

# MANIPULATION AND ANALYSIS FUNCTIONS

**Manipulation** of objects and their properties  
for a partial purpose

**Analysis** = examination of the principles - the  
essence of phenomena

# Manipulation and analysis functions

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## Manipulation function

1. Manipulation function for **spatial** data
2. Manipulation function for **attribute** data

# Manipulation and analysis functions

## 1. Manipulation function for **spatial** data

They are used on

- ▶ at the level of **individual entities**
- ▶ at the level of **entity sets** .

Set operations include:

- ▶ cut out - parts of surfaces
- ▶ insert - entity
- ▶ deletion - entity
- ▶ combination of classes – 2 or more
- ▶ spatial connection – connection of 2 or more areas into one
- ▶ entity selection

# Manipulation and analysis functions

## 1. Manipulation function for spatial data

Among the special handling means are means for

- ▶ generalization of the shape of elements,
- ▶ aggregating elements,
- ▶ geometric unification of shape ( [conflation](#) )

# Maintenance and analysis of geometric data

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## 1. Manipulation functions of spatial data

### 1.1. Format change

#### Format change

- important when receiving and transferring data
- today, large companies are members of the OGC (Open Geospatial Consortium)
- change is not always necessary
- one SW reads and works with different formats without the need to convert formats,
- however, work with foreign formats has certain limitations ( e.g. cannot be edited )

# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1. 2. Geometric transformation

## Geometric transformation

- ▶ Data transfer
  - ▶ **without an** established **coordinate system** to coordinates, possibly
  - ▶ **from** one coordinate system **to** another
- ▶ Coordinate system **to which the data is** transformed = **control** ( **target** )
- ▶ Data without a coordinate system or in another system, i.e. **which are transformed** = **input** data

# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1. 3. Settlement

**Alignment** - removal of minor geometric irregularities:

- ▶ **Chips** ( **slivers** ) – one geometric object from different sources – small deviations of individual vertices on the border, which should be common - - the easiest is to choose one source as binding, then do not use the others
- ▶ **Automatic removal of splits** - GIS tool - defines e.g. **max . the size** of the area formed by two boundaries, which is removed, or the **maximum deviation** between the boundaries - after exceeding it, the polygon remains



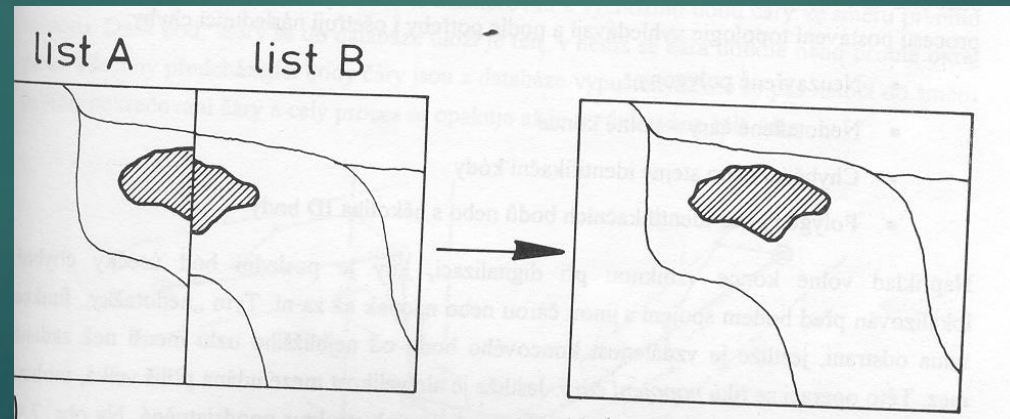
# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1. 4. Binding of edges

**Linking edges** from adjacent map sheets = creating a **seamless** map

- cannot always be done – issue of **copyright for thematic maps** – only the author is allowed there, if it is different for individual sheets, the edges remain not connected smoothly, but by jumping according to the sheet boundaries



# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1.5. Editing function

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#### Editing functions:

are used for editing positional errors

1. **Inserting and deleting** – vertices, objects
2. **Shift** – vertices and objects
3. **Dividing objects into more** (dividing the plot into 2 new ones)



# Maintenance and analysis of geometric data

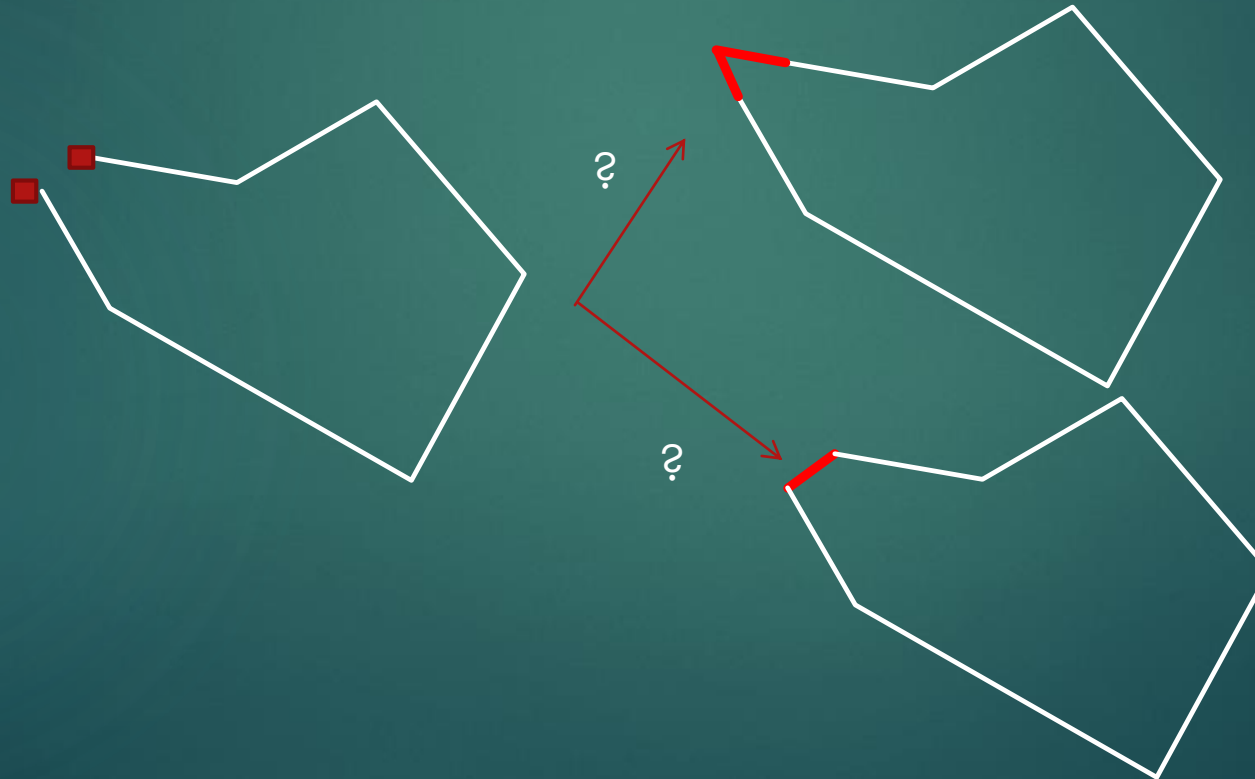
## 1. Manipulation functions of spatial data

### 1. 5. Editing function for changing topological properties of objects

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## Editing functions for changing the topological properties of objects:

1. **Closing polygons** - the task of finding free ends - SW (occurs in the drawing in CAD, not in GIS)



# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1. 5. Editing function for changing topological properties of objects

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## Editing functions for changing the topological properties of objects:

**Closing the polygons** – first you need to find the free ends (it occurs in the drawing in CAD, not in GIS)

The solution to the problem depends on the size and scale used:

1) Errors corresponding to map accuracy can be corrected automatically,

2) Bigger errors - using source maps manually



# Maintenance and analysis of geometric data

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## 1. Manipulation functions of spatial data –

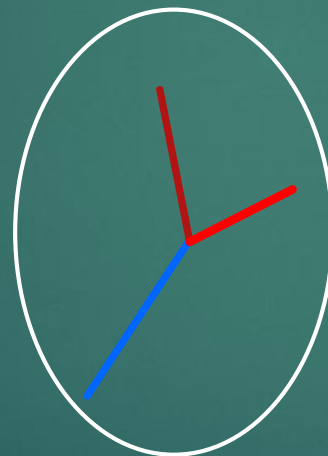
### 1. 5. Editing function for changing topological properties of objects

## Editing functions for changing the topological properties of objects:

Fulfillment of continuity - the watercourse and its tributaries must have common confluence points (the task of finding **free ends** - automated **connection function** – watch out for control



ID=1, ID=2, ID=3  
3 lines not connected in a knot  
it is an **error** if they are  
supposed to be connected



ID=1, ID=2, ID=3  
3 lines connected in  
a knot, so **OK**



2 lines: ID=1, ID=2, the intersection does  
not exist, it is a so-called **fuzzy intersection**  
, because ID 2 only touches at the node  
**error**

**The solution must always  
correspond to the actual  
situation!!!!**

# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

### 1. 5. Editing function for changing topological properties of objects

## Editing functions for changing the topological properties of objects:

Calculation of nodes ( nodes ) common to two or more objects, if they do not exist:



ID=1 , ID=2 , so only 2 objects

Only the connection is an error - the so-called **fuzzy intersection** (the picture is after moving the right tributary)

It is necessary to **divide the object** with ID=1 , on ID=1 and ID=3 so that there is an intersection

**If this situation is real!!!!**



# Maintenance and analysis of geometric data

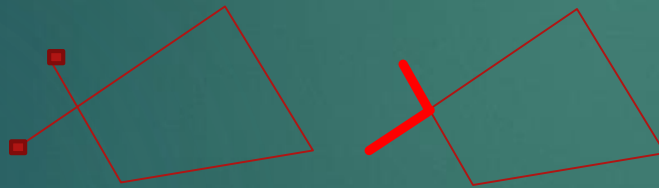
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## 1. Manipulation functions of spatial data

### 1. 5. Editing function for changing topological properties of objects

Editing functions for changing the topological properties of objects:

Overdraft removal ( dangle ) –



- the task of finding **loose ends**
- solve **fuzzy intersections** , this will create separate lines of overlaps
- remove** separate (red) lines –  
**yes** , if they are within the scale of the map (most of the errors are solved this way)  
**no** - if they are larger - check with reference data (2nd part of errors)

# Maintenance and analysis of geometric data

## 1. Manipulation functions of spatial data

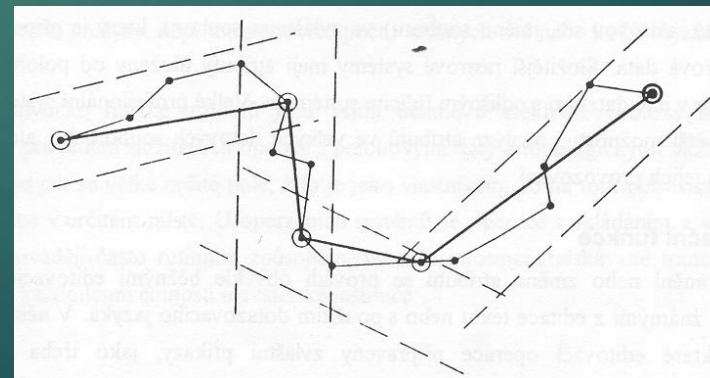
### 1.5. Editing function for changing topological properties of objects

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## Editing functions for changing the topological properties of objects:

**Point dilution** – after automatic vectorization, when the density of vertices is too high

**n - th vertex** is removed , or all **in a certain envelope zone** - an automated process





# Maintenance and analysis of geometric data

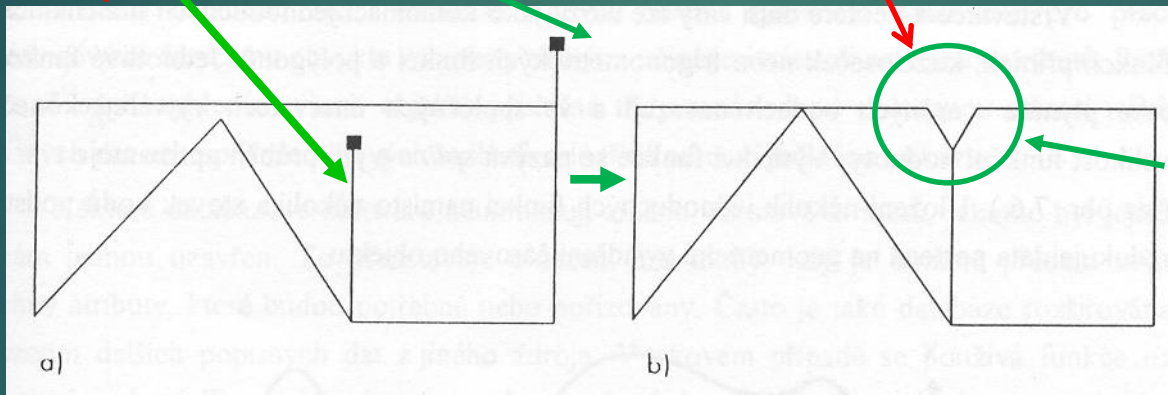
## 1. Manipulation functions of spatial data

### 1.5. Editing function for changing the topological properties of objects

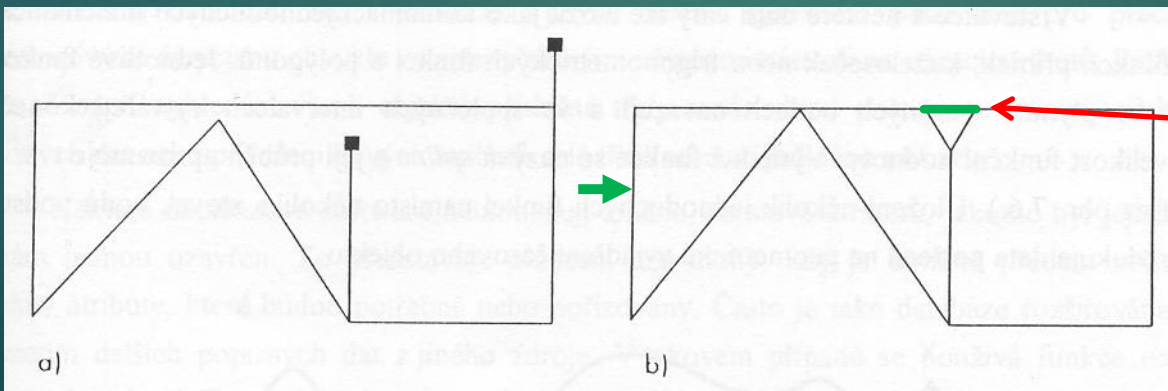
Closure of polygons done automatically

Overlap removal

This may be the result of autocorrect



Check with documents



But maybe this is right