Inspired by **SWERC 2014 (6889 - City Park),** https://icpcarchive.ecs.baylor.edu/
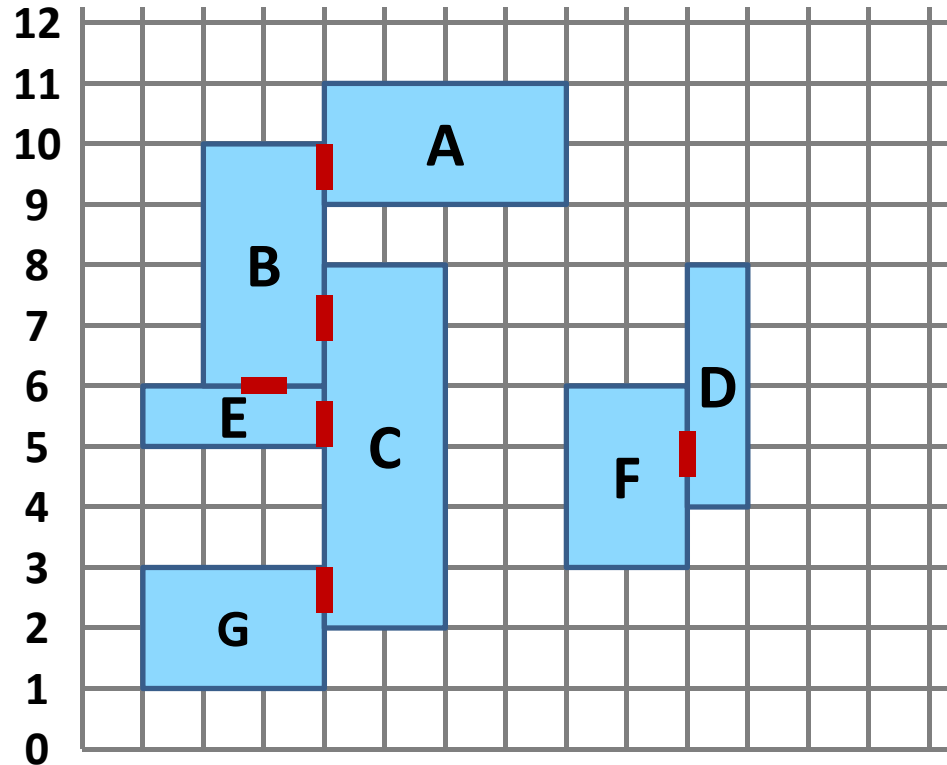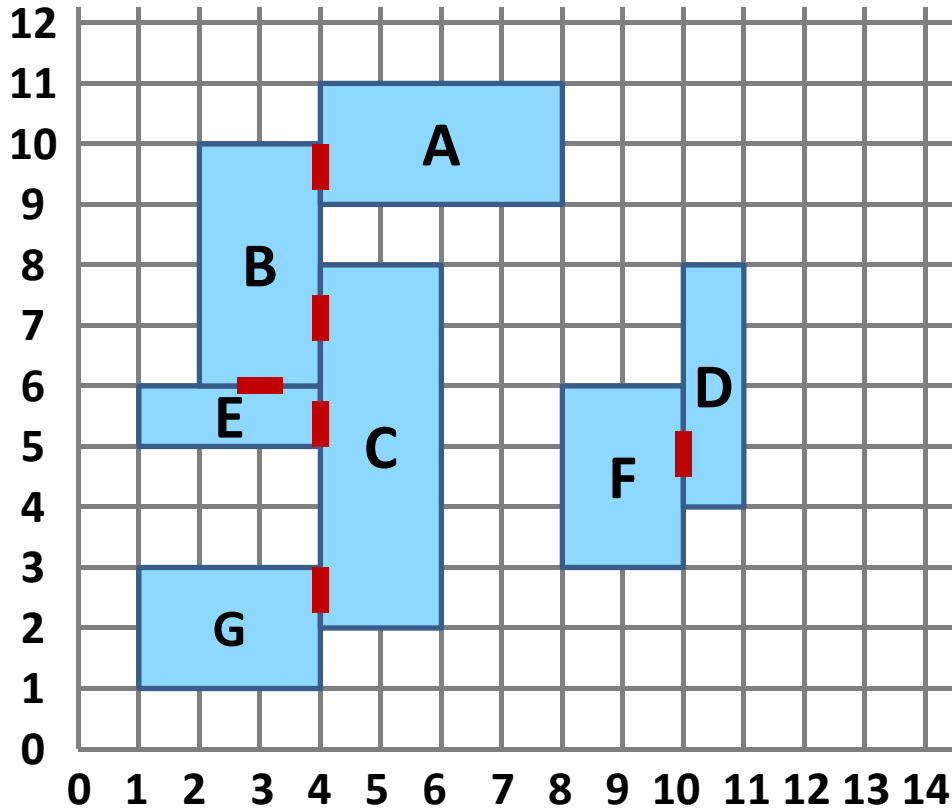

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Find all pairs of rectangles which share edge segment of nonzero length
(=touch each other). The rectangles do not overlap and their edges are parallel to the axes.

Naive solution: Check all pairs: $\Theta(N^2)$

Sweep line method: Sort coords in $O(N \cdot \log N)$ time, process in $\Theta(N)$, total **$O(N \cdot \log N)$** time.

Note: Touching rectangles define a planar graph, it has always $O(N)$ edges = $O(N)$ pairs.

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Rectangle corners		FRONT EDGES
Lower left		A(4, 9,11)
A	(4, 9)	B(2, 6,10)
B	(2, 6)	C(4, 2, 8)
C	(4, 2)	D(10,4, 8)
D	(10,4)	E(1, 5, 6)
E	(1, 5)	F(8, 3, 6)
F	(8, 3)	G(1, 1, 3)
G	(1, 1)	
Upper right		**back edges**
A	(8,11)	a(8, 9,11)
B	(4,10)	b(4, 6,10)
C	(6, 8)	c(6, 2, 8)
D	(11,8)	d(11,4, 8)
E	(4, 6)	e(4, 5, 6)
F	(10,6)	f(10,3, 6)
G	(4, 3)	g(4, 1, 3)

FRONT EDGES

A(4, 9,11)
B(2, 6,10)
C(4, 2, 8)
D(10,4, 8)
E(1, 5, 6)
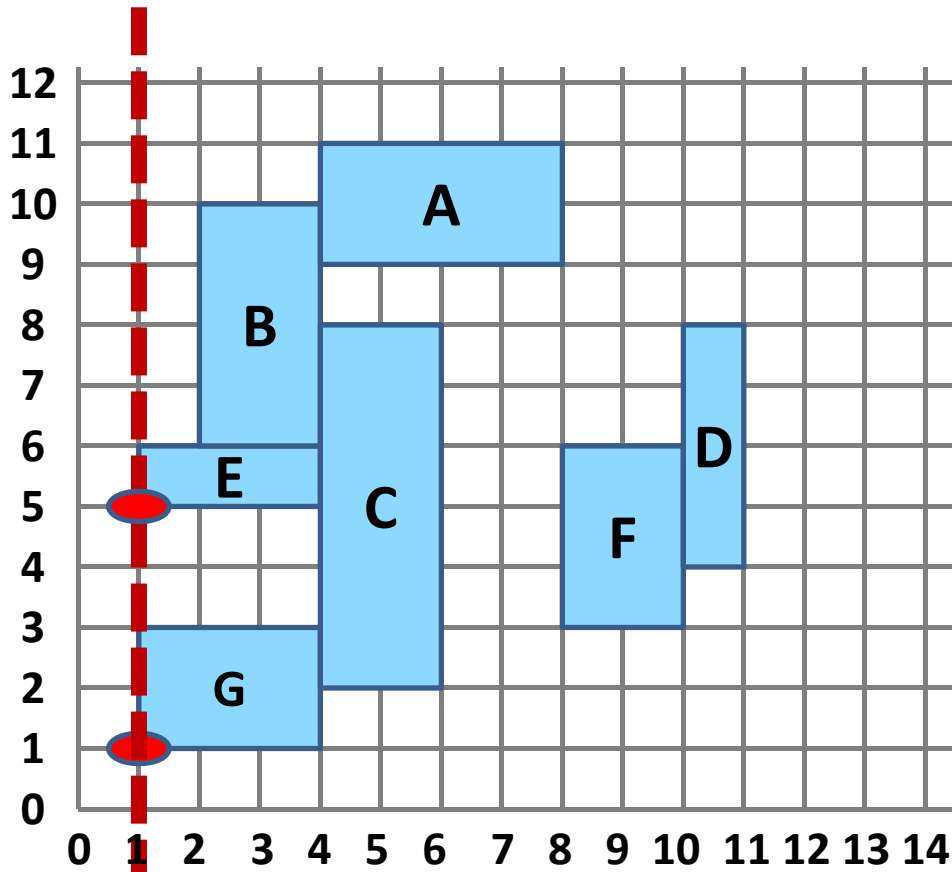F(8, 3, 6)
G(1, 1, 3)
back edges
a(8, 9,11)
b(4, 6,10)
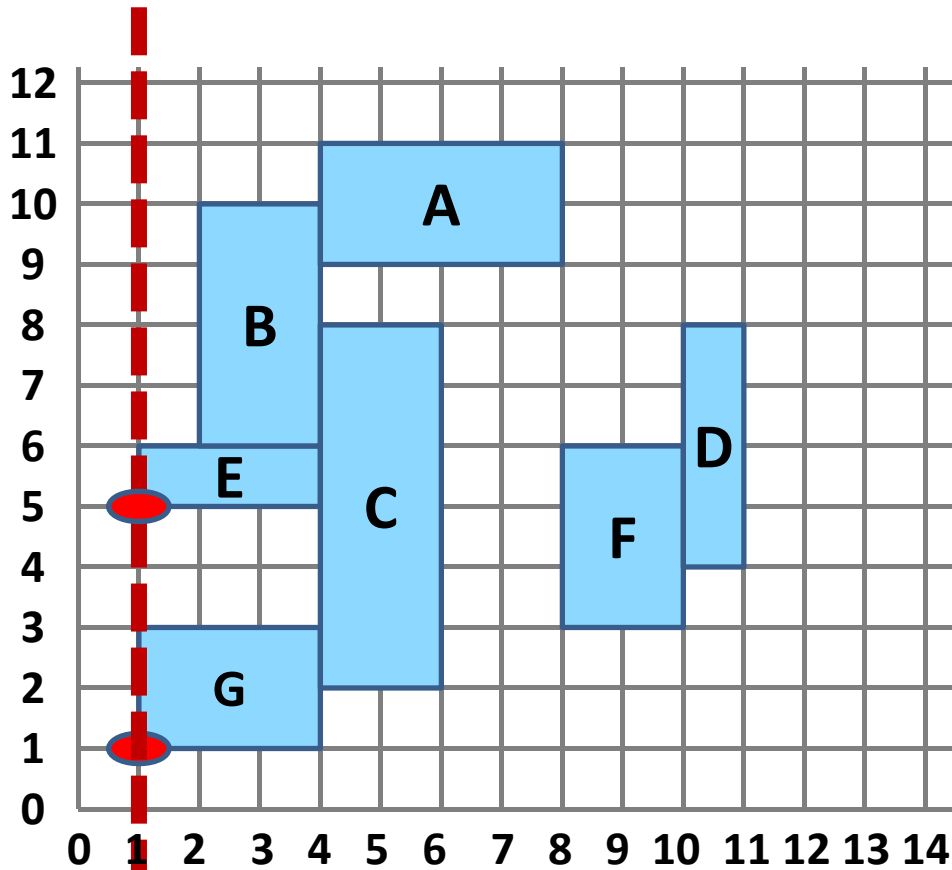c(6, 2, 8)
d(11,4, 8)
e(4, 5, 6)
f(10,3, 6)
g(4, 1, 3)

sorted edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
d(11,4, 8)

Sweep line

Explore horizontal connections:

Current vertical edges   G E

Sorted vertical edges   G E B g e b C A c a F f D d

Edges are sorted by x-coord, then by back/front flag, then by y-coord.

sorted
edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
d(11,4, 8)

Sweep line

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Edges are sorted by x-coord, then by back/front flag, then by y-coord.

sorted
edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
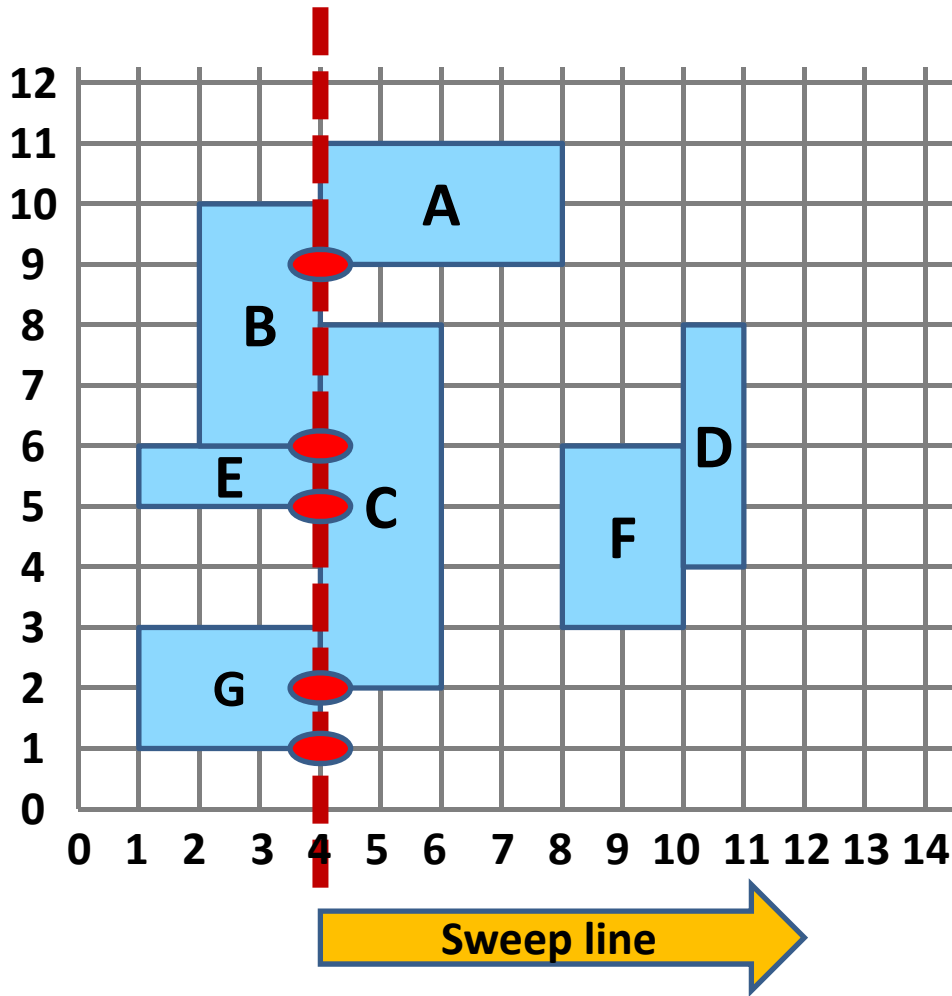f(10,3, 6)
D(10,4, 8)
d(11,4, 8)

Current vertical edges   B

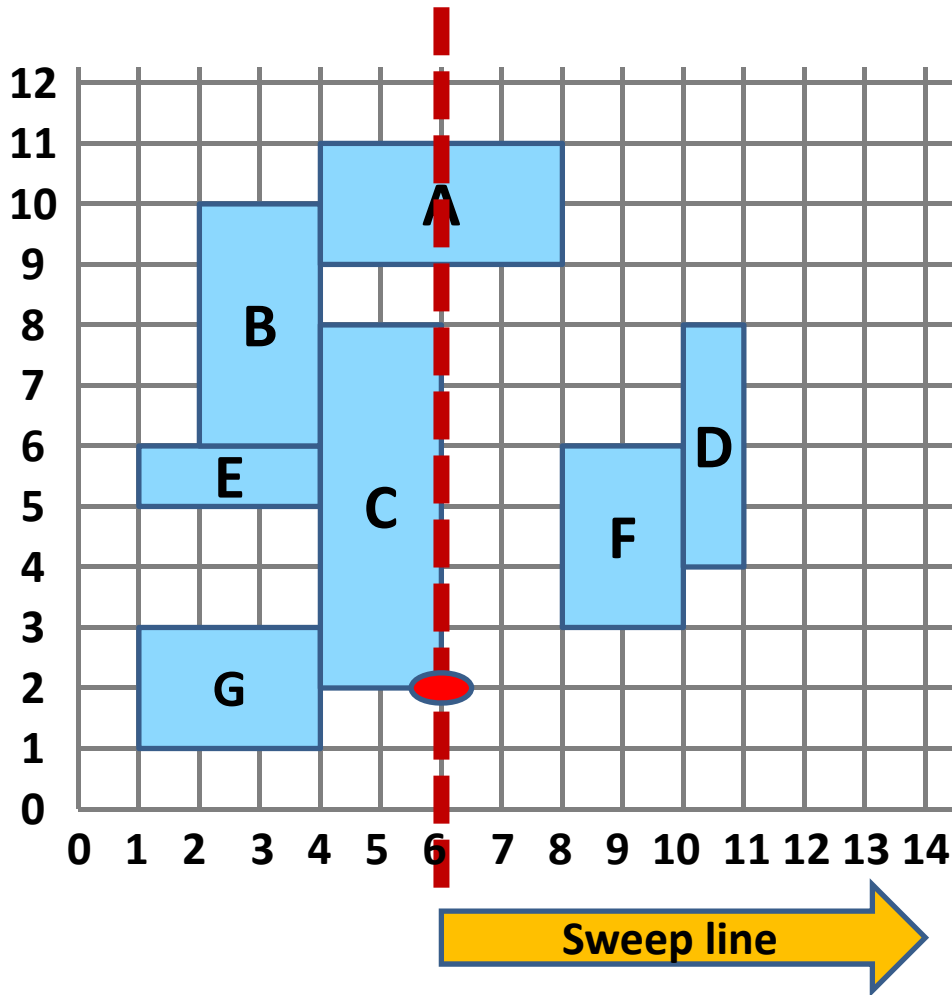**Sorted vertical edges**   G E B g e b C A c a F f D d

sorted
edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
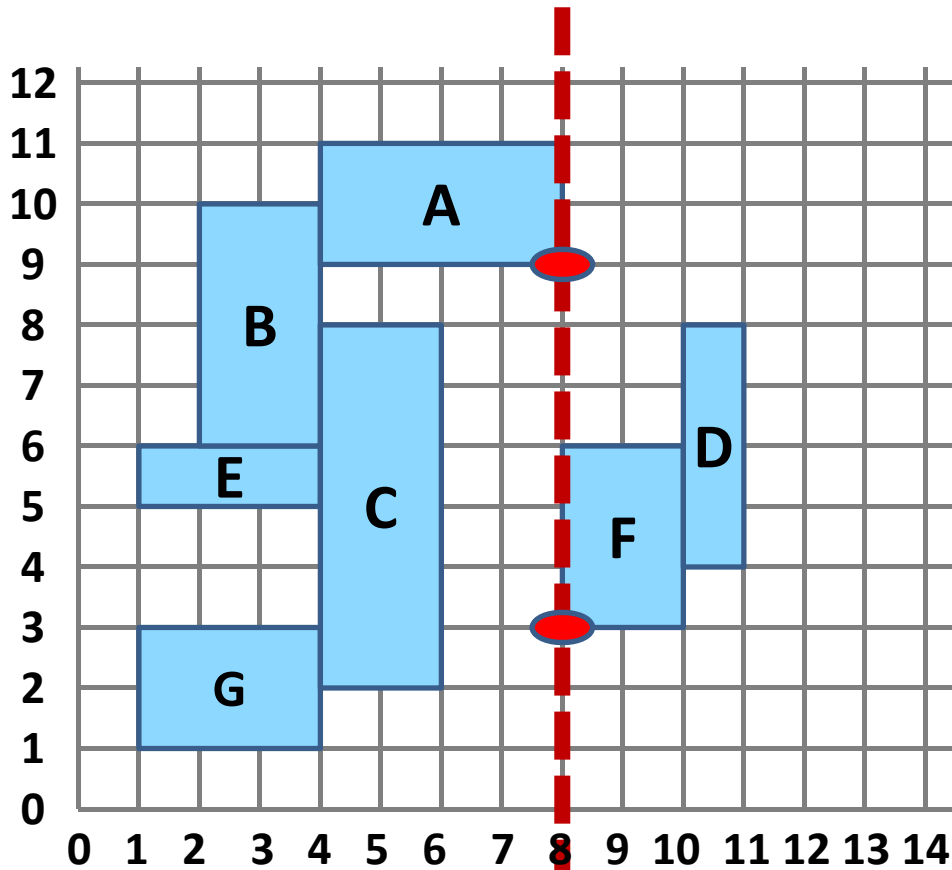d(11,4, 8)

Current vertical edges   g e b C A

Sorted vertical edges   G E B g e b C A c a F f D d

sorted
edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
d(11,4, 8)

Current vertical edges c

Sorted vertical edges G E B g e b C A c a F f D d

sorted edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
d(11,4, 8)

Current vertical edges   a F
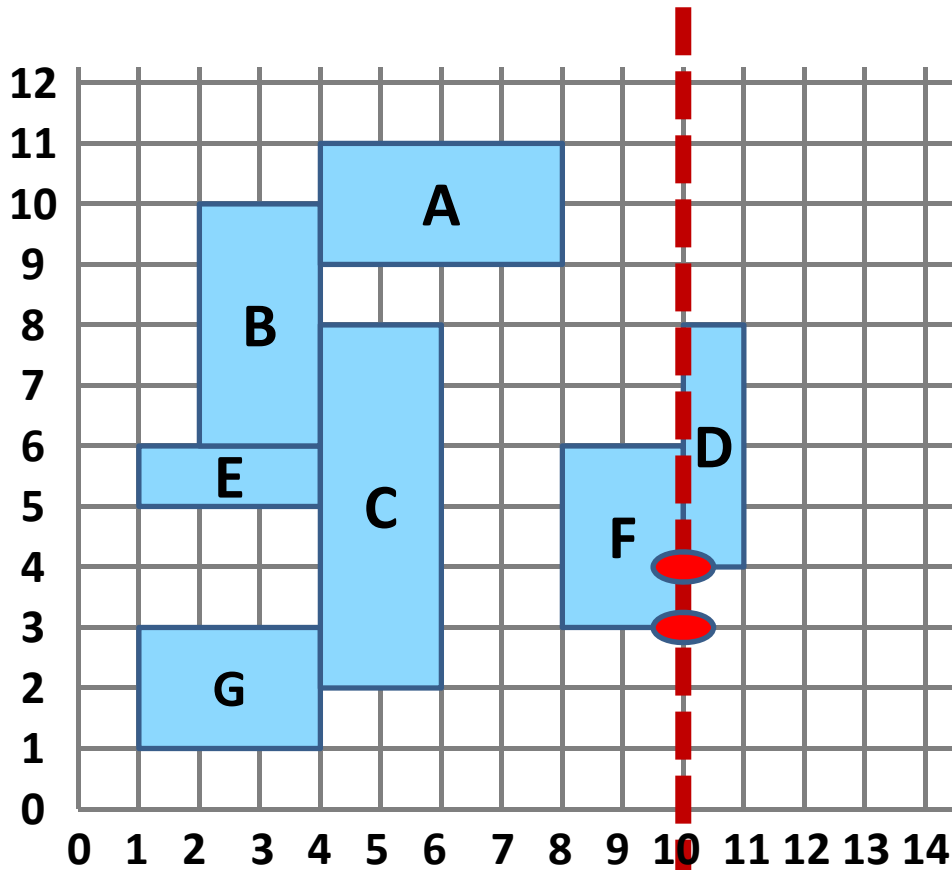
Sorted vertical edges   G E B g e b C A c a F f D d

sorted edges

G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
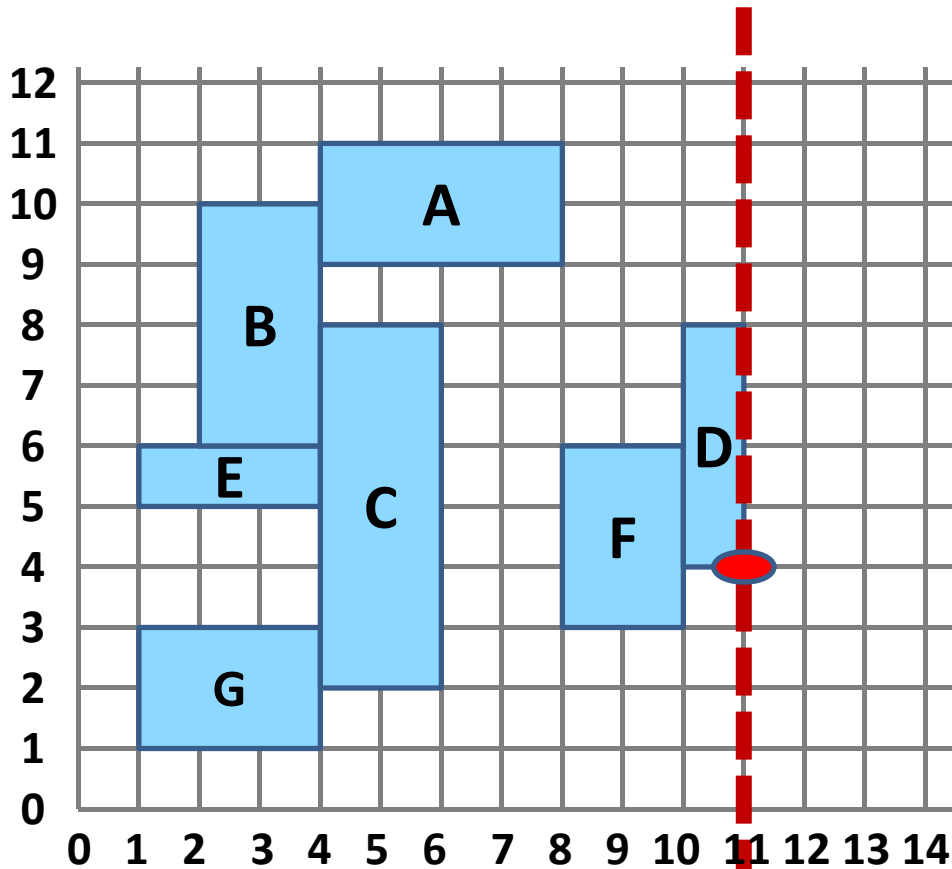D(10,4, 8)
d(11,4, 8)

Sweep line

Current vertical edges   f D

Sorted vertical edges   G E B g e b C A c a F f D d

sorted edges

```
G(1, 1, 3)
E(1, 5, 6)
B(2, 6,10)
g(4, 1, 3)
e(4, 5, 6)
b(4, 6,10)
C(4, 2, 8)
A(4, 9,11)
c(6, 2, 8)
a(8, 9,11)
F(8, 3, 6)
f(10,3, 6)
D(10,4, 8)
d(11,4, 8)
```
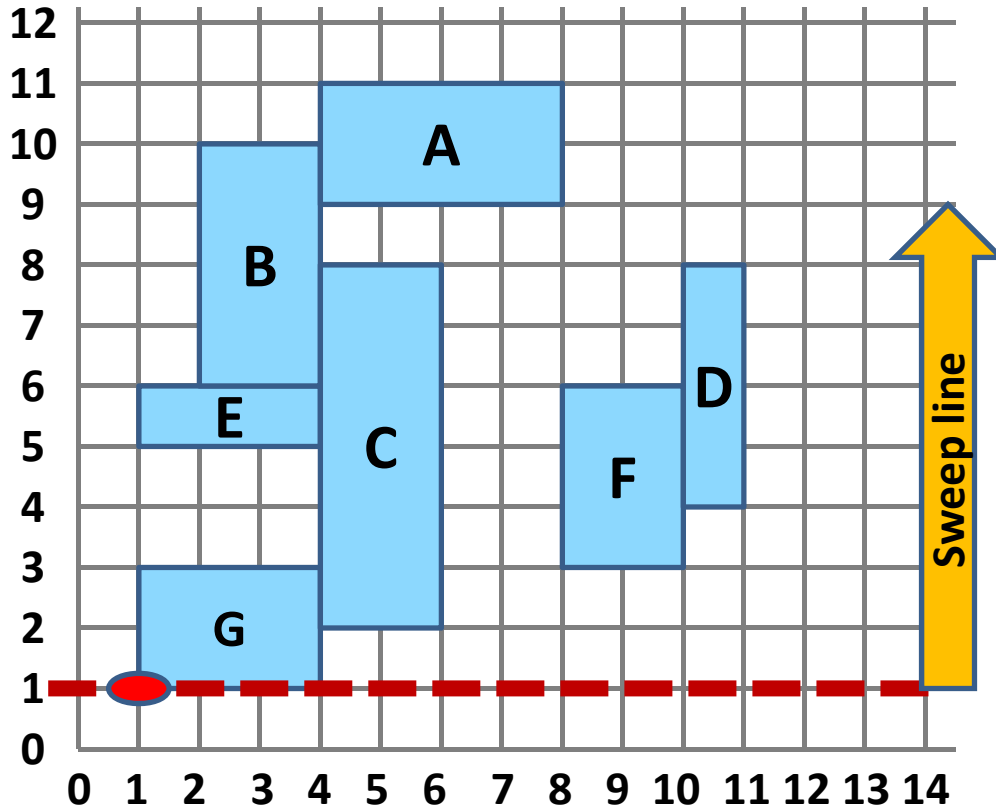
Current vertical edges   d

Sorted vertical edges   G E B g e b C A c a F f D d

sorted
edges by y

G(1, 1, 4)
C(4, 2, 6)
g(1, 3, 4)
F(8, 3,10)
D(10,4,11)
E(1, 5, 4)
e(1, 6, 4)
f(8, 6,10)
B(2, 6, 8)
c(4, 8, 6)
d(10,8,11)
A(4, 9, 8)
b(2,10, 4)
a(4,11, 8)

Explore vertical connections:

1. Apply analogous strategy, only exchange x and y coords in the code.
   Or

2. Transpose the input data (= swap x- and y-coord) and apply identical code
   (takes less time to code, a bit more time to run).