











EUROPEAN REGIONAL DEVELOPMENT FUND

Data manipulation in QGIS

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EUROPEAN UNION



Lecture purpose

• To further introduce QGIS tools



Last time

- We cutted out the student population layer around the schools
 - Based on 3 km buffers around schools
- Added streets network layer
 - Took from Google Drive folder
- Now let's move on with filtering
 - Have to filter out home areas where a number of students are not meeting our criterias



Filtering areas where "Origin,, is less than X

- It will filter out all home areas where number of students is less than X
- As it is not very practical to plan non motorized streets there due the potensial low using rate

Choose the value based on your own reasoning. It is not a traffic planning course, it would not be assessed

How to filter out

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ovider Specific	: Filter Expre	ssion				
"student_	nr" > 5					



Task- Add centroids and Huff Gravity Mode $^{ m P}$

- Going back to gravity model
 - We are going to use it in this project
- Add centroids to every polygon (home area)
- Find centroid algorithm by yourself from the toolbar

Centroids will decrease our problem as it concentrates information into the small area and prepares data for further analysis.





Task- how to find distance between schools and home centroids

- The Huff gravity model says that attractiveness will decrease in distance
- So we have to find distance from every centroid to every school



Parameters Log	Distan
Input point layer	This algorit
° Centroids [EPSG:3301] 🔹 🕻 🔧	containing a distances be
Selected features only	points layer
Input unique ID field	
123 student_nr	-
Target point layer	
📌 Schools_p2rnu [EPSG:3301] 🔹 📢	
Selected features only	
Target unique ID field	
abc kool_nimi	-
Output matrix type	
Linear (N*k x 3) distance matrix	-
Use only the nearest (k) target points	
0	•
Distance matrix	
[Create temporary layer]	
✔ Open output file after running algorithm	
0%	



Next step is to develope OD matrix

- How could we make a attribute table so from each home zone (origin) it will give distance to every school (destination)?
- It should look like this:

Origin	Dist to school	Dist to school	Dist to school	Dist to school
	1	2	3	n
100 students	1050	2300	590	N metres

Task- how to format attribute table

Q	Distance matrix — Features Total: 192, Filtered: 192, Selected: 0							
/	Z B 5 6 ~	8 8 8	S 😼 🕇 🗷 🐥	P 🖩 🖹 🗶 🗮 🚍 🛱 🍭				
	Distance	Origin	Destination					
1	625.738464786	94	Rääma_pk					
2	1890.06072743	94	Pärnu_ülejõe_pk					
	T	This is the init	ial view of le	We will add following attributes: School_1 School_2 School_3				

attributes Q Distance matrix — Field Calculator Only update 0 selected features ✓ Create a new field Create virtual field Output field name Rääma_dist Output field type Whole number (integer) Ŧ \$ Output field length 10 Precision 3 Expression Function Editor Ł Q 0

First let's add



Task- how to add distance to attributes

🔇 Distance matrix — Field Calculator		×
Only update 0 selected features		
Create a new field	✓ Update existing field	
Create virtual field Output field name Output field type Whole number (integer) Output field length 10 Precision 3	123 Rääma_dist	•
Expression Function Editor		
	Q. Search Show Val	lues group field
CASE WHEN "Destination" = 'Rääma_pk' THEN "Distance" END	 Color Conditionals CASE coalesce if nullif 	 Double-click to add field name to expression string. Right-Click on field name to open context menu sample value loading options. Notes
	regexp_match	Values Q Search
	try Conversions Date and Time Fields and Values	All Unique 10 Samples
= + - / * ^ () "\n"	NULL abc Origin abc Destination	
Feature 🔹 🖌 🕨	1.2 Distance	
Preview: NULL	123 Rääma_dist	▼
		OK Cancel Help

The script could be interpreted as- when the cell content under *destination attribute* is *Rääma_pk* then add to *Rääma_dist* a value of distance of the same feature/object



Formating a attribute table

• You should end up something like this

0	文 Distance matrix — Features Total: 32, Filtered: 32, Selected: 0									
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12	123 Origin 🔹 = 🗵									
	Origin Destination Distance Rääma_dist Ülejõe_dist Kuninga_dist									
9	107	Rääma_pk	625.738464786	626	1890	1371				
10	107	Ülejõe_pk	1890.06072743	NULL	1890	NULL				
11	107	kuninga_pk	1370.76622150	NULL	NULL	1371				
12	100	Rääma_pk	628.354949992	628	1035	992				
13	100	Ülejõe_pk	1034.61841081	NULL	1035	NULL				
14	100	kuninga_pk	991.559601497	NULL	NULL	992				
15	87	Rääma pk	1545.47457529	1545	2842	2185				



Task- delete unnessesary records/objects

 Group first 3 rows. Now take the school's distance to the student home and add distance to the top row

							From here
12	100	Rääma_pk	628.354949992	628	1035	992	
13	100	Ülejõe_pk	1034.61841081	NULL	1035	NULL	
14	100	kuninga_pk	99 1 .559601497	NULL	NULL	992	×
15	87	Rääma_pk	1545.47457529	1545	2842	2185	
16	87	Ülejõe_pk	2841.55744017	NULL	2842	NULL	
17	87	kuninga_pk	2185.18463707	NULL	NULL	2185	
18	86 🗶	Rääma_pk	5604.62492518	5605	6691	4965	
19	86	Ülejõe_pk	6691.46866036	NULL	6691	NULL	

Now you have for every origin a distance to every destination arranged to the same row



Task- delete records II

 Now delete 2 last records from a group, we will not need them anymore

9	107	Rääma_pk	625.738464786	626	1890	1371	
10	107	Ülejõe_pk	1890.06072743	NULL	1890	NULL	
11	107	kuninga_pk	1370.76622150	NULL	NULL	1371	
12	100	Rääma_pk	628.354949992	628	1035	992	
13	100	Ülejõe_pk	1034.61841081	NULL	1035	NULL 🗲	
14	100	kuninga_pk	991.559601497	NULL	NULL	992	
15	87	Rääma_pk	1545.47457529	1545	2842	2185	
16	87	Ülejõe_pk	2841.55744017	NULL	2842	NULL	
17	87	kuninga_pk	2185.18463707	NULL	NULL	2185	

Select (CTRL + clikc) and delete



Finding potensial students for each school

- In this example I will use max number of students in schools as following:
 - 750
 - 600
 - 450
- You have your own set of schools and maximum numbers

Task- find schools attractivnes

- First let's find attractivnes of schools by the home area
- Divide max school students with squares of distance (From school to students home area)
- Use decimal numbers and precision at least 6 places

You have a maximum nr of students in a given school found from the project initial data- Google Drive.

Next you should know how attractive is a school for a given home area to pull students

> Add also total attractivnes atribute for schools

Q Distance matrix — Field Calculator					
Only update 0 se	elected features				
Create virtual fi	eld				
Output field name	Atrr_tot				
Output field type	Decimal number (real)				
Output field length	10 🗘 Precision 6 🚳 🖨				
Expression Fu	unction Editor				
"Attr_R"	+ "Attr_Ü" +				
"Attr_K"					

Q Distance matrix — Field Calculator	
Only update 0 selected features	
✓ Create a new field	
Create virtual field	
Output field name Attr_R	
Output field type Decimal number (real)	
Output field length 10 <a>Precision 6	⊠ 4
Expression Function Editor	
750 / ("Rääma_dist" * "Rääma_dist")	
Feature	
Preview: 0.00011744939379669886	



Task- calculate "marketshare"

- "Marketshare" will result in student numbers
- Represent how much students will go to a given school from the home area
- Use integer type to add new attribute
- Divide school attractiveness with total attractiveness and multiply with students number in given area

"Marketshare"

Stud_R means students to Rääma school in this example.

So we have the attractiveness of Rääma by taking the max number of students and dividing it with the distance from school to home area.

Next we divide school attractiveness with total attractiveness.

And multiply by the total students in a particular home area

Remember that "originID" attributes hold a value of students from that area

🔇 distance_matri	x_p2rnu	— Fi	eld Calcu	lator	
Only update 0 se	lected fe	atures	5		
✓ Create a new f	field				
Create virtual fi	eld				
Output field name	Stud_R				
Output field type	Whole n	umbe	r (integer)		•
Output field length	10	‡ F	Precision	3	*
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("Attr R"	/ "A	ttr	tot" <mark>)</mark>	*	
"Origin"					
= + - /	*	` ['\n'	
Feature Rääma_p	k		•		
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How attribute table should look like

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12	23 Origin 💌 = 🗧	8								
	Origin	Rääma_di	Ülejõe_d	Kuninga_di	Attr_R	Attr_K	Attr_Ü	Attr_tot	Stud_R `	•
1	207	799	804	1991	0.001175	8.8e-05	0.000851	0.002114	11	5
2	213	2811	3863	2194	9.5e-05	7.3e-05	3.7e-05	0.000205	9	9
3	224	1466	2449	948	0.000349	0.000389	9.2e-05	0.00083	9	4
4	107	626	1890	1371	0.001914	0.000186	0.000154	0.002254	9	1

Here you will see the final view of the attribute table

View of home area centroids categorized by student numbers against the attracted school



Task- how to bring multipoint layer to singlepoint

	🔇 Multipart to Singleparts				×
Need it to bring tractiveness back to he home areas grid	Parameters Log Input layer • * distance_matrix [EPSG:3301] Selected features only Single parts [Create temporary layer] ✓ Open output file after running algorithm	ithm	Multip single	art to parts hm takes a vect cometries and g which all geom t. Features with are divided in a atures as parts d the same attri ch of them.	or layer with generates a etries contain a multipart is many the geometry butes are
		0%			Cancel
	Run as Batch Process		Run	Close	Help



Task-how to join by location

- Join attributes by their location to bring students back to the home area layer
- To specify attributes for algorithm click on the "field to add"
- Fields to add "Stud_to_1, 2, 3"

We have a centroid with attributes of how much students will move to a given school.

But we want it to be a more clear view and we should bring those values back to area level

Parameters Log				
Base Layer			-	
Clipped [EPSG:32635]	- 47	₹.		
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Join Layer				
^{**} Distance matrix [EPSG:32635]	- ()	₹.		
Selected features only				
Geometric predicate				
✓ intersects				
contains within				
equals crosses				
🗌 touches				
Fields to add (leave empty to use all fields) [optional]				
0 options selected				
Join type			Fiel	
Create separate feature for each matching feature (one-to-many)			all f	
Discord records which could not be joined				

O Join Attributes by Location

Results



You have to look at one school at the time, so you could have a view of how many students will move to a given school

In this example we are viewing how many students will go to Rääma school from each home area

Spatial analysis

- Let's take the first school and filter out all cells where the number of students moving is less than X
- You can choose it freely but i used 100

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attract_P			
attract_N			
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market R			
market P			
op_M			
op_R			
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atr_P_1			
atr_R_1			
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Operators			
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At the end of the course you team should submit following layers:

- Demand layer- students by area
- Offer layer- schools positions
- Gravity model of 3 objects
- Hot zone- where are the most mobility takes place
- Purposed non motorized traffic street layer





Thank you for your attention!

Interreg Central Baltic Project: INTELTRANS – Intelligent Transport and Traffic Management study module.







