Technische Universität Braunschweig
Institut für Informationssysteme
http://www.ifis.cs.tu-bs.de

Karl Neumann, Sarah Tauscher

Exercises for Spatial Databases and GIS

Sheet 1 (until 13.11.2015)

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.

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

a)

	I	B	E
I	0	0	1
B	0	1	0
E	1	0	1

b)

	I	B	E
I	1	0	1
B	1	0	1
E	1	1	1

c)

	I	B	E
I	0	0	1
B	1	0	1
E	1	1	1

d)

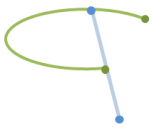
	I	B	E
I	1	0	1
B	0	0	1
E	1	1	1

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

a)

	I	B	E
I			
B			
E			

b)

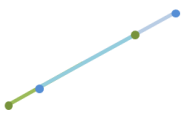


	I	B	E
I			
B			
E			

c)

	I	B	E
I			
B			
E			

d)



	I	B	E
I			
B			
E			

3. Can you think of further topological relations between two simple lines? Give four examples and their corresponding matrices.
4. Which of the eight matrices for topological relations between simple polygons (slide 89) can't be fulfilled by simple lines? Why?
5. Why are there more different topological relations between simple lines (33 altogether) than between polygons (only 8)?

Exercise 2 (Semi-line algorithm)

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

a) The point has the same y-coordinate as a point of the polygon.
b) 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 = p_i,p_i+1 of poly do begin
// e intersects horizontal  line through q
    if (((p_i.y > q.y) ∧ (p_i+1.y < q.y)) ∨ ((p_i.y < q.y) ∧ 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 := ((counter mod 2) = 1)
end;
```

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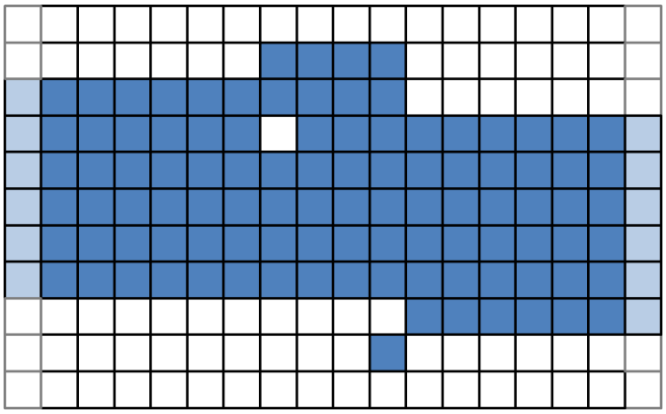
Exercise 3 (Centerline extraction)

1. Vectorize the dark blue part of the given line using topological thinning. The light blue pixels only show how the line continues.



2. If holes and stubbles consisting of only a few pixels are most probably faults, what could be used as preprocessing step to eliminate them?