Restructuring, data manipulation

Restructuring, data manipulation

Data manipulation

1. Change of map projection, coordinate system transformation
2. Resampling in raster GIS
3. Generalization in GIS
4. Conversion of raster GIS to vector and vice versa
5. Handling DTM

Restructuring, data manipulation

1. Handling of data

Manipulation of object geometry or attributes:

- Spatial editing of objects when topological relationships are changed - adding a new boundary, dividing objects , the change can also affect several objects
- Spatial division of **vector** representations - for processing sub-sites - using **regular** (e.g. square grid) and **irregular** boundaries (administrative boundaries)
- Spatial division of **raster** representations – usually according to rectangular windows – is a division of territory into smaller ones
- Spatial **joining of** vector representations (to create seamless data - it is necessary to treat the connection of objects on the border of the joined map sheets - edge matching – for small deviations can be used automatic repairs , larger it is advisable to check individually

Restructuring, manipulation of data

1. Change of map projection, transformation of the coordinate system

- Changes to the map projection – currently already part of GIS – just choose the right way
- Coordinate system transformation:
  - **1. Linear conformal transformation (Helmert)**

$$x' = mx\cos\beta + my\sin\beta + a$$
$$y' = -mx\sin\beta + my\cos\beta + b,$$

Where a is the displacement in the X *direction*

b is the displacement in the Y *direction*

β is the rotation angle

Restructuring , manipulation of data

1. Change of map projection, transformation of the coordinate system

The coefficients of the Helmert transformation are calculated **by the method of least squares** :

$$m.what\ \beta = ((x_2 - x_1)(y_2' - y_1') - (y_2 - y_1)(x_2' - x_1'))/((x_2' - x_1')(x_2' - x_1') + (y_2' - y_1')(y_2' - y_1'))$$

$$m.sin\ \beta = ((x_2 - x_1)(x_2' - x_1') + (y_2 - y_1)(y_2' - y_1'))/((x_2' - x_1')(x_2' - x_1') + (y_2' - y_1')(y_2' - y_1'))$$

x,y – original coordinates

x', y' - new coordinates

Restructuring , manipulation of data

1. Change of map projection, transformation of the coordinate system

2. Polynomial transformations – 1st – nth order

Display equation for 1st order:

$$x' = ax + by + c$$

$$y' = dx + ey + f$$

Individual coordinates are transformed independently (unlike the Helmert transformation)

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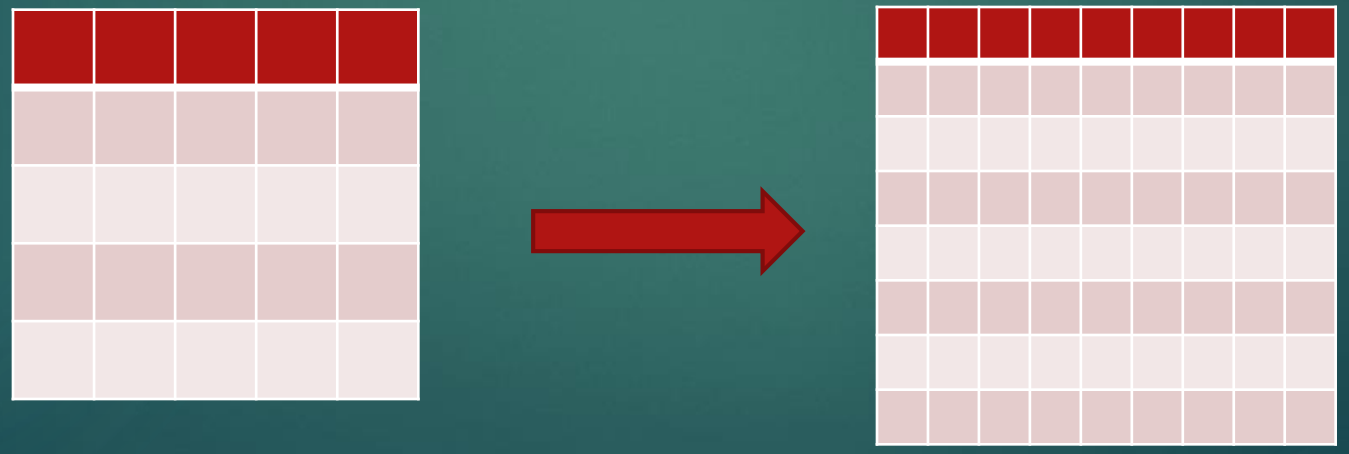
2. Re -sampling

Resampling (resampling)–

raster transformation, i.e. changing the pixel size or resolution of a raster GIS

- it is necessary to assign new pixel values to the newly created pixels!!!!



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2. Manipulation of resampling data

Raster GIS

Resizing the raster for a raster representation = **resampling** the raster will necessitate the creation of new attribute (digital) values stored in the newly created pixels - there are different approaches

Inserting dig . values into the newly created pixels:

1. smaller pixels are created - attribute values from larger pixels are taken over
2. larger pixels are created - mostly calculation methods are used (i.e. not assignment) - some original attribute values in pixels may be omitted

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3. Generalization in the GIS environment

Generalization is the selection and simplification of the representation of object details with respect to a new scale and new for the purpose of maps (cartographic generalization).

Generalization is important for visualization (maps) and analysis

Automating generalization processes is a complex process

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3 . Generalization in a GIS environment

4 reasons for generalization:

1. Economic requirements – already during the actual data collection
2. Requirements to reduce the volume of data - detailed rendering of intersection curves does not increase the accuracy of the source data
3. Data is used for multiple purposes – including benchmarks
4. Requirements resulting from visualization possibilities - it has been present in cartography for a long time - the transition from a larger scale to a smaller one:
    1. **small area objects** become points or disappear,
    2. **planar objects with one predominant dimension** em become lines, etc.

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3 . Generalizability and data quality

Generalization is related to the transition from one scale to another, it occurs:

- reduction of positional accuracy
- decreasing attribute accuracy
- completeness may be violated

Generalization changes spatial resolution - the ability to distinguish between 2 different nearby points

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3 . Generalizability and data quality

Methods used for generalization

Mostly not part of GIS or only to a limited extent:

Generalization of vector data - "dilution of the number of breakpoints" under the assumption of maintaining the predetermined geometric conditions - maintaining the maximum distance of the newly created section of the polygon line newly created from the original data

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4 . Scale -free and scale-dependent databases

1. Scaleless data

geodetic directly measured data

They can be used in any scale, only when displaying the scale must be taken into account - e.g. to distinguish 2 points

2. Hierarchically structured database

multiple scale-dependent levels without duplicates - eg a quadtree structure

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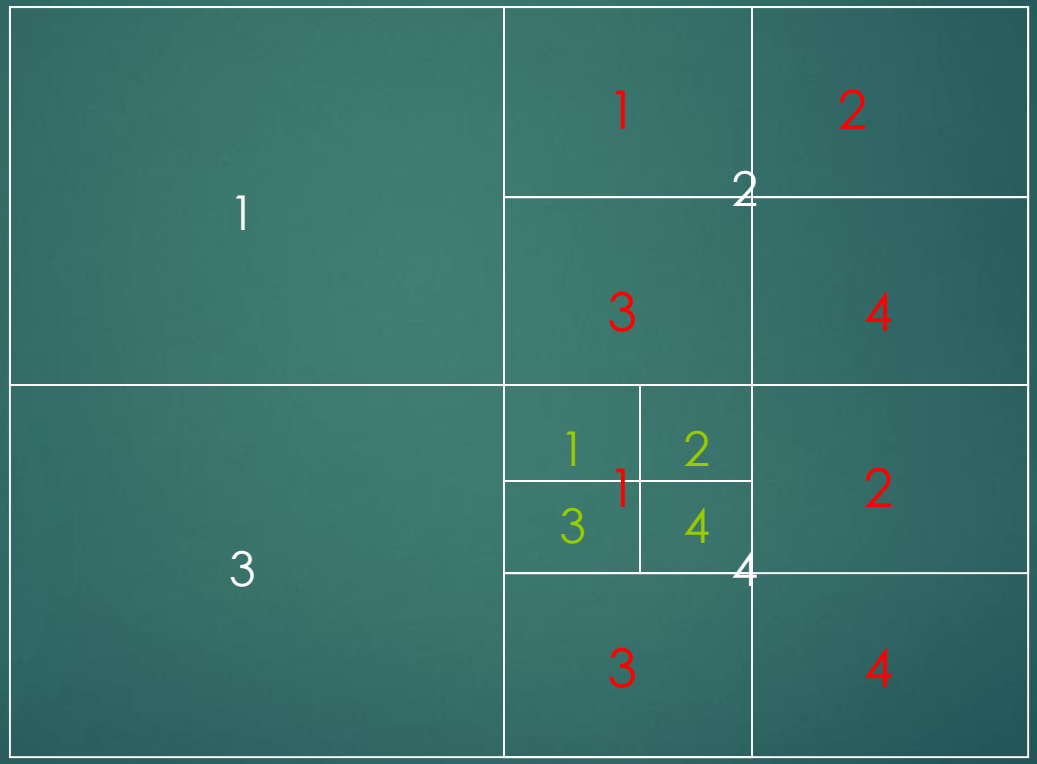
4 . Scale -free and scale-dependent databases

2. Hierarchically structured database

Quadtree

(you know it from compression raster data)



In each sub-area, only 1 value valid for the entire area

I keep dividing until I get it

Restructuring, data manipulation

4 . Scale -free and scale-dependent databases

3. Multiple storage of data at different scales according to the purpose of use – especially for cartographic data

Generalization can lead to:

- merging (joining) objects (coalescing)
- overlapping of objects (conflict)
- accumulation of objects (congestion)

Restructuring, manipulation of data
5. Conversion of representations

Conversion from raster to vector - raster - vector :

point elements – 1 pixel = 1 point

line elements - guiding the line with a raster template

a line consisting of **one** pixel (column, row) or **all the** pixels through which the line passes

surface elements - drawing a line on the border between two different surfaces - follows a raster structure, or the curve is smoothed

- **pixels** included in the area , whose area more than half lies in the given area

Restructuring, manipulation of data
5 . Conversion of representations

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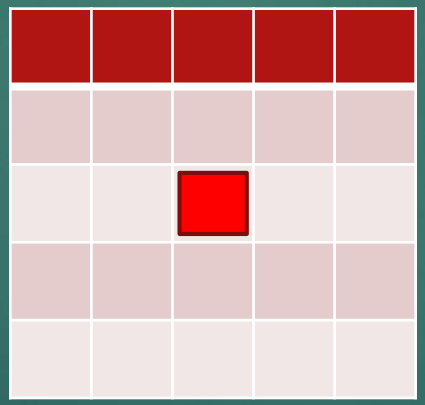

Restructuring, manipulation of data
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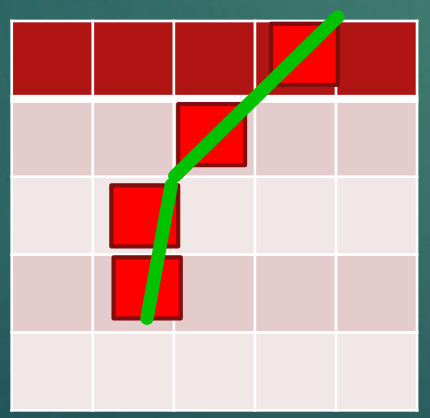

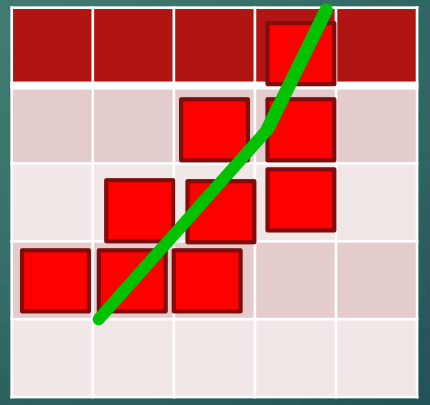

Restructuring, manipulation of data
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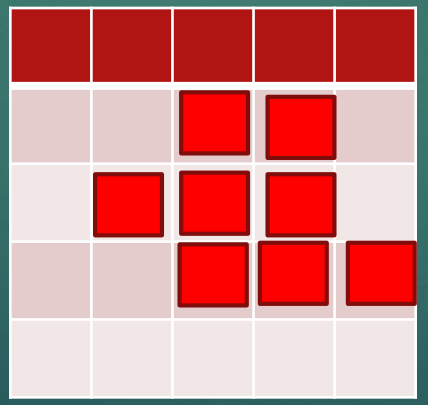
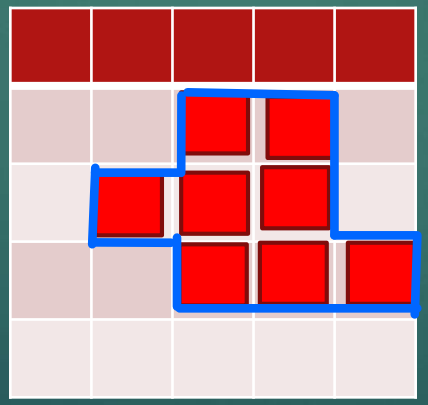


Restructuring, manipulation of data
5 . Conversion of representations

Vector to raster conversion :

for surface elements – one option: line management on the boundary between two different surfaces – follows the raster structure

- therefore the areas of all **pixels are included in the area**



Restructuring, data manipulation
4. Conversion of representations

Vector to raster conversion :

surface elements - the second option: drawing a line on the border between two different surfaces - with a smoothed fracture line

- the area includes **pixels** whose area is more than half in the given area, sometimes the line is led diagonally across one or 2 cells