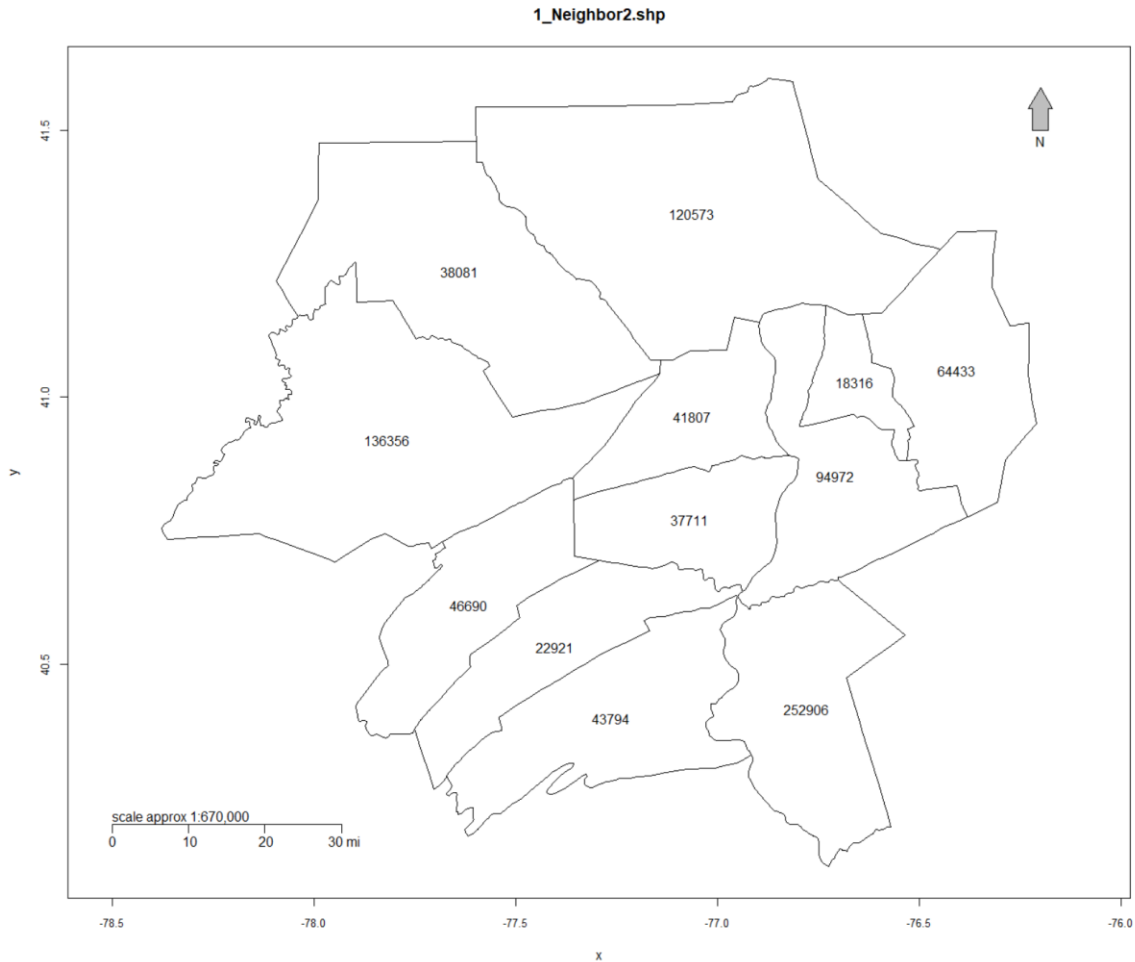
Final Exam

Student: Zechen Wang (zew20)

I.   Part A
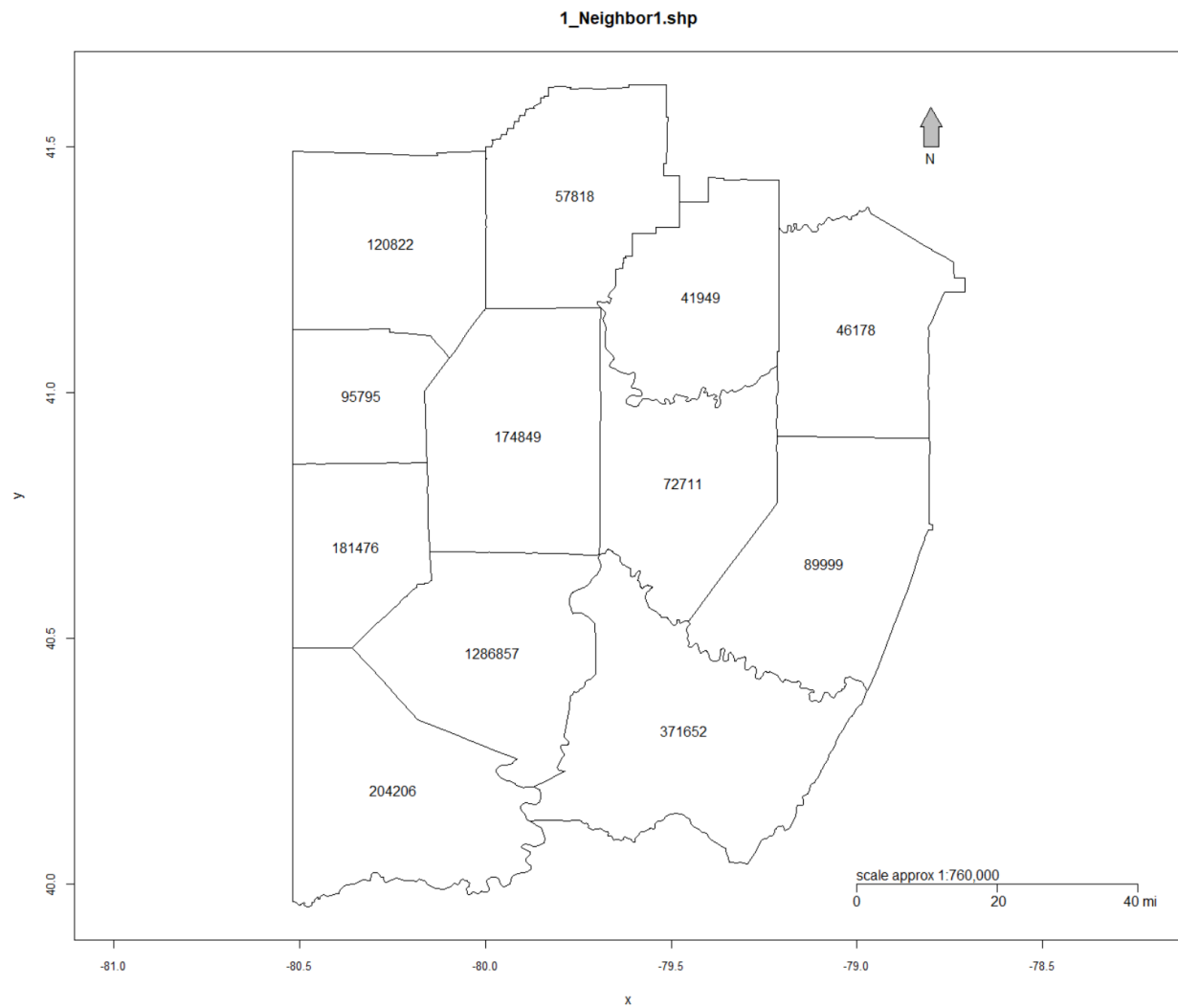
1_Neighbor1.shp

1_Neighbor1.shp	Moran's I	Geary's C
Rook's adjacency	0.100817015	0.82080589
Queen's adjacency	0.050152300	0.88672003

1_Neighbor2.shp

1_Neighbor2.shp	Moran's I	Geary's C
Rook's adjacency	-0.11613638	0.91050078
Queen's adjacency	-0.20617426	0.9984425

Answers:

For 1_Neighbor1.shp:

(a) According to Tobler's first law of geography, "everything is related to everything else, but near things are more related than distant things."

Both Moran's I and Geary's C shows the data are positively autocorrelated rather than independent or randomly distributed.

(b) The result of Rook's adjacency shows a relatively stronger positive autocorrelation than that of Queen's adjacency.

(c) In regression statistics, it is important to evaluate the spatial autocorrelation for the residuals (as these are supposed to be independent, not correlated). If the residuals are spatially autocorrelated, this indicates that the model is mis specified.

For 1_Neighbor2.shp:

(a) According to Tobler's first law of geography, "everything is related to everything else, but near things are more related than distant things."

The Moran's I and Geary's C shows the data are spatially autocorrelated rather than independent or randomly distributed.

(b) Moran's I indicates the data are negatively autocorrelated, while Geary's C indicates the data are positively autocorrelated. Moran's I of Queen's adjacency shows a relatively stronger negative autocorrelation than Rook's. Geary's C of Rook's adjacency shows a relatively stronger positive autocorrelation than Queen's.

(c) In regression statistics, it is important to evaluate the spatial autocorrelation for the residuals (as these are supposed to be independent, not correlated). If the residuals are spatially autocorrelated, this indicates that the model is mis specified.

II.   Part B

IDW Table:

	r	k	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
1	0.008	0.1	63.71461	64.89814	65.21714	65.42634	65.91094	68.37344
2	0.009	0.1	63.71434	64.89785	65.21989	65.42763	65.91368	68.37382
3	0.01	0.1	63.71521	64.89737	65.21947	65.42818	65.91502	68.37335
4	0.008	0.15	62.73139	64.57494	65.06213	65.37933	66.11465	69.92369
5	0.009	0.15	62.73096	64.57539	65.06589	65.38128	66.11715	69.92427
6	0.01	0.15	62.73231	64.57389	65.06417	65.3821	66.1214	69.92355
7	0.008	0.2	61.68855	64.23717	64.89878	65.32589	66.31747	71.55175
8	0.009	0.2	61.68796	64.23738	64.90597	65.32849	66.31906	71.55255
9	0.01	0.2	61.68982	64.2352	64.90585	65.32959	66.32627	71.55156
10	0.008	0.25	60.58748	63.88508	64.73786	65.26643	66.5163	73.25862
11	0.009	0.25	60.58673	63.88646	64.74299	65.26968	66.52067	73.25966
12	0.01	0.25	60.58912	63.88321	64.74529	65.27105	66.53181	73.25838
13	0.008	0.3	59.43032	63.52213	64.58477	65.20149	66.71946	75.04473
14	0.009	0.3	59.42939	63.52097	64.58769	65.20541	66.72429	75.04602
15	0.01	0.3	59.43235	63.51804	64.58824	65.20706	66.73642	75.04443
16	0.008	0.35	58.21997	63.14374	64.45703	65.13178	66.92061	76.90982
17	0.009	0.35	58.21885	63.14206	64.46303	65.13636	66.92592	76.91137
18	0.01	0.35	58.2224	63.1379	64.46265	65.1383	66.93726	76.90947
19	0.008	0.4	56.9601	62.75363	64.3884	65.05814	67.12641	78.8529
20	0.009	0.4	56.95878	62.75234	64.3899	65.06338	67.13182	78.85472
21	0.01	0.4	56.96296	62.74941	64.38961	65.06561	67.13369	78.85248
22	0.008	0.45	55.65516	62.35401	64.31727	64.98154	67.32951	80.87211
23	0.009	0.45	55.65364	62.35176	64.32373	64.98745	67.34323	80.87422
24	0.01	0.45	55.65846	62.34809	64.32618	64.98999	67.34177	80.87163
25	0.008	0.5	54.31033	61.94556	64.23276	64.90309	67.53809	82.96469
26	0.009	0.5	54.30861	61.94236	64.23895	64.90968	67.55127	82.9671

27	0.01	0.5	54.31409	61.93814	64.23877	64.91255	67.54567	82.96414

OK Table:

	x	y	z
0	-79.7573	41.40043	66.49756
1	-79.4196	41.19335	65.81856
2	-79.0005	41.12763	66.5115
3	-80.2567	41.30344	66.79314
4	-79.9129	40.91113	66.21923
5	-79.4659	40.81461	58.06613
6	-79.0879	40.65152	66.32468
7	-80.3329	40.99304	69.27695
8	-80.3493	40.6844	80.49749
9	-79.4667	40.31117	67.15806
10	-79.9811	40.46988	73.32133
11	-80.2486	40.1913	55.63172

IDW interpolated surface (r=0.009, k=0.2, most similar one based on smallest MSE of z value):

IDW Interpolated Surface Map

OK interpolated surface:

OK Interpolated Surface Map
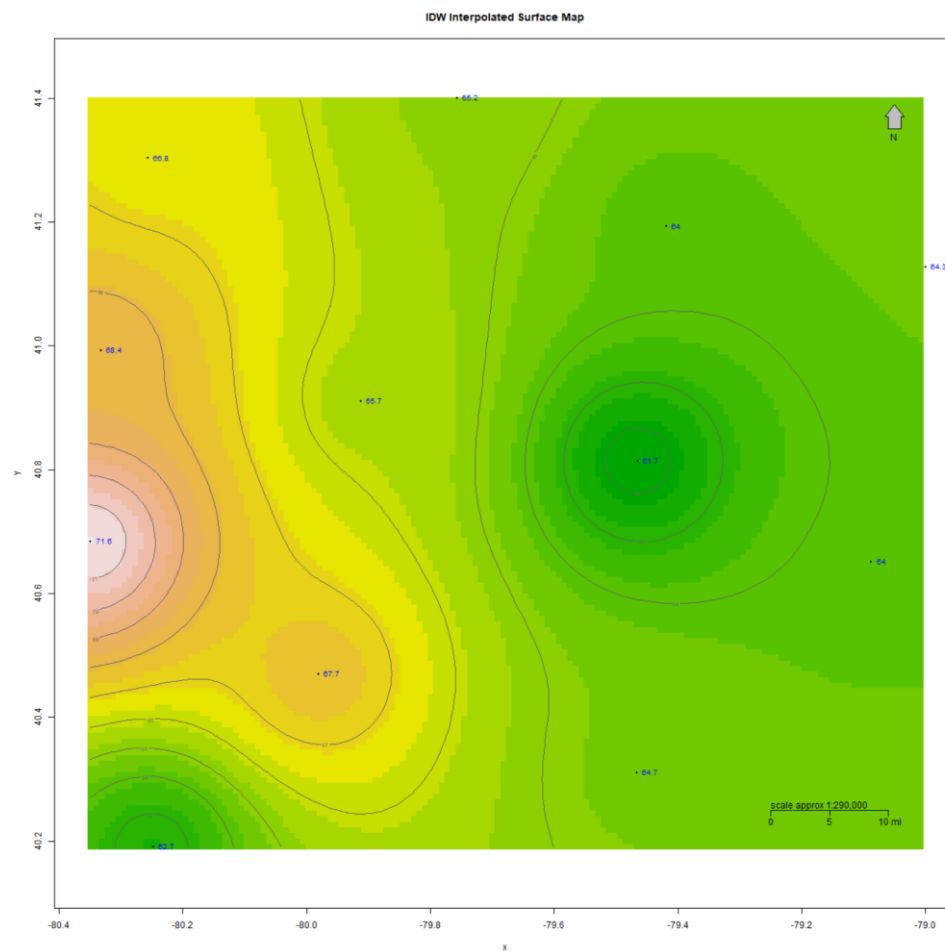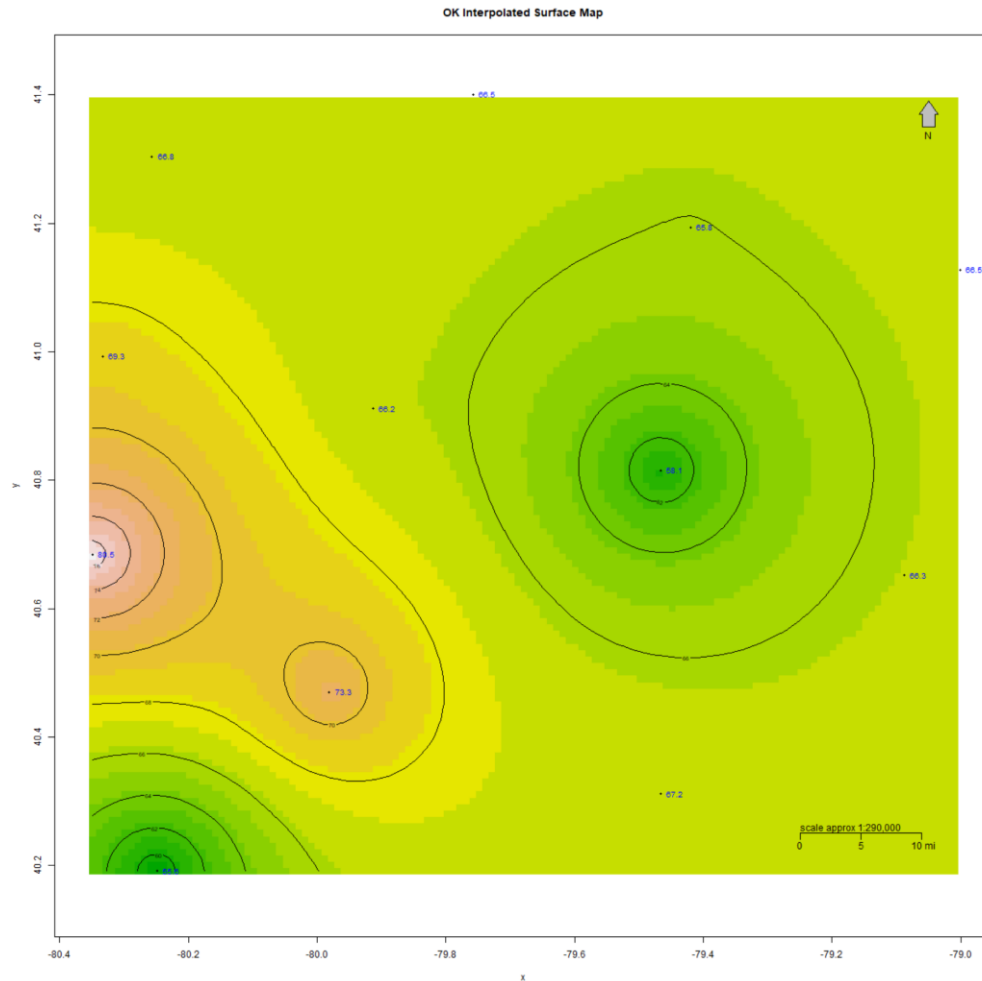
Answers:

(a) Compared to IDW, OK interpolated surface appears much more realistic and that the method has some ability to adjust the spatial structure of estimates to reflect local variations in the surface structure.

(b) The most suitable interpolation method is OK, because the given values in this question are spatial autocorrelated. Ordinary Kriging makes use of variograms to calculate the spatial autocorrelation between points at graduated distances.
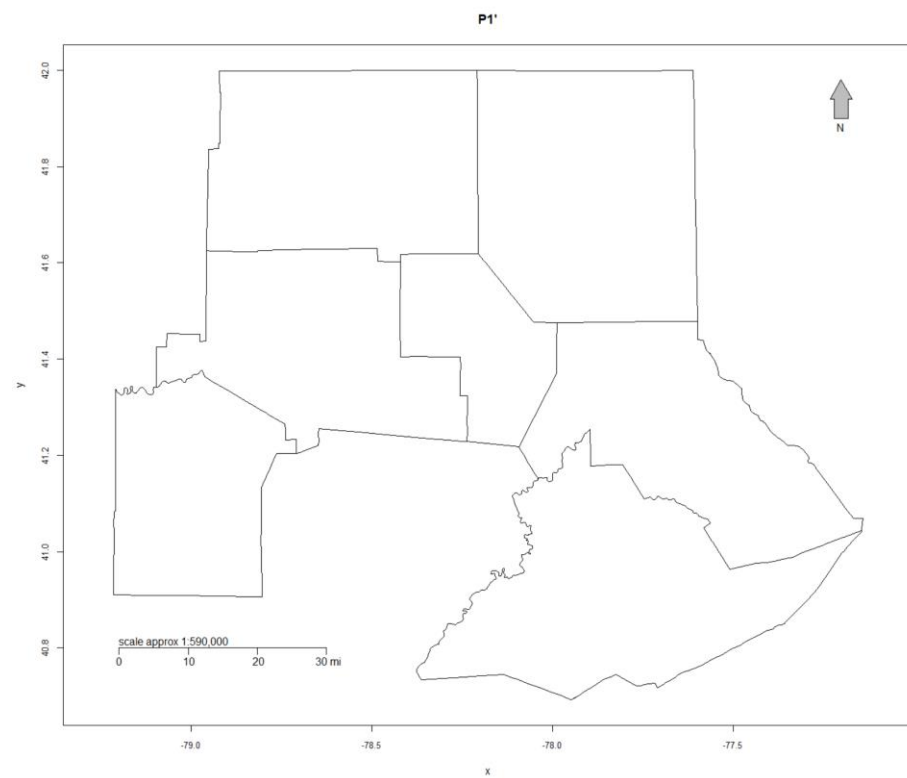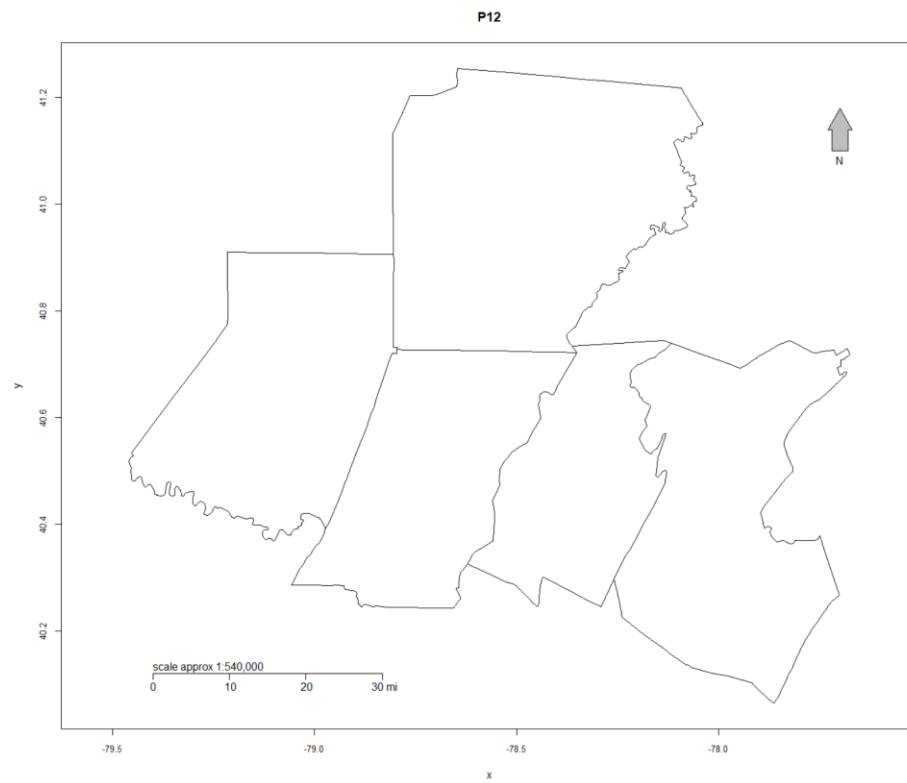
(c) My choice: OK.

Ordinary Kriging is a statistical method that makes use of variograms to calculate the spatial autocorrelation between points, so if the data are spatially correlated, OK would be my choice.

IDW differs from OK is that no statistical models are used, therefore, it is not suitable for spatially correlated data compared with OK.
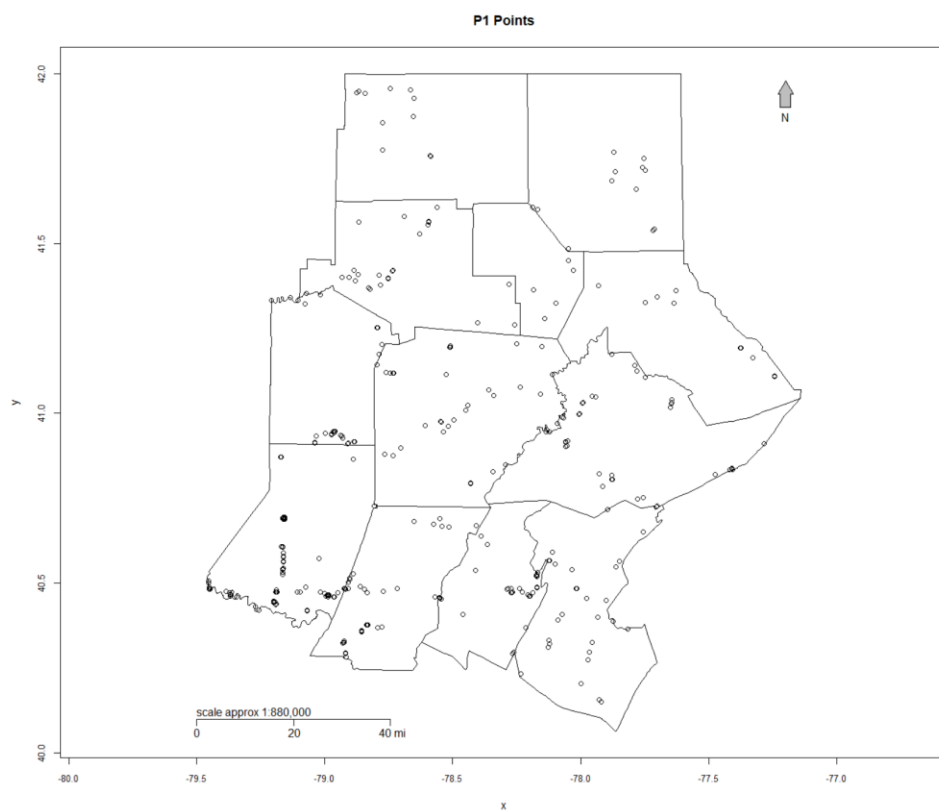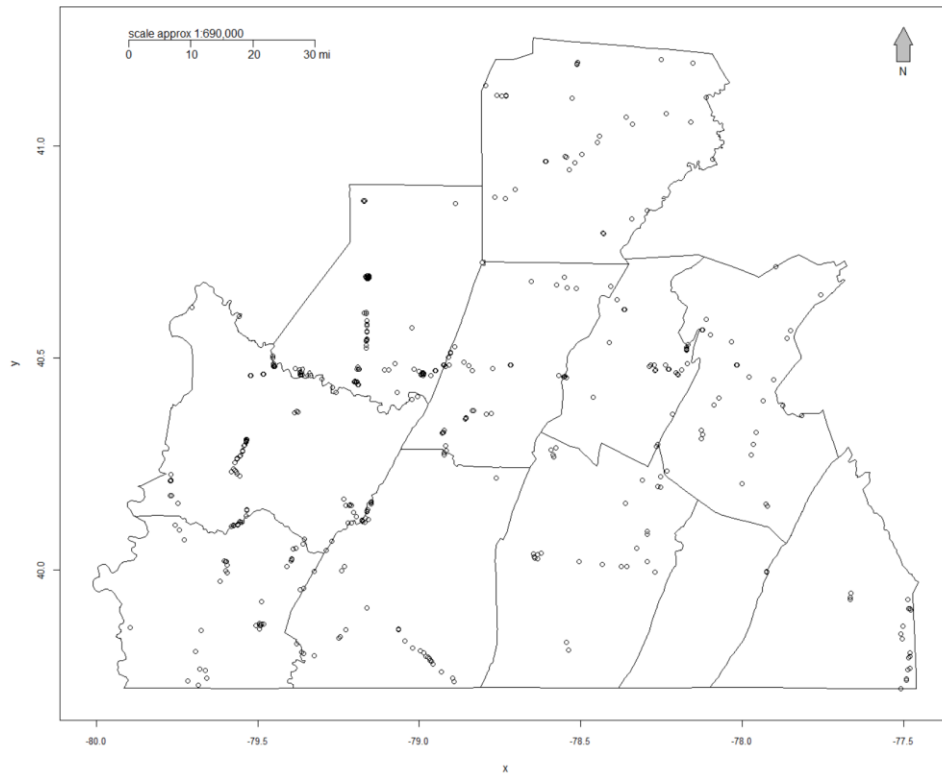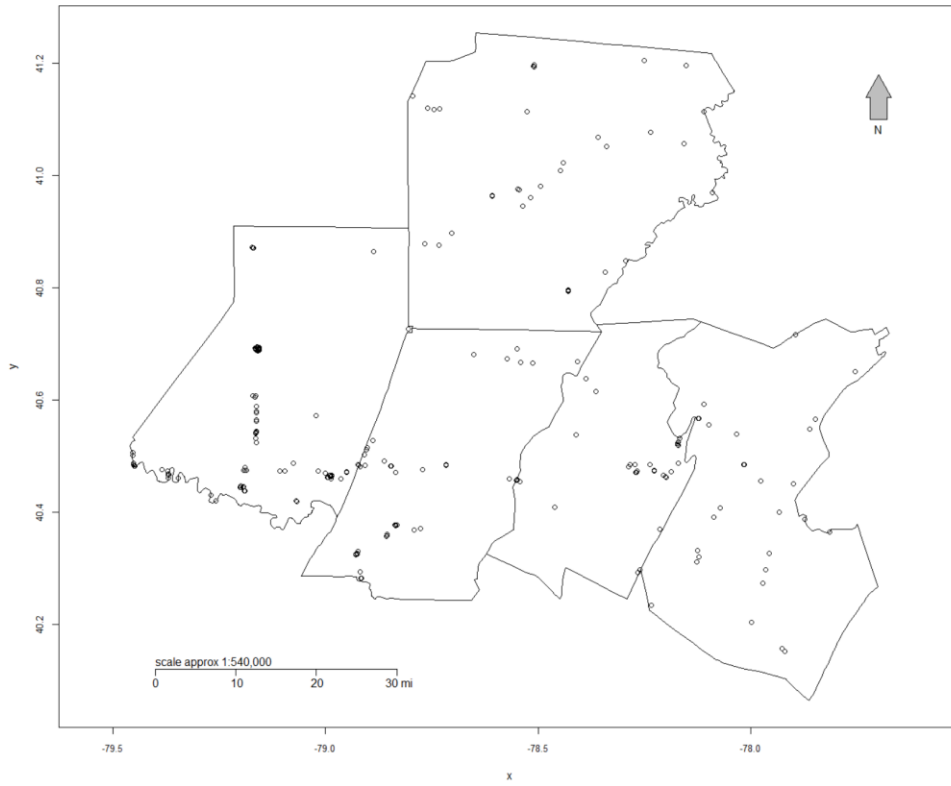
III.   Part C

(a)

P2'

(b)

P1 Points

P2 Points

P12 Points

(c)

P1 Road Segments

scale approx 1:880,000

P2 Road Segments

scale approx 1:690,000

P12 Road Segments

scale approx 1:540,000
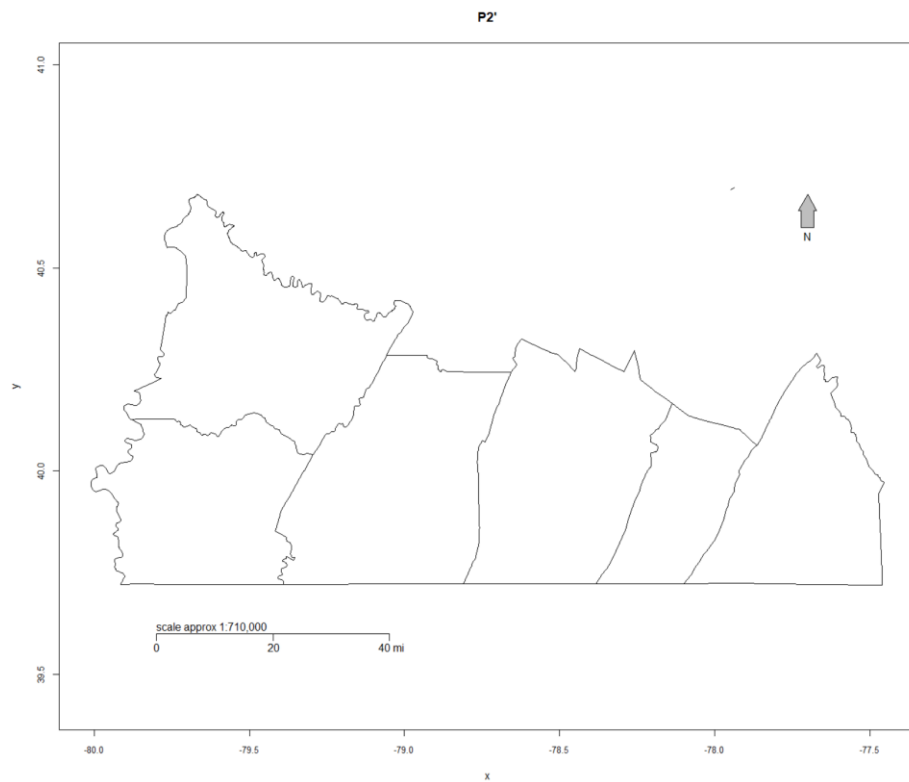
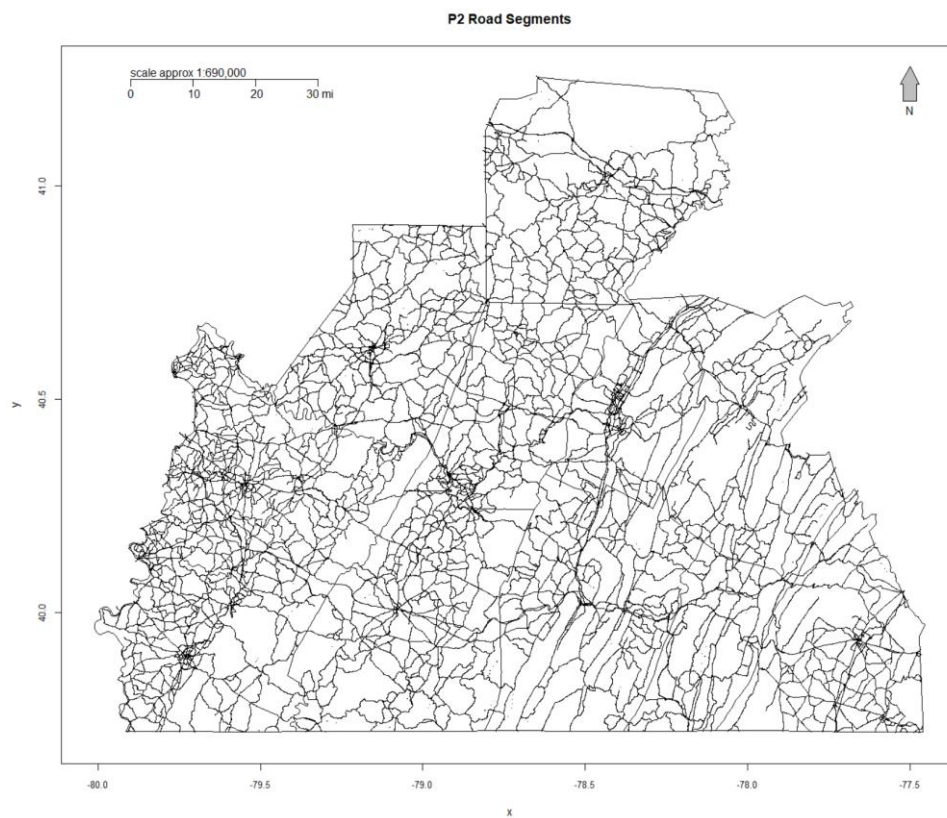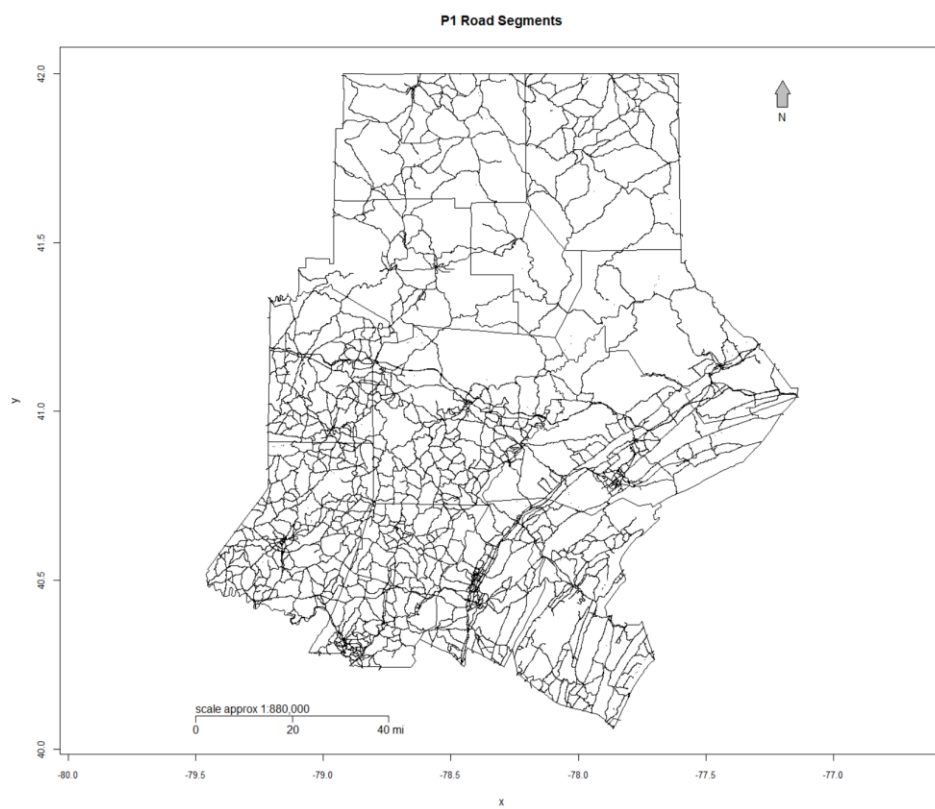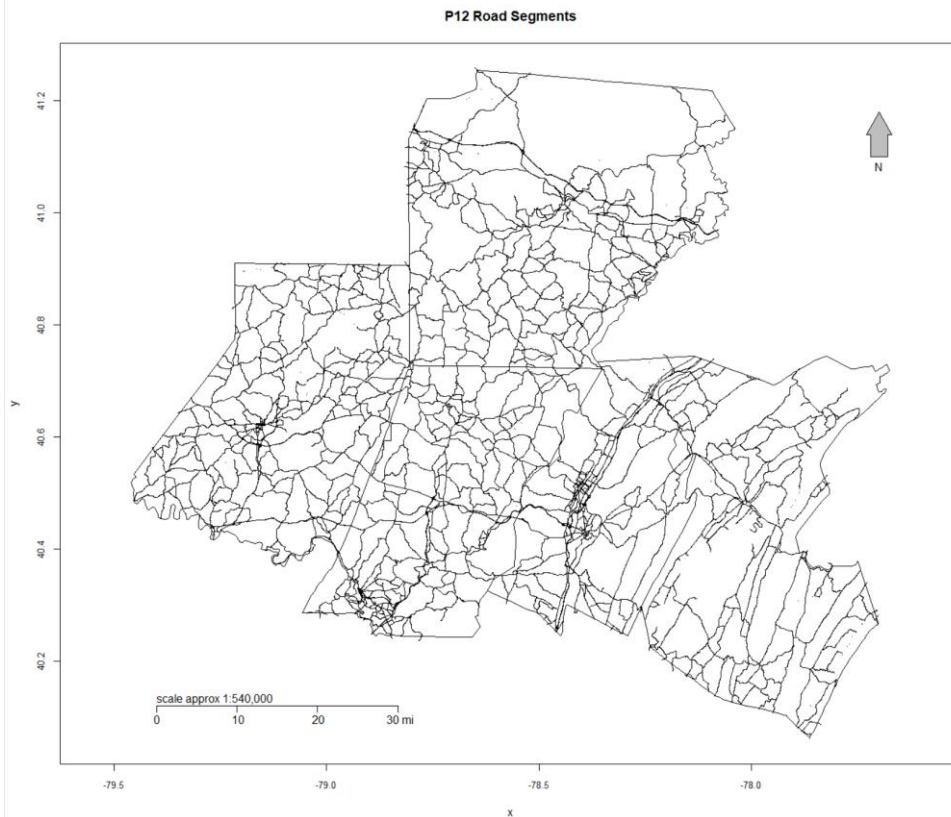**Answers:**

(a)

P12 shows the polygons P2 and P1 shares in common;

P1' shows the polygons which are included in P1 but not included in P2;

P2' shows the polygons which are included in P2 but not included in P1.

(b)

The area of P12: 1.132137

Points within P1: 428

Points within P2: 566

Points within P12: 281

Total length of road segments within P1: 35635832

Total length of road segments within P2: 48283239

Total length of road segments within P12: 20040341