

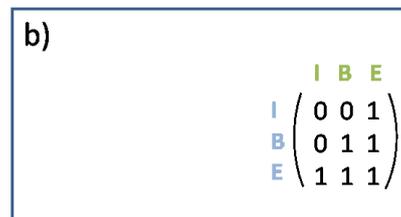
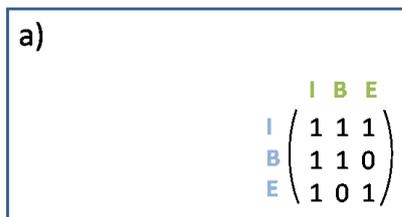
Exercises for Spatial Databases and GIS

Sheet I (until 11.11.2011)

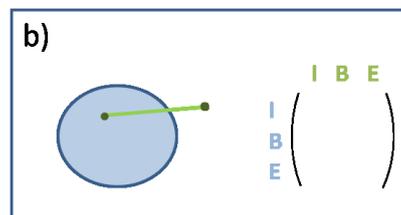
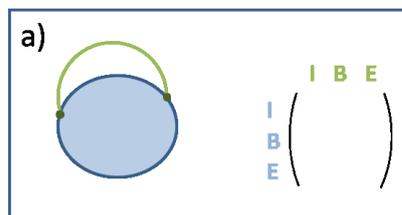
Exercise 1 (9-intersection model)

A simple line is a line with exactly two endpoints and any connection between them, e.g. straight line, arc, ogee, etc. A simple polygon is one polygon without any holes.

1. Draw two simple lines to exemplify the given 9-intersection matrices.



2. Write down the matrices for the topological relations between the drawn geometries.



3. Another definition of topological relations is the 4-intersection model, that considers only the intersections between the inner part of the objects and their boundaries. Give two examples of topological relations that can be distinguished using the 9i-model but not by the 4i-model.
4. Can you think of topological relations, having the same 9i-matrix, although you might consider them to be different?

Exercise 2 (Rasterization)

1. How can you determine the raster-width you need to represent a given vector polygon accurately in that raster?
 - a. What is the complexity of the calculation of the raster-width?
 - b. Will it work for all polygons? Give examples of problematic polygons if they exist.

Exercise 3 (Semi-line algorithm)

Extend the given algorithm to handle the following special cases correctly:

- The point has the same y-coordinate as a point of the polygon.
- The point has the same y-coordinate as a horizontal edge of the polygon.

point-in-polygon(point q, polygon poly)

begin

counter := 0

for all edges $e = \overline{p_i, p_{i+1}}$ of poly **do begin**

// e intersects horizontal line through q

if $((p_i.y > q.y) \wedge (p_{i+1}.y < q.y)) \vee ((p_i.y < q.y) \wedge p_{i+1}.y > q.y))$ **then**

calculate intersection point s

// s is right of q

if $(s.x > q.x)$ **then**

counter++;

end;

In := $((\text{counter} \bmod 2) = 1)$

end;