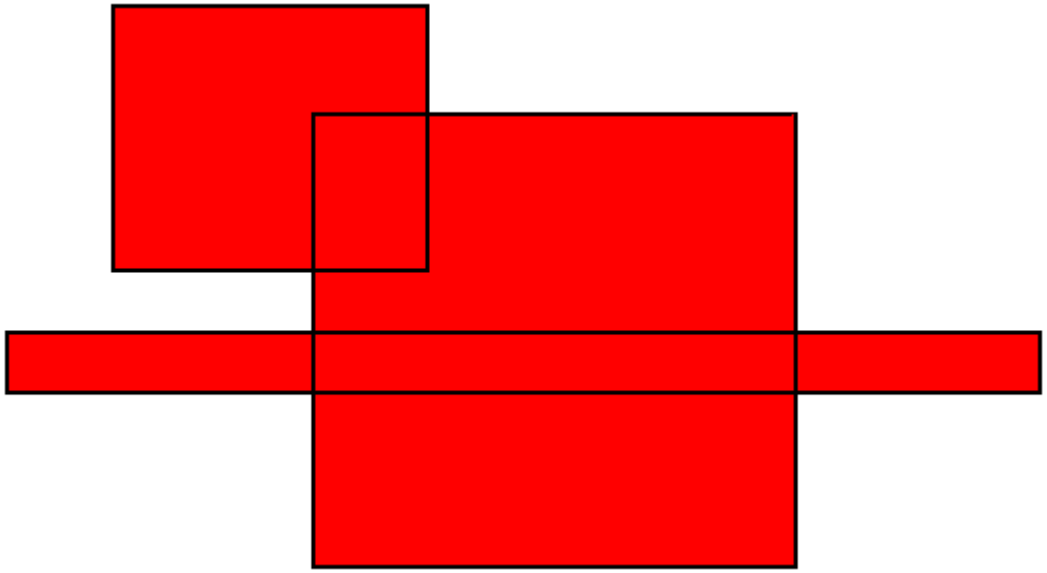
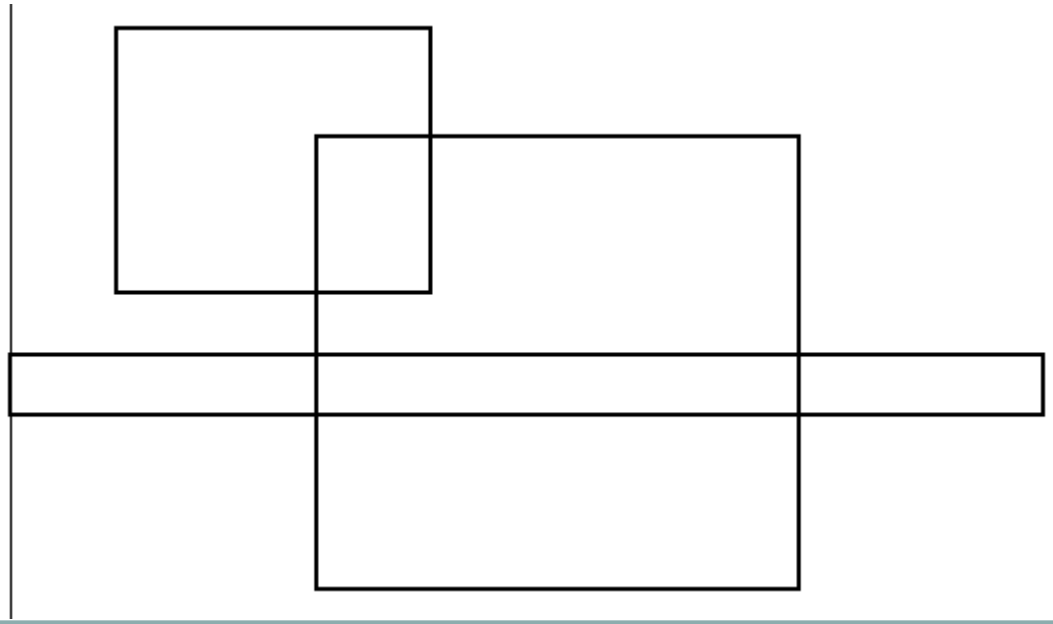
Computational Geometry

- Area of the union of rectangles problem
  (n rectangles or 4n lines or 4n points)



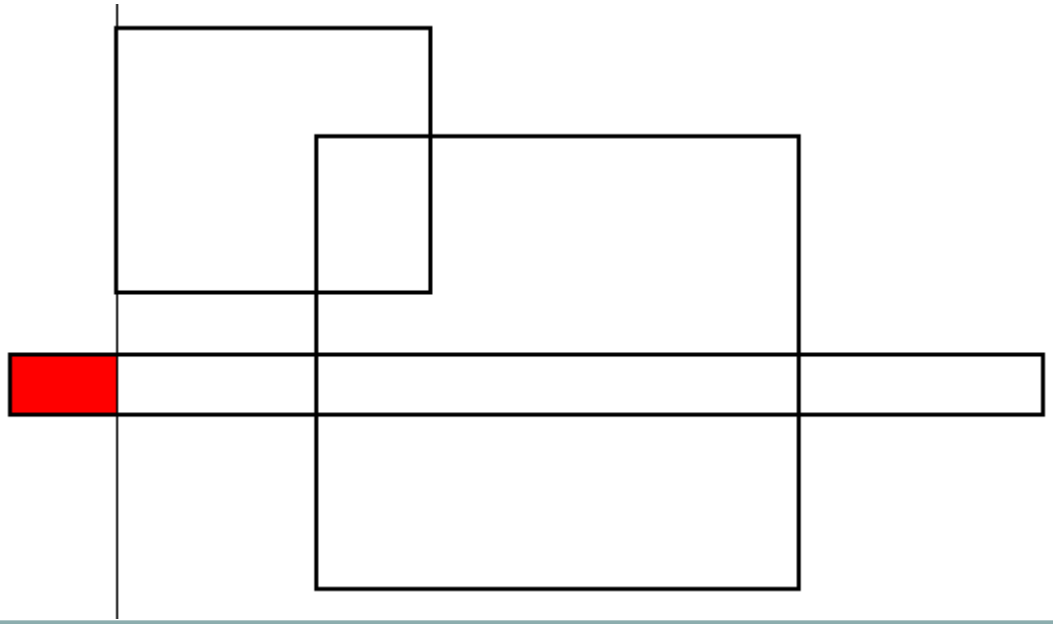
Computational Geometry

- Area of the union of rectangles problem



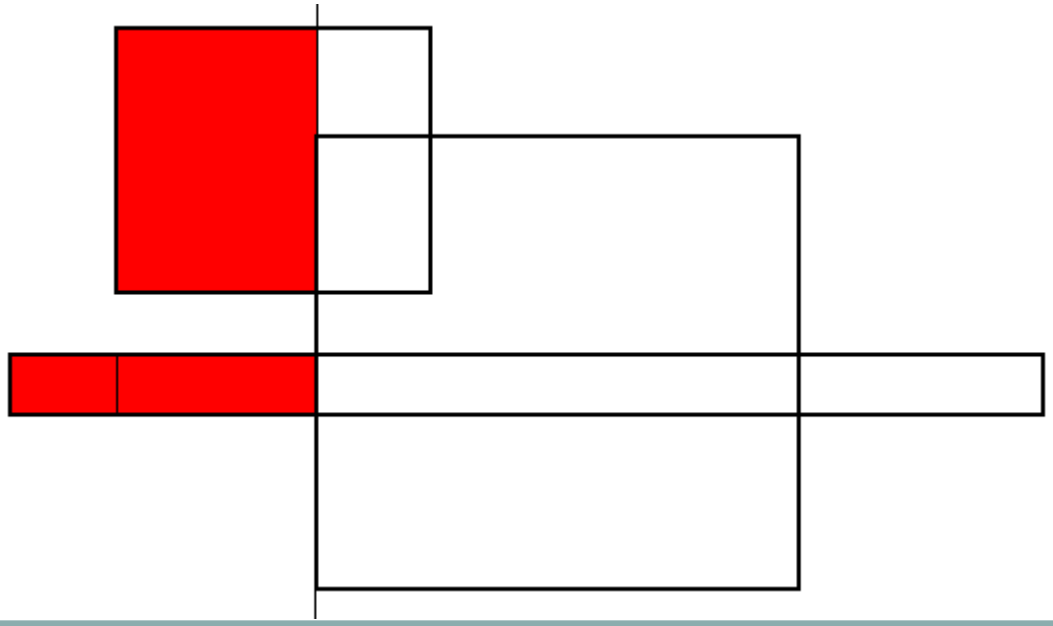
Computational Geometry

- Area of the union of rectangles problem



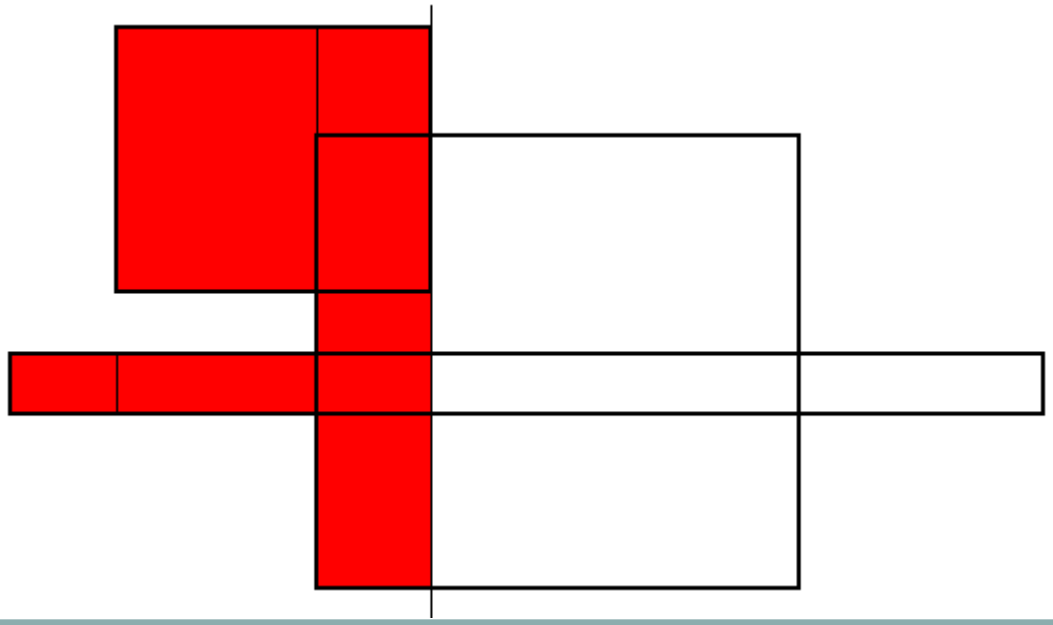
Computational Geometry

- Area of the union of rectangles problem



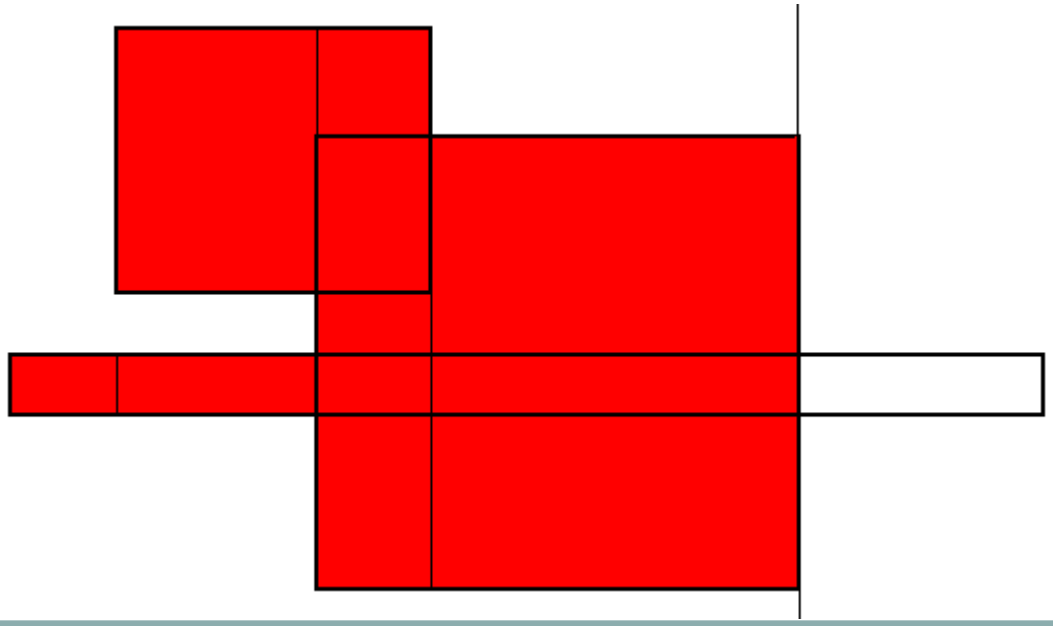
Computational Geometry

- Area of the union of rectangles problem



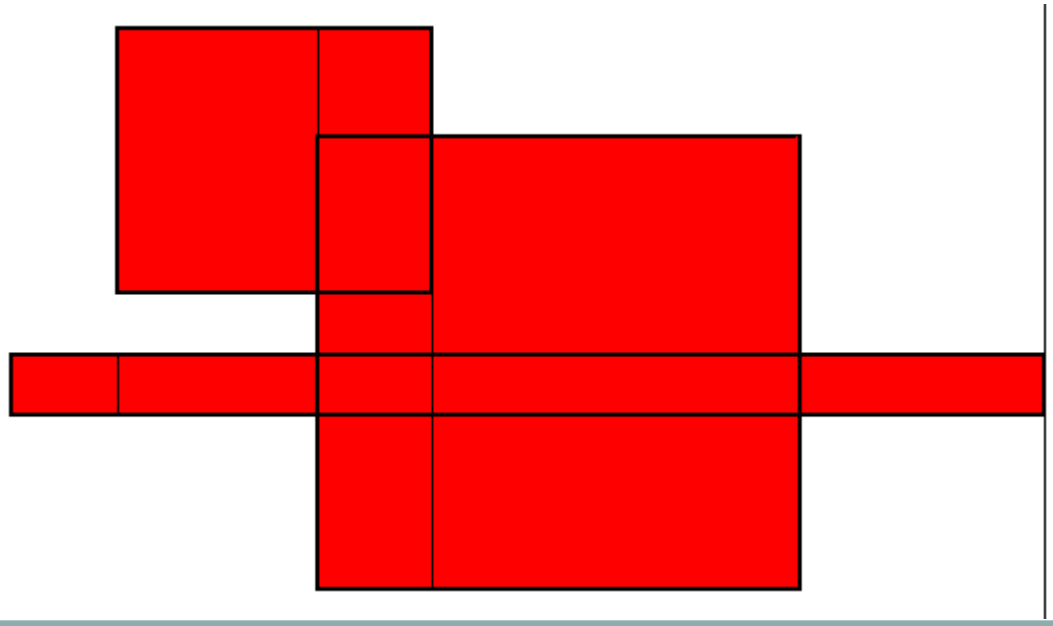
Computational Geometry

- Area of the union of rectangles problem



Computational Geometry

- Area of the union of rectangles problem



Computational Geometry

- Area of the union of rectangles problem

  Step 1: Sort points in x-coordinate

  Step 2: For each vertical segment l:

    Step 2.1: Update the area from the last visited segment to l

Computational Geometry

- $P_x = \{p_x^1,\ldots,p_x^{2n}\}$ is the set of vertices sorted wrt *x*-axis
- $P_y = \{p_y^1,\ldots,p_y^{2n}\}$ is the set of vertices sorted wrt *y*-axis

- *A:* area of the union of rectangles
- *Q:* list of active rectangles between two successive points in P_x
- *v:* height of the union of rectangles in *Q*

Invariant: At a point p_x^i the area until that point is

$$A = A + v\,(p_x^i - p_x^{i-1})$$

Computational Geometry

$A = 0$

$Q = \{r\}$ // r is the leftmost rectangle

for $i=2$ *to* $|P_x|$

...

Vertical sweep at point p_x^{i-1}

...

$A = A + v\,(p_x^{i} - p_x^{i-1})$

if p_x^{i} *is at the left side of rectangle* r

$Q = Q \cup \{r\}$

else if p_x^{i} *is at the right side of rectangle* r

$Q = Q \setminus \{r\}$

Return A

Computational Geometry

Vertical sweep at point p_x^{i-1}

$v = 0,\ l = 0,\ S = 0$

for $j=1$ *to* $|P_y|$

  if p_y^j *is at the top of rectangle r in Q*

    if $S > 0$

      $v = v + (l - p_y^j)$

    $S = S + 1$

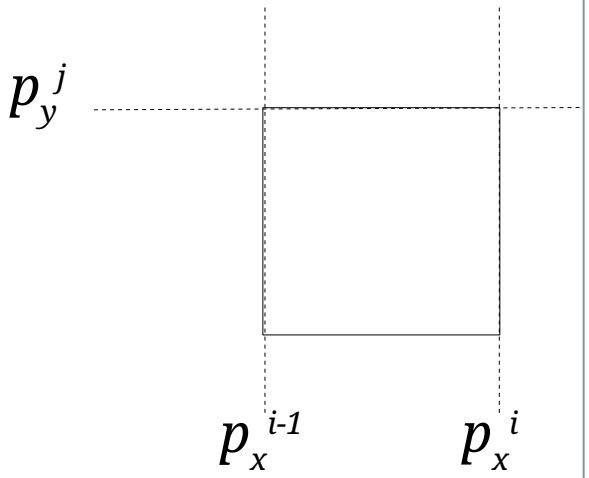
    $l = p_y^j$

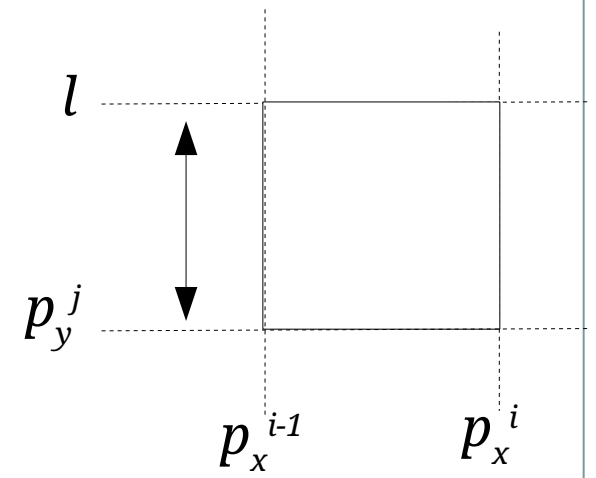
  else if p_y^j *is at the bottom of rectangle r in Q*

    $v = v + (l - p_y^j)$

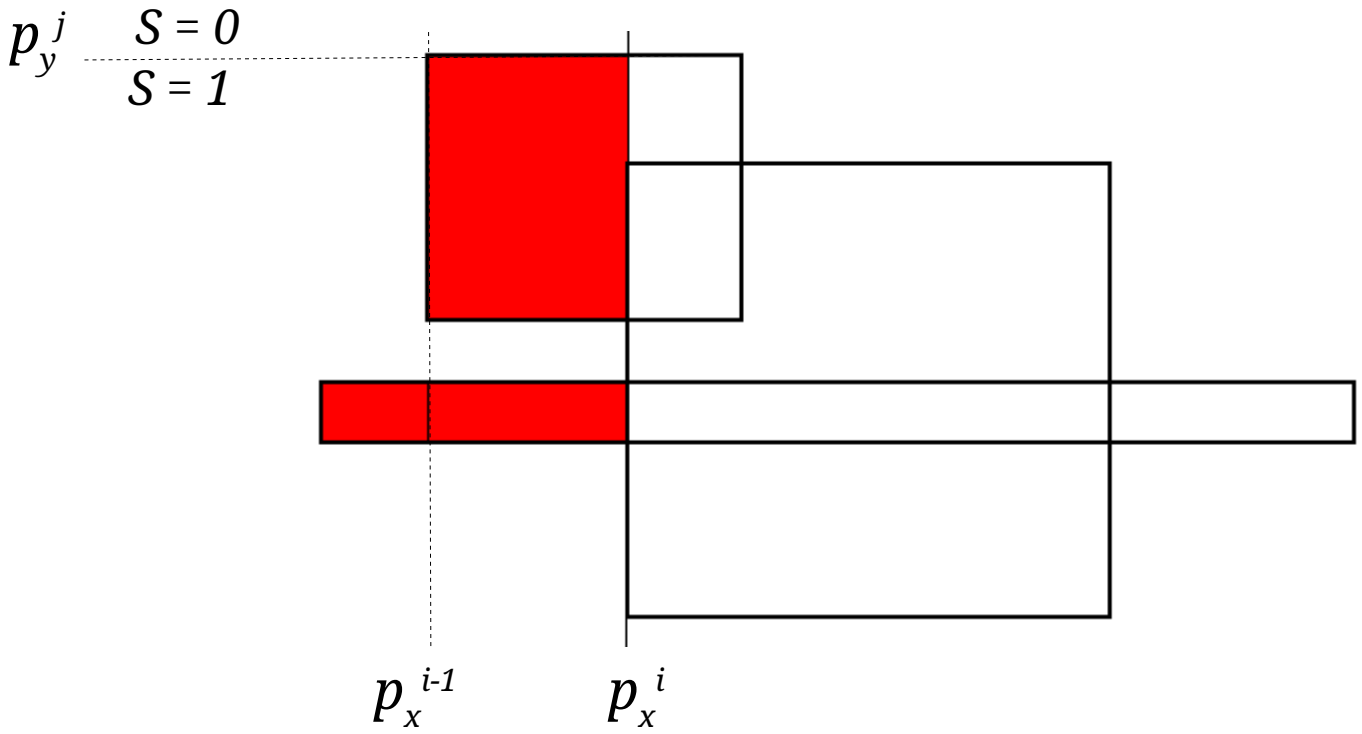
    $S = S - 1$

    $l = p_y^j$

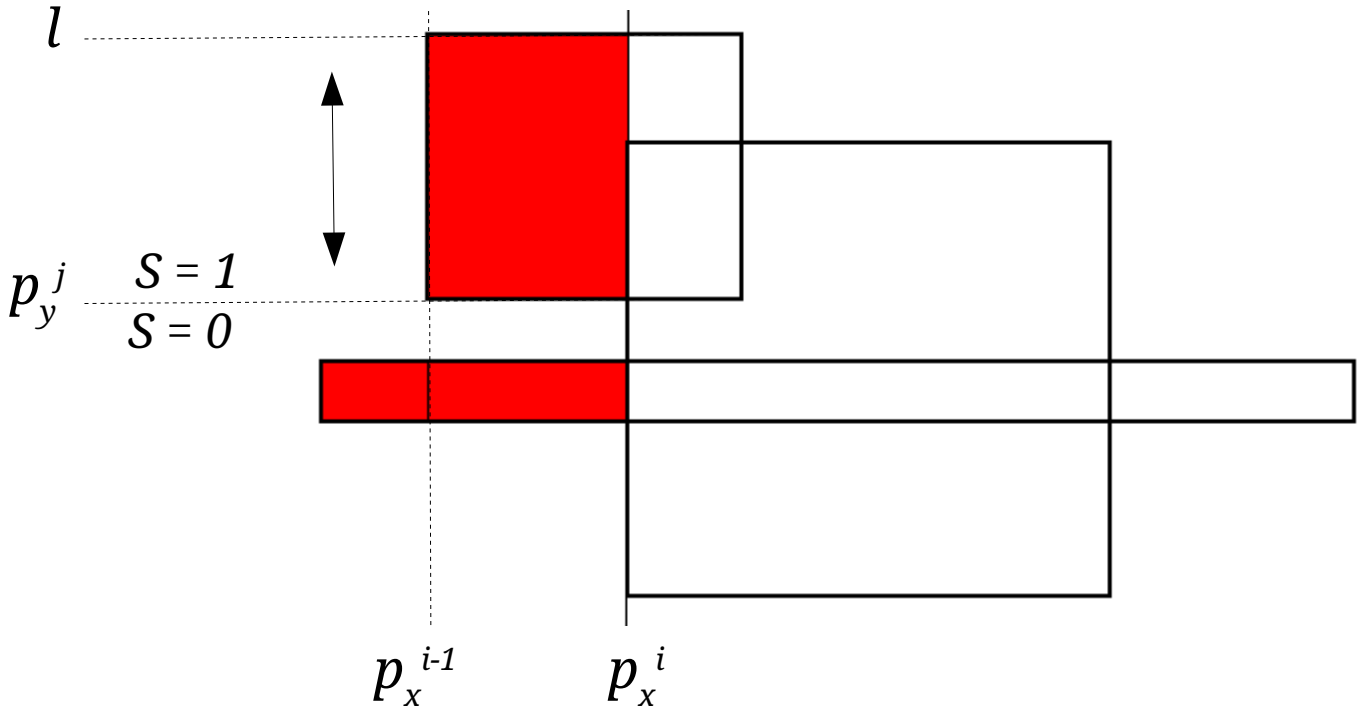




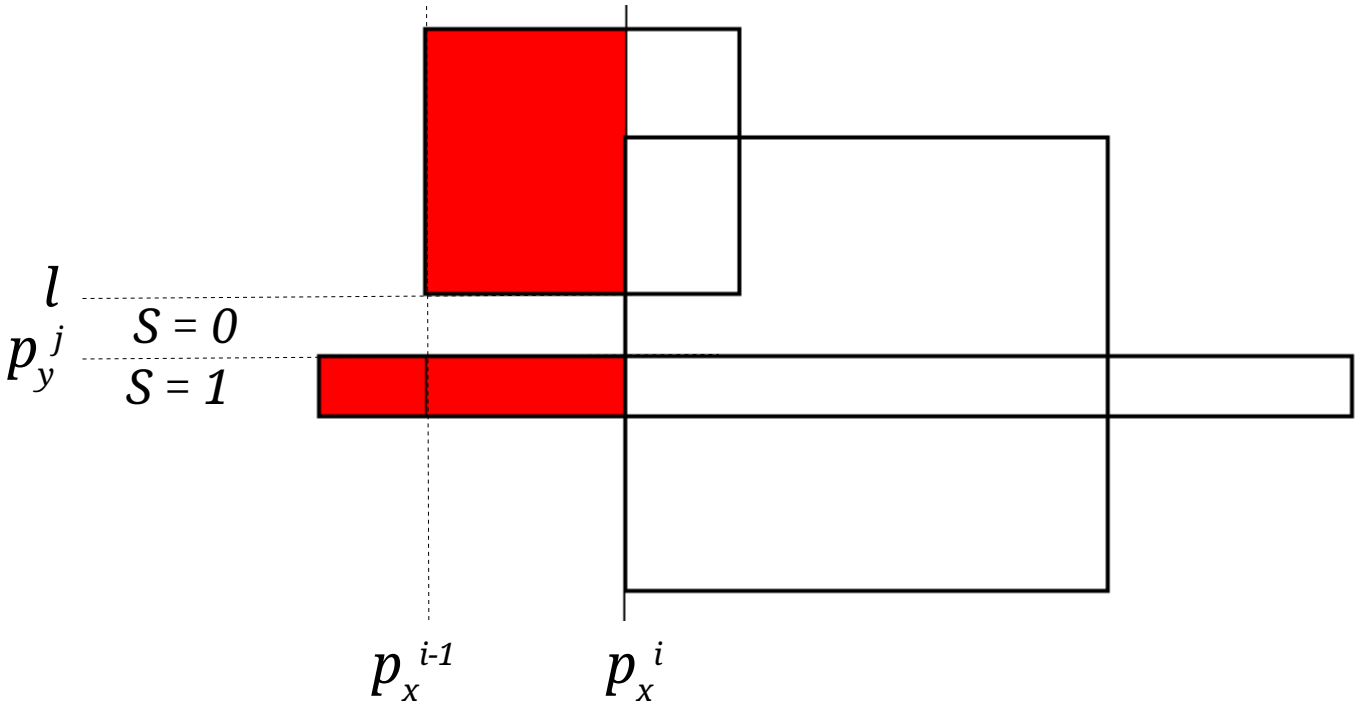
Computational Geometry



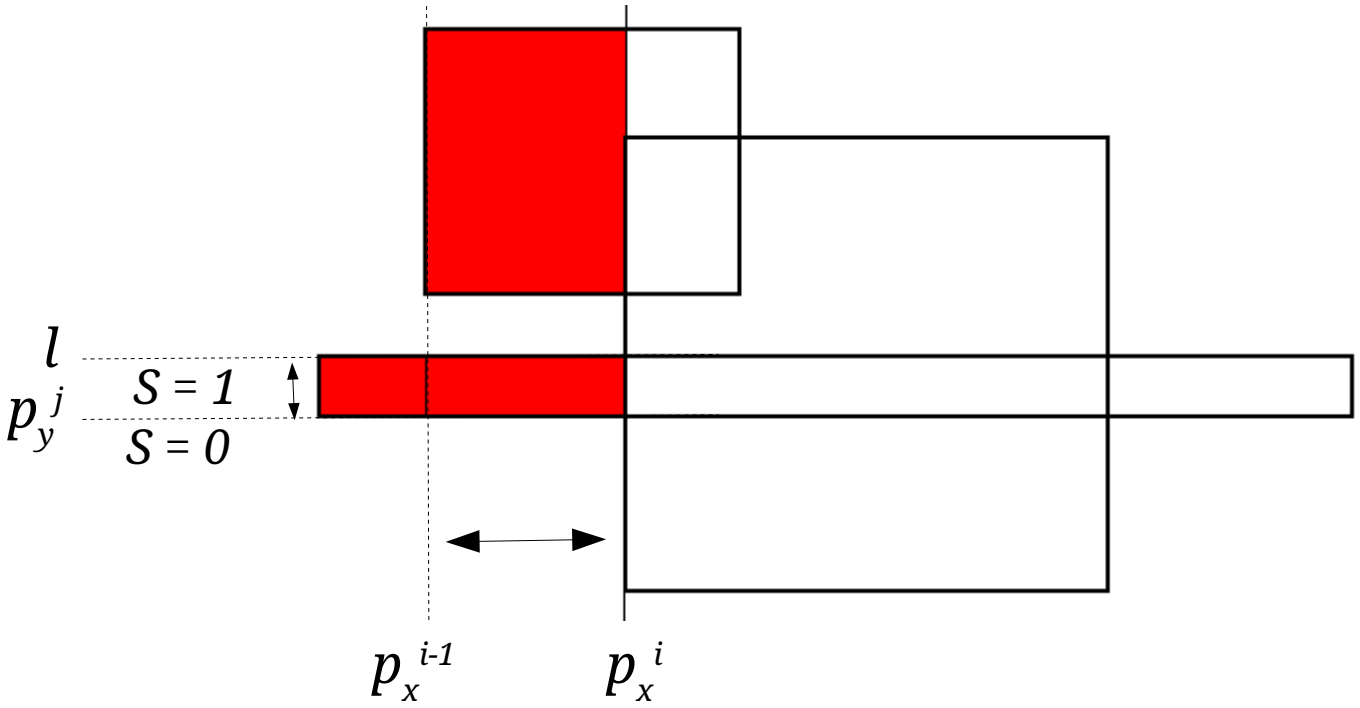
Computational Geometry



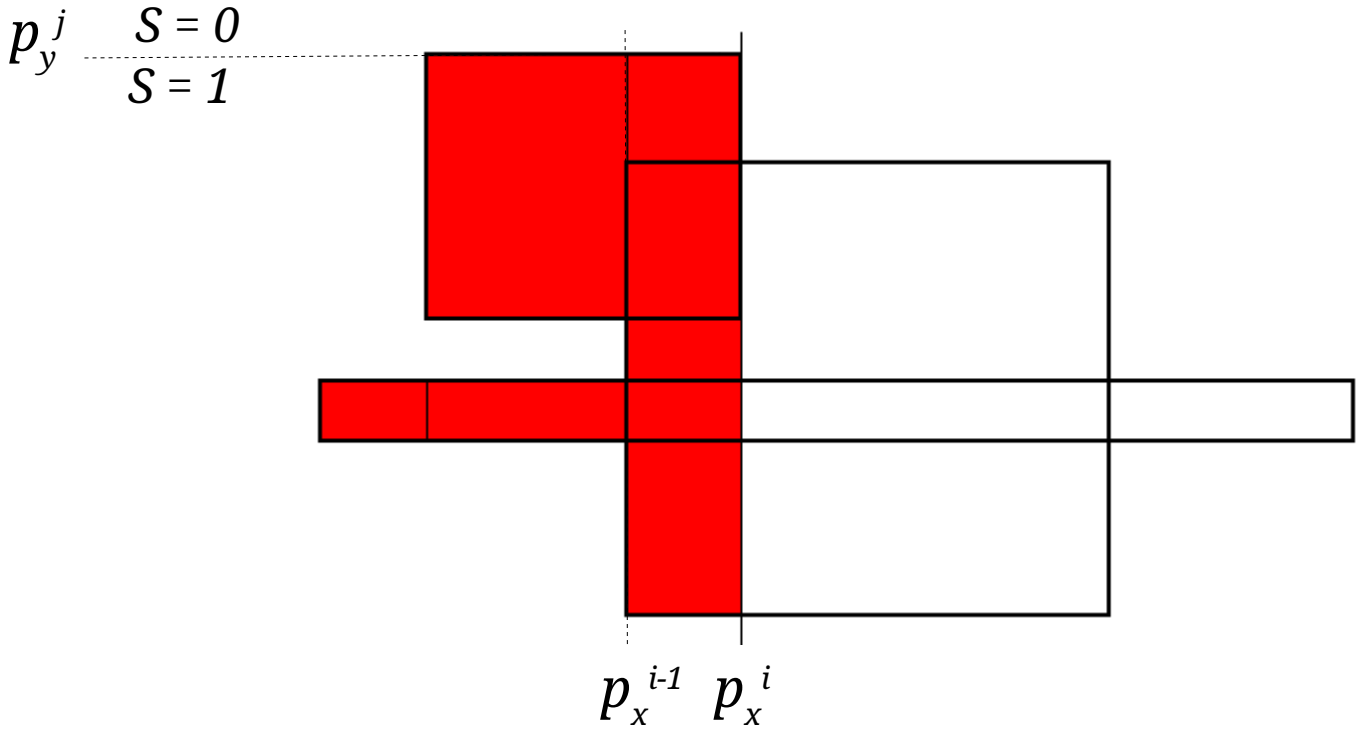
Computational Geometry



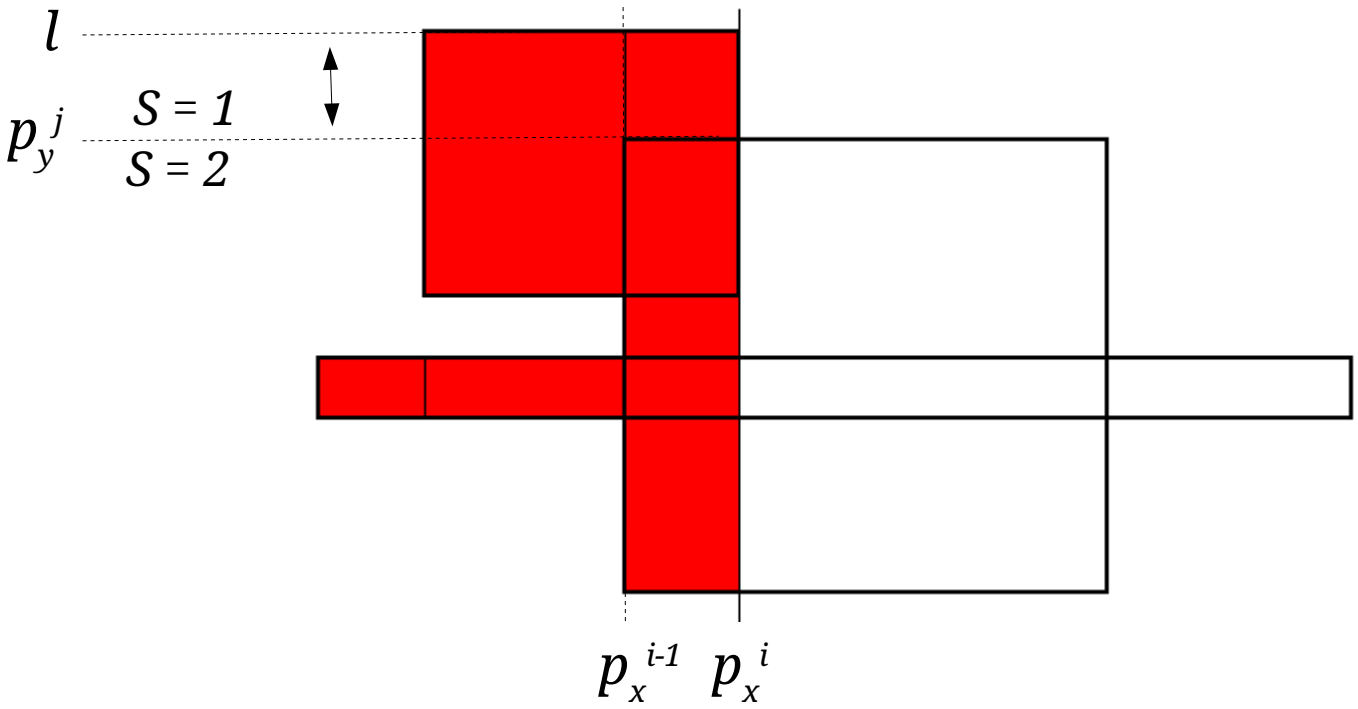
Computational Geometry



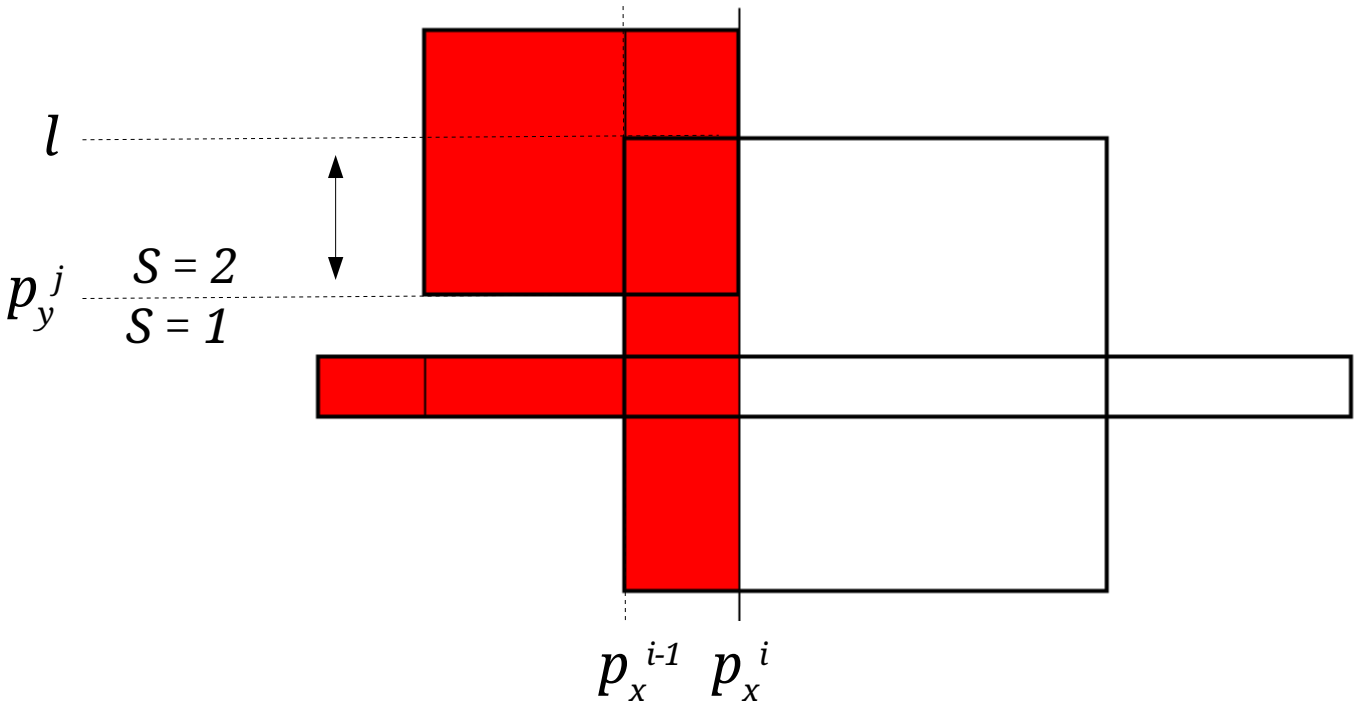
Computational Geometry



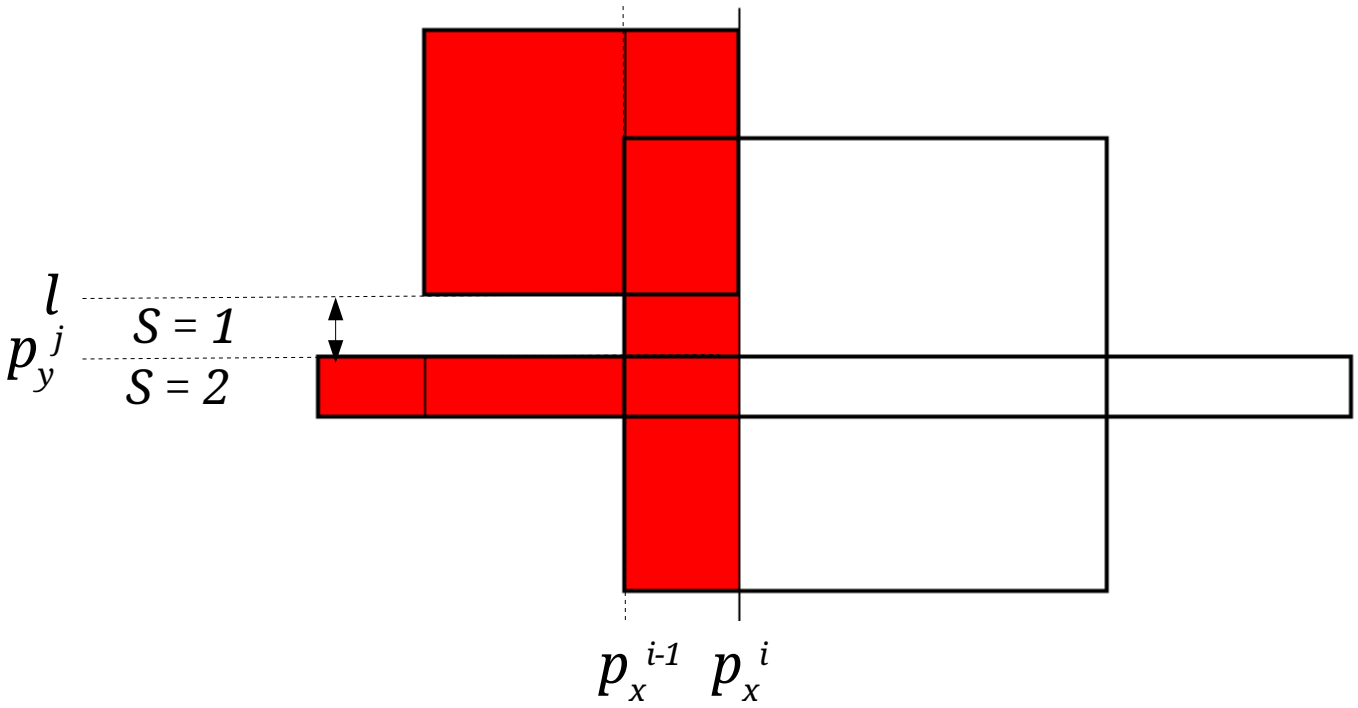
Computational Geometry



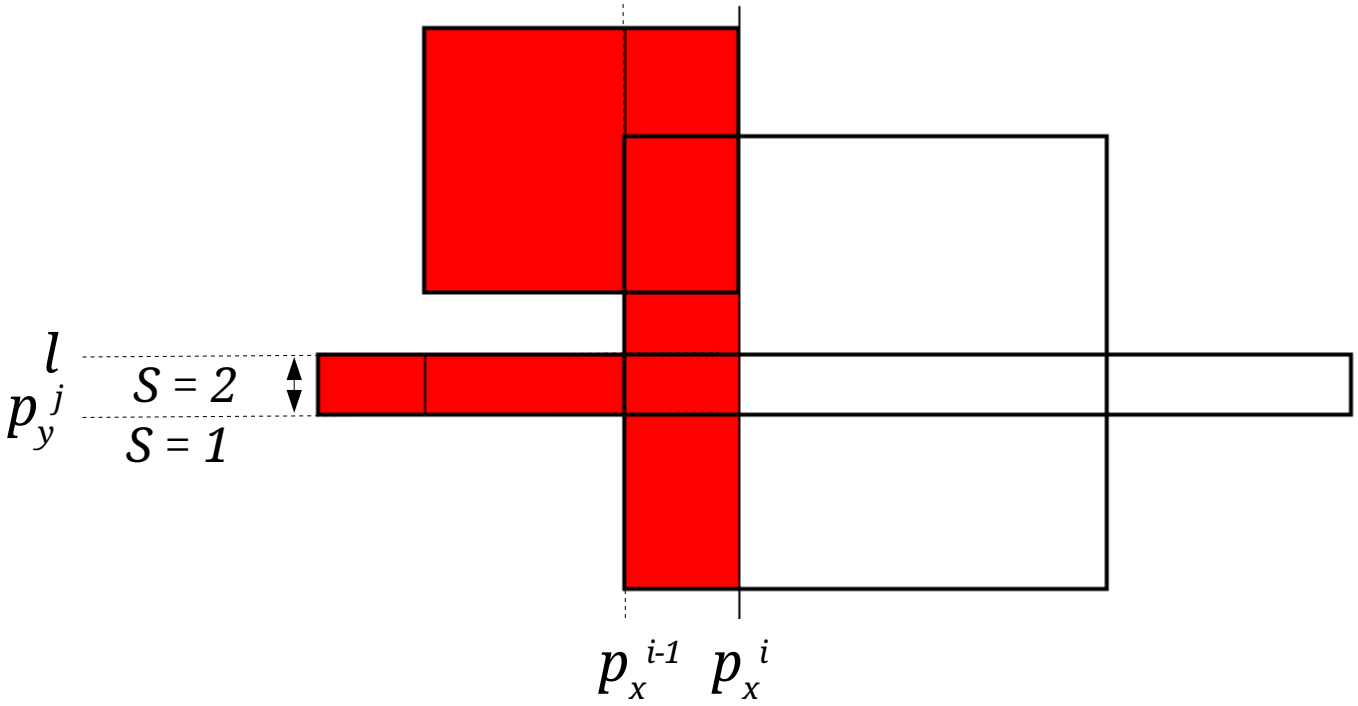
Computational Geometry



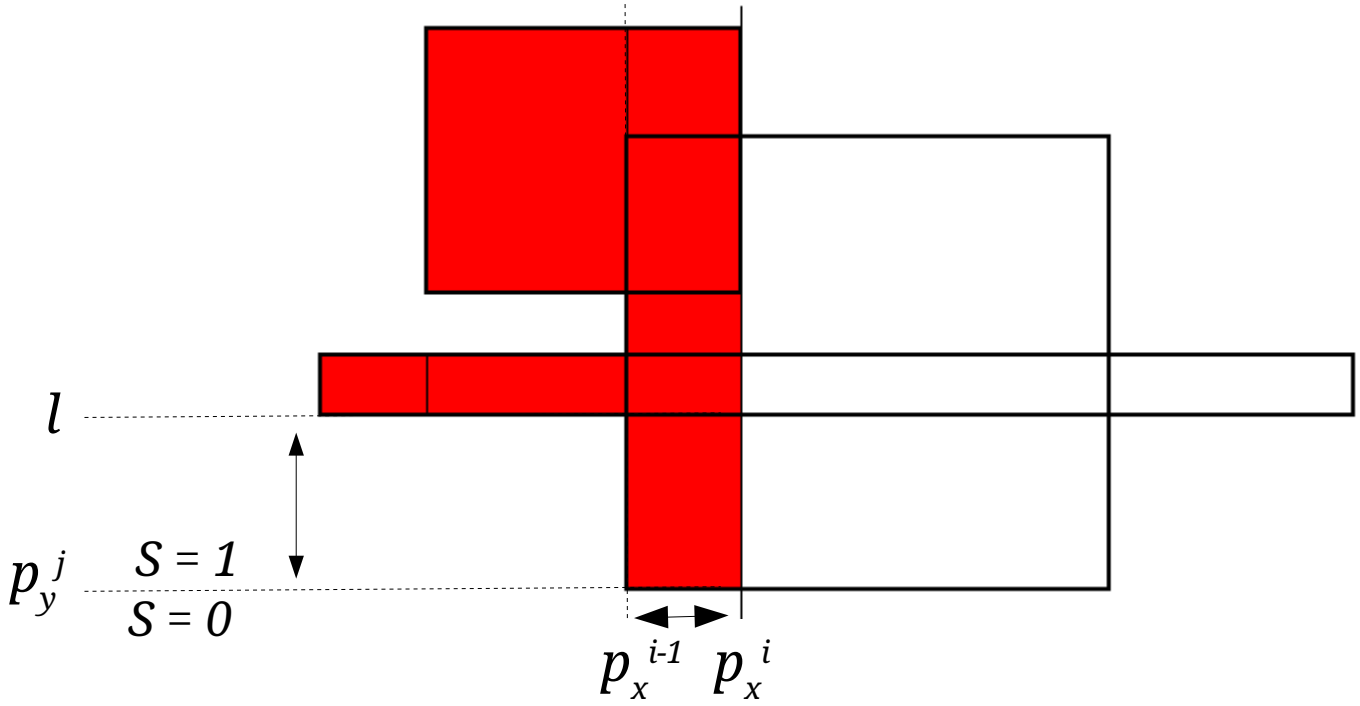
Computational Geometry



Computational Geometry

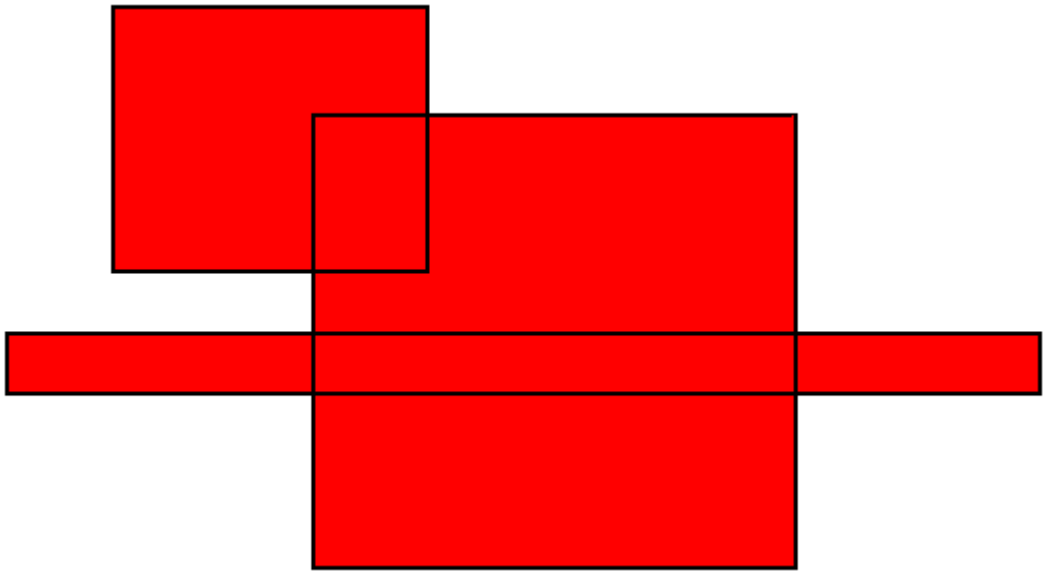


Computational Geometry



Computational Geometry

- Perimeter of the union of rectangles problem



1. Compute the lenght of the horizontal edges

Computational Geometry

P = 0

Q = {r} *// r is the leftmost rectangle*

for i=2 to $|P_x|$

...

Vertical sweep at point p_x^{i-1}

...

if p_x^i *is at the left side of rectangle r*

$Q = Q \cup \{r\}$

else if p_x^i *is at the right side of rectangle r*

$Q = Q \setminus \{r\}$

Return P

Computational Geometry

Vertical sweep at point p_x^i

$S = 0$

for $j=1$ *to* $|P_y|$

  if p_y^j *is at the top of rectangle r in Q*

    if $S = 0$

      $P = P + (p_x^i - p_x^{i-1})$

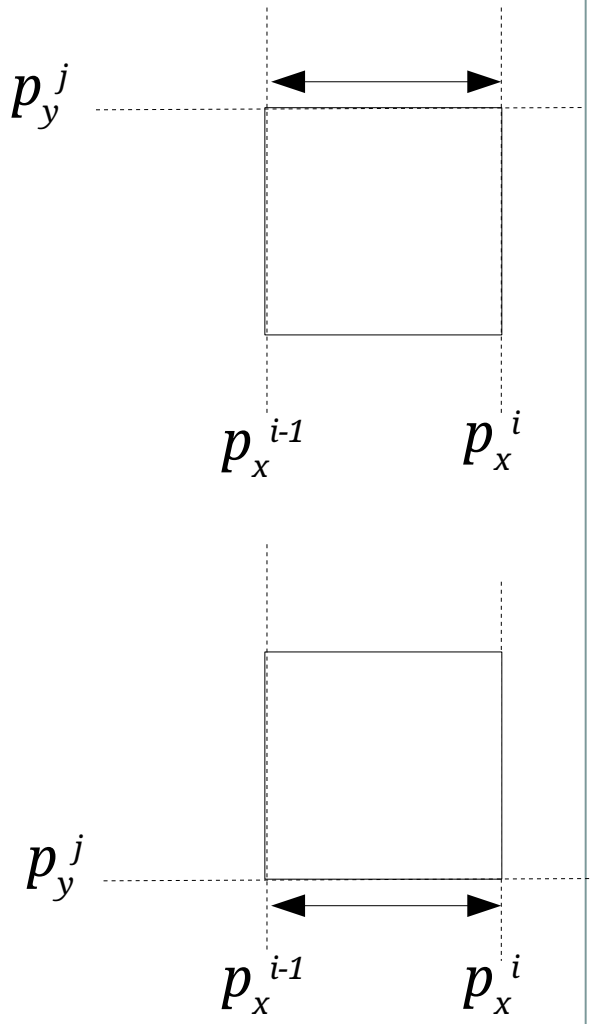
    $S = S + 1$

  else if p_y^j *is at the bottom of rectangle r in Q*

    $S = S - 1$

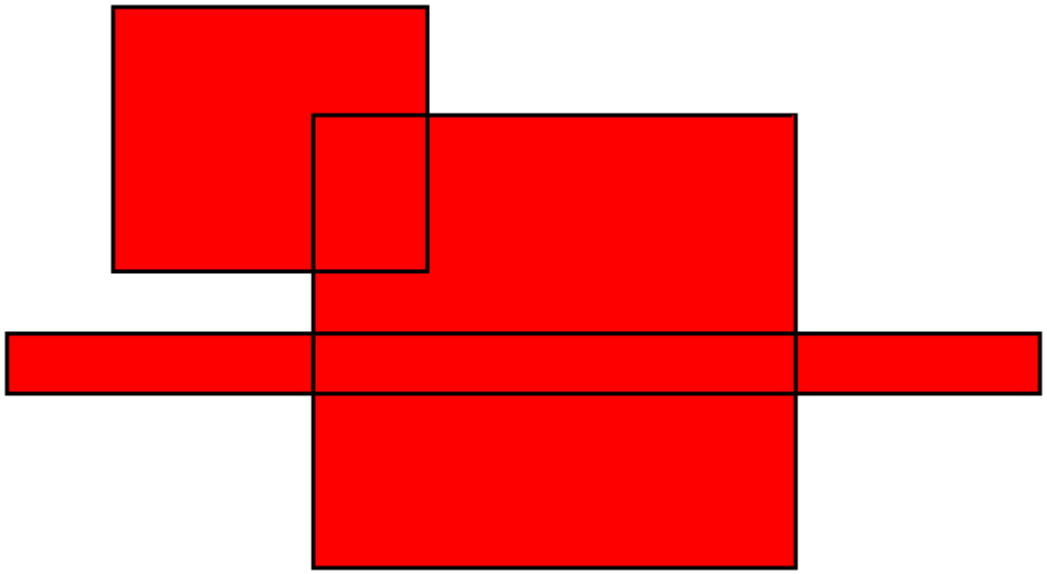
    if $S = 0$

      $P = P + (p_x^i - p_x^{i-1})$



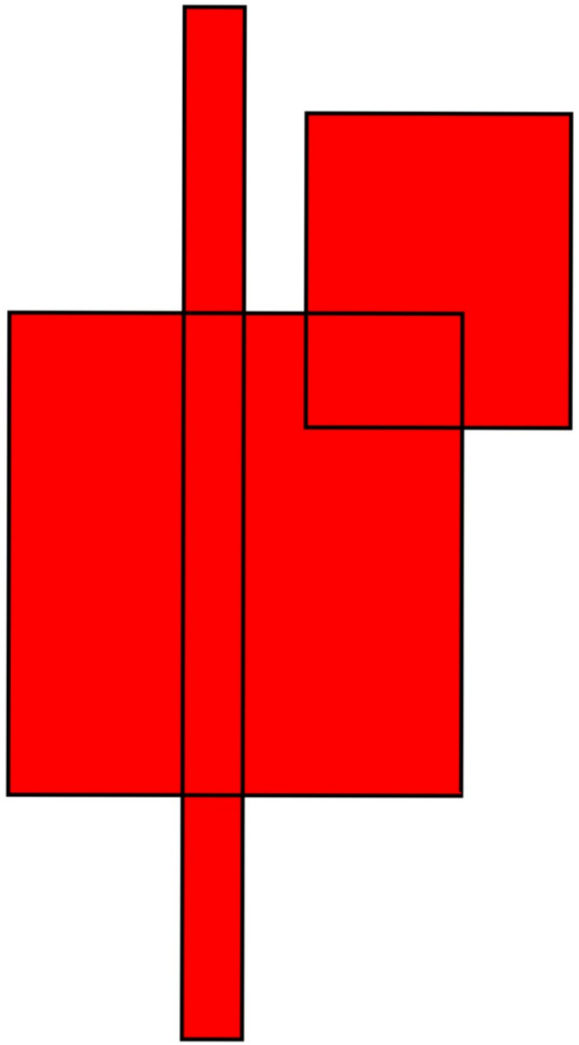
Computational Geometry

- Perimeter of the union of rectangles problem



2. Compute the lenght of the vertical edges (how)?

Computational Geometry



Rotate the Figure!