Seoul Kindergarten Project

Gachon Univ. South Korea

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Contents

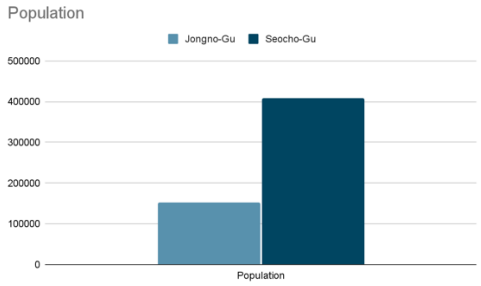
1. Introduction

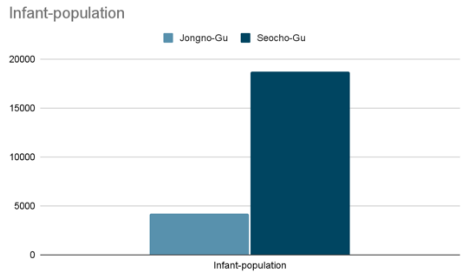
Education passion in Seoul, Korea is high. This is usually revealed as a university entrance examination, but before that, fierce competition is also emerging for kindergarten entrance. In this report, I would like to analyze the factors that are factors of preference for kindergartens, propose ways to resolve such competition, and explain the expected effects.

2. Motivation

For example, there are two regions, Jongno-gu and Seocho-gu

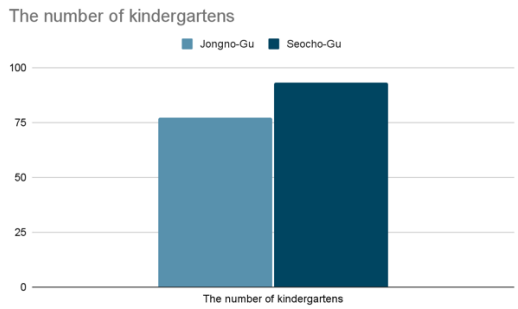
population and infant-population between the two regions are so different.

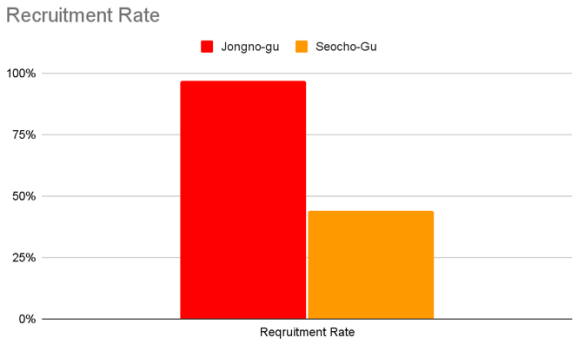




However, there is no significant difference in the number of kindergartens.

As a result, only 4 out of 10 infants in Seocho-gu go to kindergarten.





In this situation, the competition rate for kindergarten admission in Seocho-gu is bound to intensify. Nevertheless, people continue to migrate.

The reasons that I expected are below

1. People want to move to area of good infrastructure.

2. People think about relationships around their children from an early age.

so I should collect the relevant data.

3. Data

Before entering the contents, let me explain the address system of Korea.

Korea > Metropolitan city/Provinces(Si/Do) > District(Gu) > Mesh block(Dong)

I Use POSTGIS for processing spatial data,

QGIS for visualization,

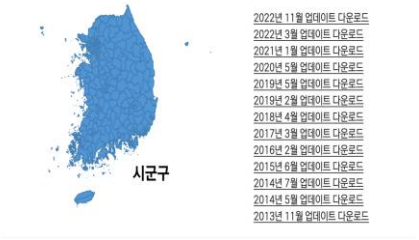
Docker for making a container and running.

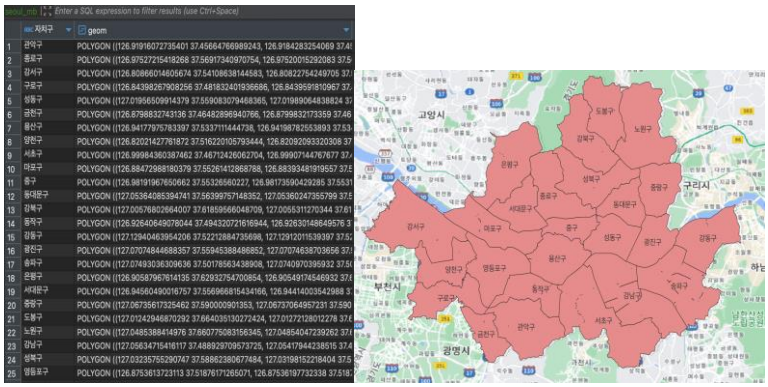
3.1. Data source

1. I get the Seoul district(gu) data to analyze the difference between the districts

http://www.gisdeveloper.co.kr/?p=2332

website/table/visualization in qgis





2. Get the Korean population data

https://data.seoul.go.kr/dataList/10718/S/2/datasetView.do

data information

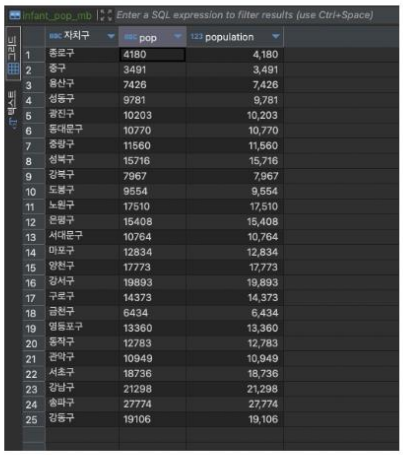
데이터 정보

공개일자	2021.05.21.	최신수정일자	2022.04.26.
갱신주기	정기(분기)	분류	복지
원본시스템		저작권자	서울특별시 디지털정책관
제공기관	서울특별시	제공부서	디지털정책관 빅데이터담당관
담당자	황재일 (02-2133-4361)		
원본형태	DB	제3저작권자	없음
라이선스	저작권자표시(BY) : 이용이나 변경 및 2차적 저작물의 작성을 포함한 자유이용을 허락합니다.		
관련 태그	5세별, 내국인, 등록인구, 연령별, 외국인, 한국인, 행정동별, 등록외국인, 인구, 인구수		

Tables

	자치구	pop	population
1	종로구	152403	152,403
2	중구	130722	130,722
3	용산구	233696	233,696
4	성동구	288564	288,564
5	광진구	350723	350,723
6	동대문구	353823	353,823
7	중랑구	390698	390,698
8	성북구	442981	442,981
9	강북구	298261	298,261
10	도봉구	314583	314,583
11	노원구	509265	509,265
12	은평구	472841	472,841
13	서대문구	318372	318,372
14	마포구	375457	375,457
15	양천구	444853	444,853
16	강서구	575456	575,456
17	구로구	417500	417,500
18	금천구	243444	243,444
19	영등포구	398392	398,392
20	동작구	392162	392,162
21	관악구	501484	501,484
22	서초구	408924	408,924
23	강남구	534885	534,885
24	송파구	665437	665,437
25	강동구	464324	464,324

population of seoul by district table



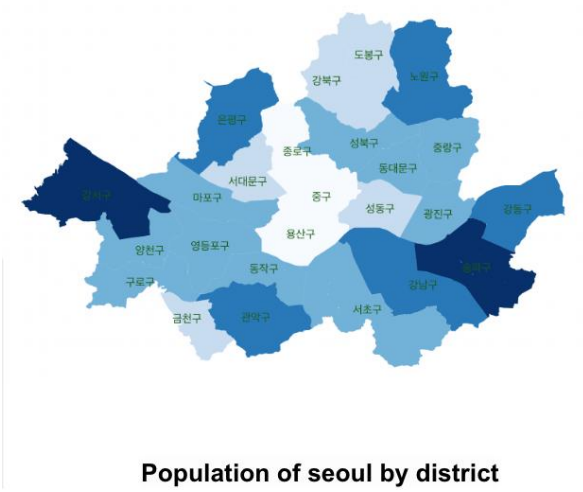
	자치구	pop	population
1	종로구	4180	4,180
2	중구	3491	3,491
3	용산구	7426	7,426
4	성동구	9781	9,781
5	광진구	10203	10,203
6	동대문구	10770	10,770
7	중랑구	11560	11,560
8	성북구	15716	15,716
9	강북구	7967	7,967
10	도봉구	9554	9,554
11	노원구	17510	17,510
12	은평구	15408	15,408
13	서대문구	10764	10,764
14	마포구	12834	12,834
15	양천구	17773	17,773
16	강서구	19893	19,893
17	구로구	14373	14,373
18	금천구	6434	6,434
19	영등포구	13360	13,360
20	동작구	12783	12,783
21	관악구	10949	10,949
22	서초구	18736	18,736
23	강남구	21298	21,298
24	송파구	27774	27,774
25	강동구	19106	19,106

infant population of seoul by district table

Population of Seoul : 9.682.126

Infant-population of Seoul : 323,365

draw it as a heat map



Population of seoul by district

3. get the kindergarten data

https://download.geofabrik.de/asia.html

Download this from the geofabrik.

Philippines	[.osm.pbf] (485 MB)	[.shp.zip]	[.osm.bz2]
Russian Federation	[.osm.pbf] (3.2 GB)	✖	[.osm.bz2]
South Korea	[.osm.pbf] (164 MB)	[.shp.zip]	[.osm.bz2]
Sri Lanka	[.osm.pbf] (107 MB)	[.shp.zip]	[.osm.bz2]
Syria	[.osm.pbf] (38.7 MB)	[.shp.zip]	[.osm.bz2]

Input the data into the database by ogr2ogr

filtered by kindergarten.

this is the result table

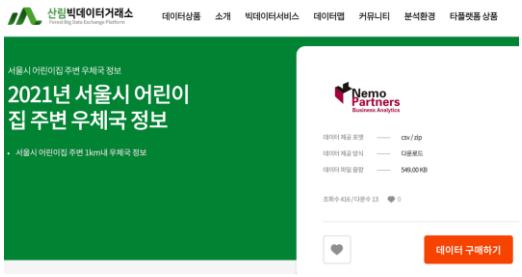
buildings_kindergarten — Enter a SQL expression to filter results (use Ctrl+Space)

	ogc_fid	osm_id	code	fclass	name	type
1	480,806	967041988	1,500	building	파랑새어린이집	kindergarten
2	481,038	967044678	1,500	building	능수어린이집	kindergarten
3	481,039	967044679	1,500	building	지구마을어린이집	kindergarten
4	481,046	967044686	1,500	building	쌍용역코오롱하늘	kindergarten
5	481,664	967592004	1,500	building	세정어린이집	kindergarten
6	481,672	967592014	1,500	building	진원어린이집	kindergarten
7	482,429	968763370	1,500	building	은곡유치원	kindergarten
8	483,025	970538069	1,500	building	라온어린이집	kindergarten
9	483,213	970970893	1,500	building	한나어린이집	kindergarten
10	483,654	972209271	1,500	building	고양국제유치원	kindergarten
11	483,663	972237316	1,500	building	꽃향기유치원	kindergarten
12	483,937	972875286	1,500	building	[NULL]	kindergarten
13	484,327	973088151	1,500	building	착정어린이집	kindergarten
14	484,645	974881990	1,500	building	고강도 어린이집	kindergarten
15	484,932	975163342	1,500	building	아름다운 어린이집	kindergarten
16	485,234	975327739	1,500	building	파랑새 어린이집	kindergarten
17	485,244	975327751	1,500	building	엠코동화어린이집	kindergarten
18	485,246	975327760	1,500	building	새싹어린이집	kindergarten
19	485,247	975327761	1,500	building	새싹유치원	kindergarten
20	485,692	975635314	1,500	building	엘매유치원	kindergarten
21	485,705	975635335	1,500	building	예나어린이집	kindergarten
22	486,086	976267676	1,500	building	[NULL]	kindergarten
23	486,257	976772329	1,500	building	용지어린이집	kindergarten
24	488,853	979921313	1,500	building	일품유치원	kindergarten
25	489,838	980764566	1,500	building	원화현광어린이집	kindergarten
26	491,365	981524005	1,500	building	[NULL]	kindergarten
27	492,200	982373762	1,500	building	꿈열매유치원	kindergarten
28	492,426	983087824	1,500	building	[NULL]	kindergarten
29	494,412	985066359	1,500	building	[NULL]	kindergarten
30	494,885	985682407	1,500	building	[NULL]	kindergarten
31	496,983	987029073	1,500	building	[NULL]	kindergarten
32	499,036	987628100	1,500	building	[NULL]	kindergarten

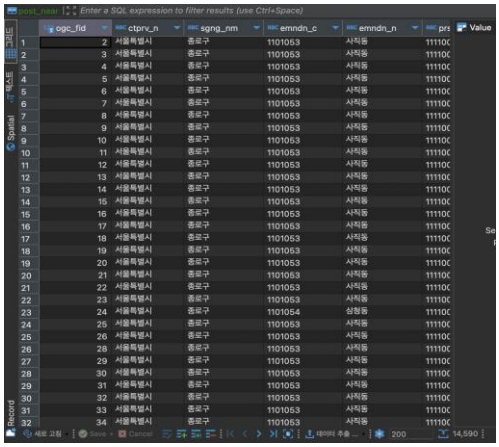
4. I want to analysis of preference factors for kindergartens in Seoul so that I get the

surrounding environment of kindergarten.

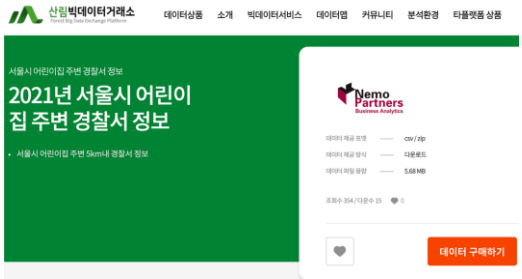
Post office : https://www.bigdata-forest.kr/product/NMO008401



table(403 presents, 14,590 rows)



Police station : https://www.bigdata-forest.kr/product/NMO008501



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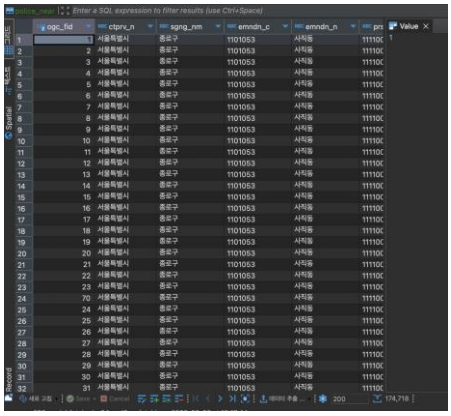
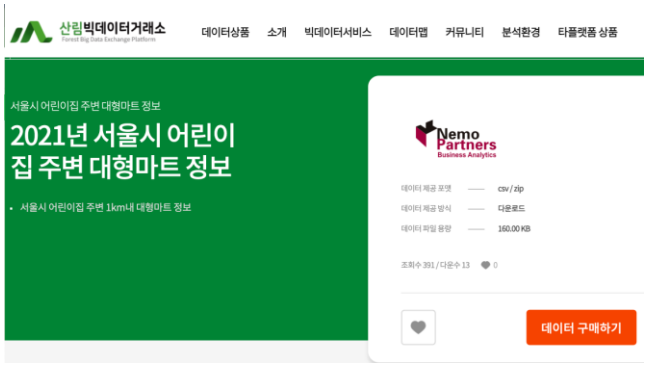
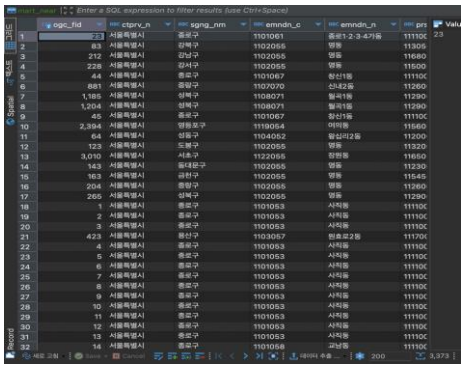


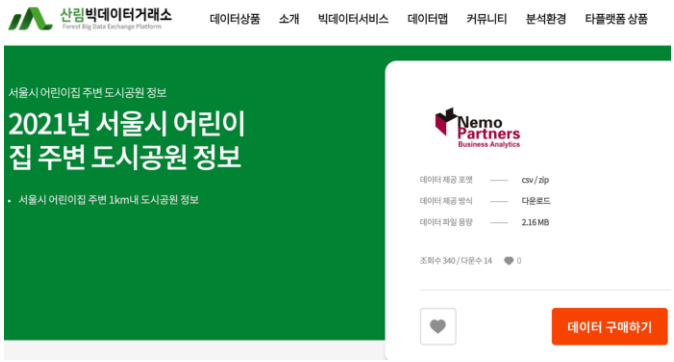
Mart: https://www.bigdata-forest.kr/product/NMO008301



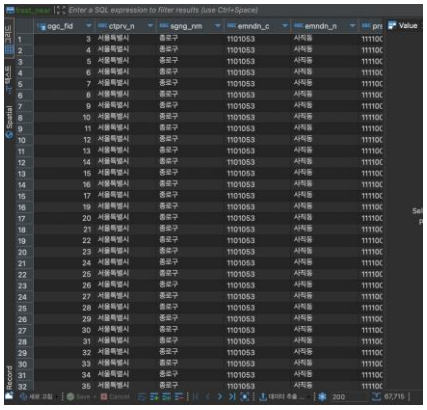
table(70 presents, 3,373 rows)



Park: https://www.bigdata-forest.kr/product/NMO008201



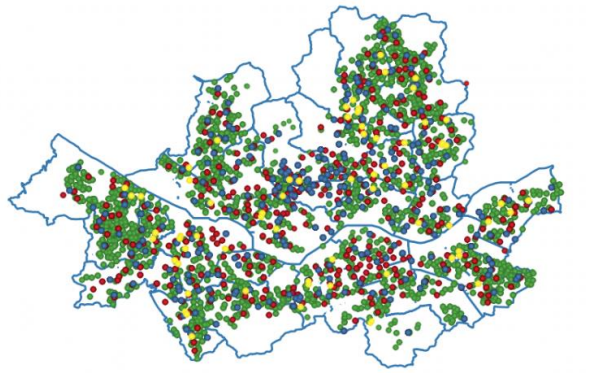
Table(1754 presents, 67,715 rows)



post office : red, police station : blue,

mart : yellow, park : green

surrounding environment of kindergarten in Seoul.



5. Get the percentage of high-income earners by districts in Seoul

Seoul Research Institute, 2014, Seoul Survey,

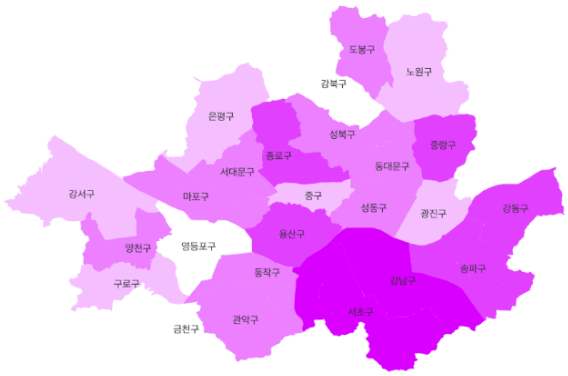
https://www.si.re.kr/si_download/56731/18179,

https://v.daum.net/v/20220717060141744

Result table

	ABC 자치구	123 percentage
1	종로구	28
2	중구	16.5
3	용산구	27
4	성동구	23.2
5	광진구	17.4
6	동대문구	23.6
7	중랑구	31.6
8	성북구	22.6
9	강북구	10.4
10	도봉구	25.5
11	노원구	17.6
12	은평구	18.9
13	서대문구	22
14	마포구	21.2
15	양천구	26.9
16	강서구	15.2
17	구로구	15.9
18	금천구	11.3
19	영등포구	7
20	동작구	21
21	관악구	21.3
22	서초구	40.2
23	강남구	37.1
24	송파구	33.4
25	강동구	27.4

Visualization



percentage of high-income earners by districts(Gu) in Seoul

the darker the color, the richer the area

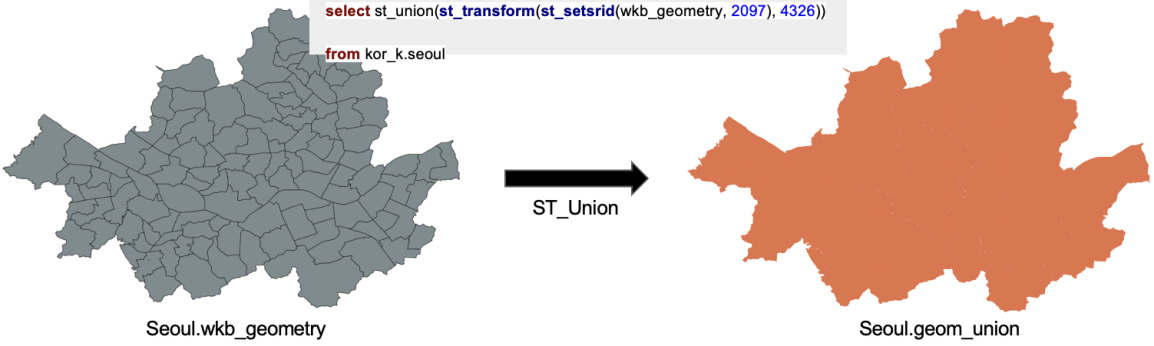
4. Processing the data

4.1. Preprocessing

I need to filtering the kindergartens only in seoul.

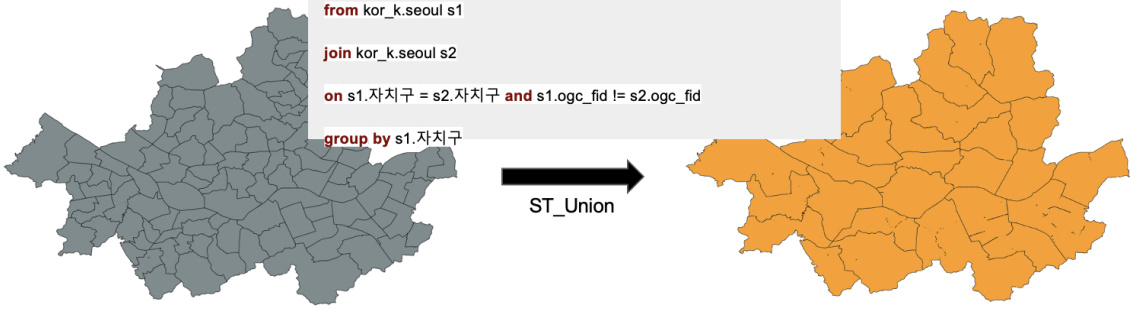
step 1 : Union area for whole Seoul

```
insert into kor_k.seoul (geom_union)
select st_union(st_transform(st_setsrid(wkb_geometry, 2097), 4326))
from kor_k.seoul
```



step 2 : Union area for each Seoul district

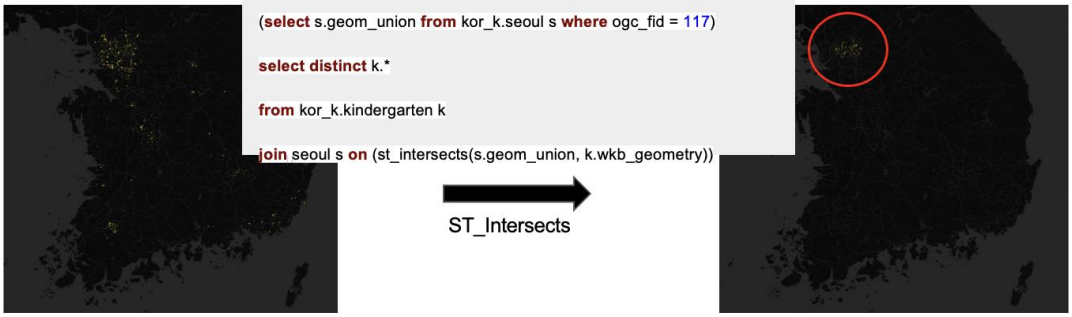
```
select s1.자치구, st_union(s1.wkb_geometry) geom
from kor_k.seoul s1
join kor_k.seoul s2
on s1.자치구 = s2.자치구 and s1.ogc_fid != s2.ogc_fid
group by s1.자치구
```



Seoul.wkb_geometry　　Seoul_mb.geom

step 3 : Filter kindergartens in Seoul

```
with seoul as
(select s.geom_union from kor_k.seoul s where ogc_fid = 117)
select distinct k.*
from kor_k.kindergarten k
join seoul s on (st_intersects(s.geom_union, k.wkb_geometry))
```

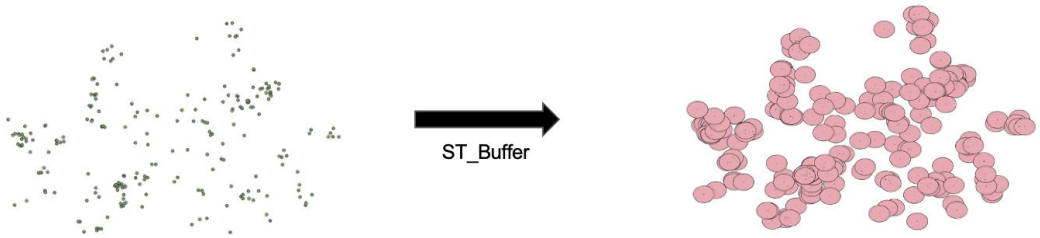


Kindergarten.geom　　SeoulKindergarten.geom

Create the radius 1.0 km for each kindergarten.

I will use this later for searching the surrounding environment of each kindergarten.

```
select ogc_fid, "name", wkb_geometry geom,
st_buffer(wkb_geometry::geography, 1000)::geometry buffer
from kor_k.kindergarten_seoul
```



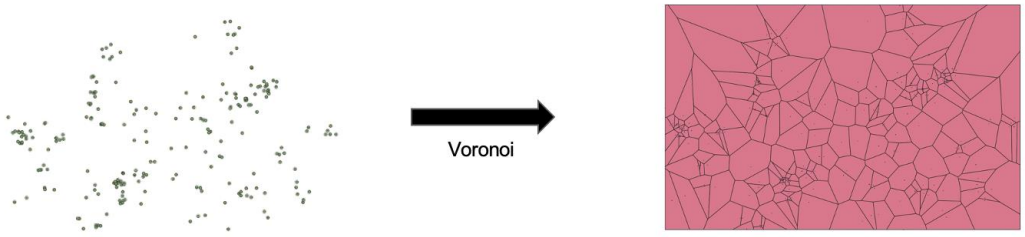
SeoulKindergarten.geom　　SeoulKindergarten.buffer

Create the Voronoi diagram for each kindergarten.

As above, it will be used to search the surrounding environment, and it is made for other criteria application.

create Voronoi diagram using QGIS

import to DBeaver



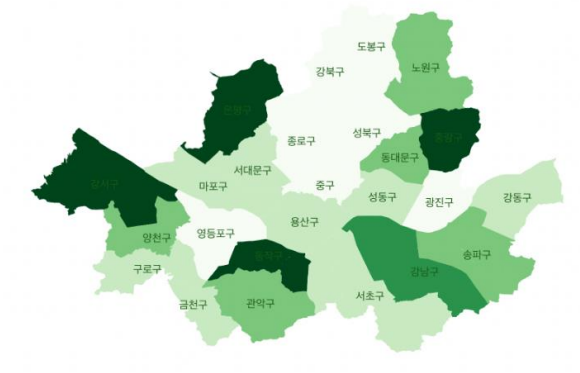
SeoulKindergarten.geom

SeoulKindergarten.vor

4.2. Processing

Aim 1 : Count kindergarten for each district.

because I want to check the difference between each district in Seoul.

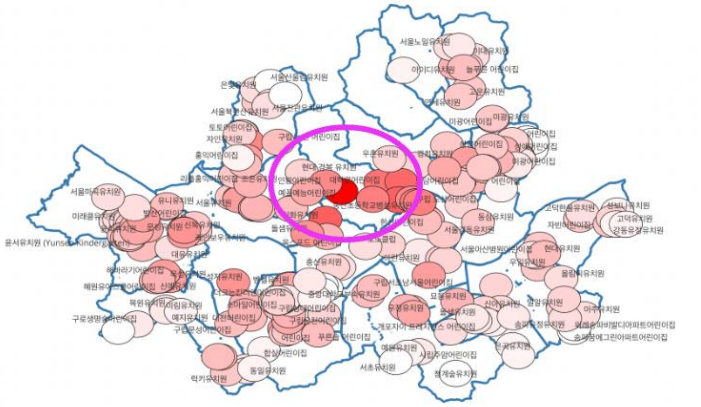


	ABC 자치구	123 k_total_cnt
1	중랑구	24
2	동작구	24
3	은평구	20
4	강서구	20
5	강남구	17

TOP 5 districts

Aim 2 : Count surround facilities for each kindergarten(using radius)

It is a heat map derived from the number of nearby police station, post offices, marts, and parks as scores and tables created accordingly.



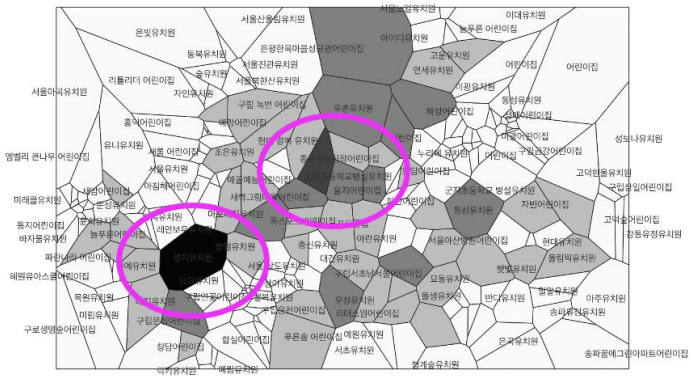
Most of high score kindergartens are located in '중구'

Aim 3 : Count Surrounding facilities for each kindergarten(using Voronoi)

same as above. Consider the number of nearby police station, post offices, marts, and parks as scores.

ogc_fid	name	frest_num	mart_num	police_num	post_num	total_score
169,750	성지유치원	6	6	8	17	37
163,384	종로구청직장어린이집	4	2	11	11	28
283,776	서계어린이집	5	1	8	7	21
62,125	어린이집	3	6	4	6	19
146,106	[NULL]	1	1	10	7	19
245,480	우촌유치원	2	3	6	8	19
478,897	동심유치원	3	1	5	10	19
431,007	돌샘유치원	4	2	3	8	17
486,086	[NULL]	2	0	5	10	17
48,798	반포퍼스티지하늘어린이집	3	3	5	5	16

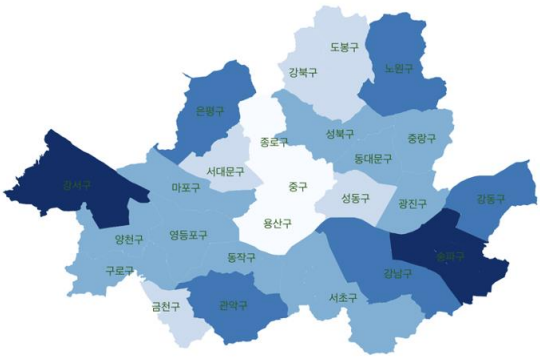
then I can draw a heat map below.



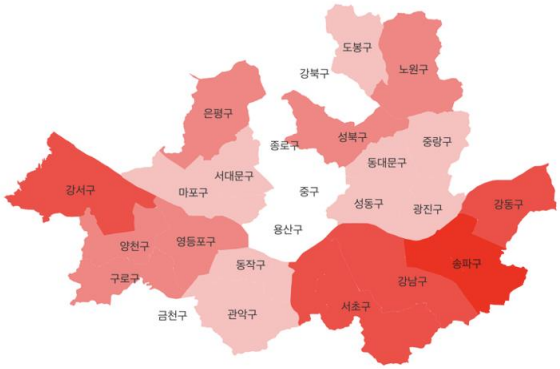
Most of high score kindergartens are located in '중구' and '영등포구'

Aim 4 : draw the heat map of the population in Seoul by districts

you can see the population concentrated in the Seocho-gu and Ganam-gu line.



Whole population



Infants population

The darker the color, the larger the population.

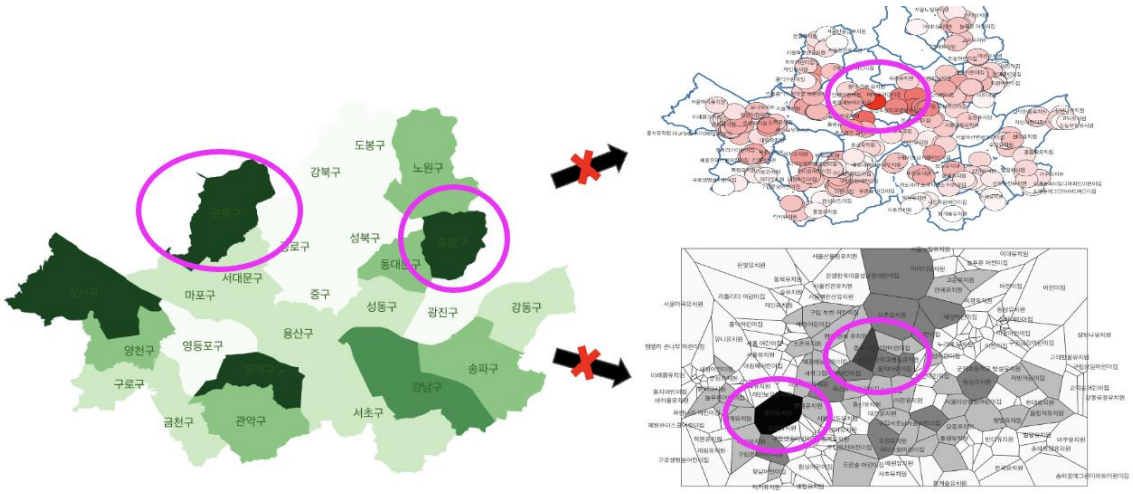
5. Analysis

Now I have all heat map from our tables.

let's summarize it into the analysis.

On the left is a heat map of the distribution of kindergartens in Seoul, and on the right is a heat map of the scores of surrounding facilities in Seoul.

Contrary to the expectation that there will be many kindergartens in places with many nearby facilities, I can see that kindergartens are concentrated in certain areas.

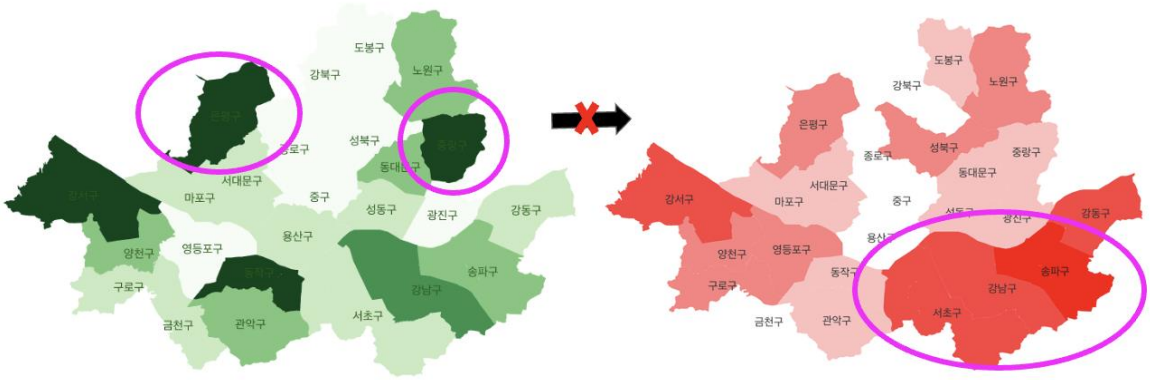


Count kindergarten in Seoul

Facilities score in Seoul

The following is a comparison with the distribution of infant population.

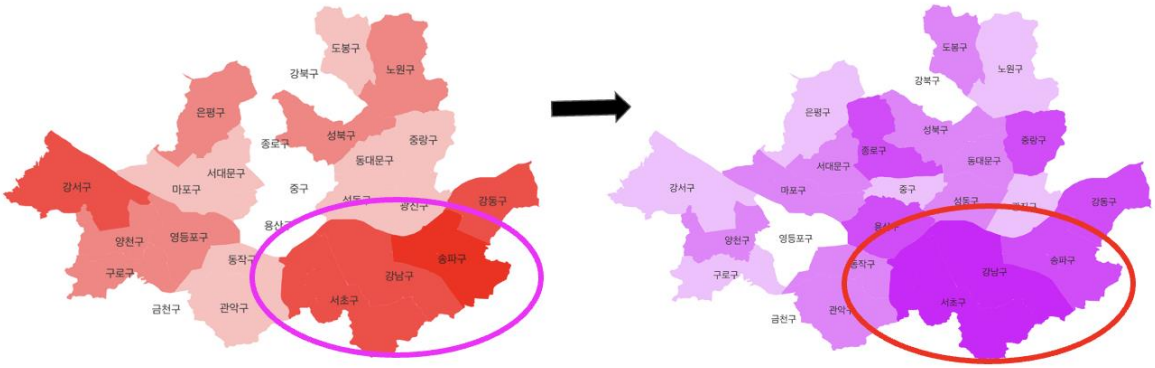
Contrary to the expectation that there will be a lot of infants in places with many kindergartens, it was concentrated in Seocho-gu and Gangnam-gu, even there are few kindergartens.



Count kindergarten in Seoul

Infants population in Seoul

The expected high-income as a reason for the crowding in Seocho-gu was almost consistent with the distribution of the number of infants.



Infants population in Seoul

Earning household in Seoul

6. Conclusion

It was different from the acutal data. Which was our first prediction, " The surrounding infrastructure greatly influence kindergarten choices. "

The problem was that parent wanted to rais their children in a high-income area

So, I can propose this kind of solution.

first of all, the number of kindergarten in areas where the competition rate is fierce such as Gangnam-Gu, Seocho-Gu, Songpa-Gu should be increased to resolve the current competition rate for kindergarten

admission.

A more fundamental solution is

1. to abandon the perception that children with parents who are currently prevalent high-income earners are in good relationships

2. promote balance development in all regions

3. create a perception that they can enter kindergartens with low competition rates.(I mentioned that if considering the overall level of Korea, the number of kindergartens is not insufficient.)

The above solution will lead to the expected effects below.

1. the resolution of excessive competition for kindergarten admission.

2. resolving the population concentration phenomenon caused by the competition for kindergarten admission.

3. balanced development through distribution of population.